



2022 THE SCIENCE OF CONSCIOUSNESS

April 18–22, 2022

Hybrid Format In-Person and Remote Livestream
www.consciousness.arizona.edu

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The University of Arizona – Center for CONSCIOUSNESS STUDIES

Presents

2022
**THE SCIENCE OF
CONSCIOUSNESS**

APRIL 18–22, 2022

Tucson, Arizona

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Center for Consciousness StudiesPg. 12

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2022 THE SCIENCE OF CONSCIOUSNESS

TUCSON, ARIZONA | APRIL 18-22, 2022

Hybrid Format In-Person and Remote Livestream
Loews Ventana Canyon Resort Tucson, Arizona

OVERVIEW

Welcome to the 29th annual **'The Science of Consciousness' ('TSC') Conference**, the world's largest, longest-running and premier interdisciplinary conference addressing fundamental questions regarding consciousness, the brain, reality and existence, organized by the Center for Consciousness Studies at the University of Arizona.

TSC 2022 is a 5-day gathering consisting of 9 Workshops by 36 presenters, 12 Plenary Sessions with 30 Plenary and Keynote Speakers, 14 Concurrent Sessions, Poster and Exhibitor presentations, Social, Wellness Events and Entertainment. We anticipate that this Hybrid conference will bring together in person over 400 scientists, philosophers, educators, academicians, students, meditators, artists, interested public and seekers from around the world, gathering in-person in Tucson and virtually an estimated 500 plus remote participants.

The Science of Consciousness (TSC) conference takes place in Tucson every two years (alternating with TSC conferences elsewhere). In April 2020, the conference was online at the start of the Covid outbreak, and for **April 18-22, 2022**, a **'hybrid'** conference was planned with **both in-person** audience and speakers in Tucson and **remote online presentation livestreamed and later uploaded for on-demand review**. The live sessions and remote headquarters will be at Loews Ventana Canyon Resort, Tucson, Arizona.

The Science of Consciousness ('TSC') is an interdisciplinary conference emphasizing rigorous approaches to the study of consciousness and its place in the universe. Topical areas include neuroscience, philosophy, psychology, cognitive science, biology, quantum physics and quantum brain biology, cosmology, meditation, altered states, artificial intelligence/machine consciousness, the nature of reality, culture and experiential phenomenology.

Held annually since 1994, the TSC conference is hosted by the Center for Consciousness Studies at the University of Arizona, and alternates yearly between Tucson, Arizona and various locations including Italy, Denmark, Japan, Sweden, Czech Republic, Hungary, Hong Kong, India, Finland, San Diego and Switzerland.

Our live participation and broadcast will take place at the Loews Ventana Canyon Resort, a beautiful eco-lodge in the hills above Tucson, Arizona.

The Tucson TSC conferences consist of keynote, plenary and concurrent talks, posters, exhibits, workshops, art-tech, wellness and social events. For April 2022, the mix of live and remote presentations and audience will depend on the pandemic conditions.

We thank our sponsors, program committee, support staff, hosts, presenters, attendees, exhibitors and volunteers for making TSC possible. We especially acknowledge the extraordinary efforts and many years of service of **Abi Behar-Montefiore**, Assistant Director of the Center for Consciousness Studies at the University of Arizona. Without Abi, The Center and TSC conferences would not be possible.

Special thanks to **Deepak Chopra** for a morning wellness-meditation kick-off on Tuesday, April 19 at 7:30 am – Kiva Ballroom and for the session with **Sue Blackmore** scheduled for Tuesday evening after the Welcome Reception entitled "Mystery of Existence. Why is there sentience? A dialogue between **Sue Blackmore and Deepak Chopra**".

We are grateful to **BioCommunications** at the University of Arizona for their overall contribution to present this event through AV production and design concepts. To the entire Staff at **Loews Ventana Canyon Resort** and Christopher McLaren, Associate Director of Sales and Bonnie Finlay, Director of Catering and Conference Management, thank you for all you do to make our program a success. Thank you to the Tucson-based **Commotion Studios** who were able to work with us on this intense program again and to provide us with excellent session video files to upload after the conference. Thank you **Matt George and Team for keeping us online and inline**.

We also thank **Professor George Mashour**, conference co-chair, co-sponsor, and Robert B. Sweet Professor & Chair, Anesthesiology, Faculty, Neuroscience Graduate Program, Professor of Neurosurgery, Pharmacology, and Psychology, Director, Michigan Psychedelic Collaborative, Scientific Director, Center for Consciousness Science, for his leadership, rigor and support.

Professor Thomas Bever, UA Regent's Professor, and Co-Director of CCS; **Jay Sanguinetti**, UA Research Assistant Professor, Associate Director CCS, and Director of the SEMA Lab. Additional thanks to our External Advisors, **David Chalmers**, Co-Founder of CCS, Professor of Philosophy and Neural Science, New York University; **John Allen**, Distinguished Professor, Clinical and Cognition Neural Systems, U Arizona; **Dante Lauretta**, UArizona, Regents Professor, Planetary Science and Cosmochemistry, University of Arizona Lunar & Planetary Laboratory. Ginny Healy, Senior Director of Development, SBS. Special thanks to Stuart Hameroff's Anesthesiology colleagues at Banner - University Medical Center Tucson and to Betsy Bigbee for her advice and knowledge across a broad range of areas.

2022 THE SCIENCE OF CONSCIOUSNESS

This year's TSC conference is unique for several reasons. It is 'hybrid', with a mix of in-person/live and remote/online presentations and audience. Also, for the first time, there will be 4 Keynote speakers, one for each day of the Plenary program, and all luminaries.

Tuesday April 19 Keynote is Christof Koch, one of the world's most highly recognized neuroscientists and head of the Allen Institute for Brain Science in Seattle. Christof spoke at the first TSC in 1994 when he was collaborating with Francis Crick, and has returned several times over the years.

Wednesday April 20 Keynote is Robin Carhart-Harris, a leader in psychedelic research. Robin spoke at the 2012 TSC (the first at Ventana Canyon) and startled everyone with his results showing that subjects having vivid experience due to psilocybin paradoxically had very low energy MRI signals and low frequency EEG. From the UK, Robin is the new head of the Psychedelic Research Center at UCSF.

Thursday April 21 Keynote is Harvard's Avi Loeb who searches for the origins of life and consciousness from extraterrestrial sources. In 2018, based on the anomalous behavior of 'Oumuamua', the first known interstellar object to pass through our solar system, Loeb suggested that alien space craft may be in our solar system.

Friday April 22 Keynote is former CCS Director David Chalmers who gave the famous 'hard problem' talk at the first TSC in 1994, galvanizing the field. David's Keynote will cover his new book *Reality +: Virtual Worlds and the Problems of Philosophy*, discussing whether the reality we experience is actually a simulation. David is also known for his renditions over of the Zombie Blues at the Friday night Poetry Slam. As David has explained, a zombie is someone who looks and behaves like us, but with no inner consciousness. How sad and blue they must feel, if only they could feel.

In addition to the Plenary, Keynote, Workshop, Concurrent, Poster, Exhibits and Art - Tech presentations, Tuesday evening welcome party, Thursday night optional dinner and Friday night Poetry Slam, two special presentations include a Tuesday evening (following the welcome reception) dialogue between **Sue Blackmore and Deepak Chopra** (who famously quarreled at TSC in 2012) on 'The mystery of existence – What is sentience?

Thursday evening before the optional Conference Dinner, an outdoor presentation will feature **Paolo Roberto Silva de Souza**, the leader of Brazil's Church of Santo Daime that ritualizes the use of the potent hallucinogenic brew 'Ayahuasca' from Amazon plants.

We look forward to the next **TSC planned for 2023 in Taormina, Sicily, Italy - May 22-28, 2023** organized by Riccardo Manzotti, IULM Milan; Pietro Perconti, University of Messina; Antonio Chella, University of Palermo and co-sponsored by the Center for Consciousness Studies, University of Arizona.

Covid Health Precautions:

TSC is committed to providing a safe environment for our attendees.

People may be asked to show proof of vaccination or proof of a recent negative Covid test to attend in person.

Reminder to prepare for the parties:

POETRY SLAM / ZOMBIE BLUES /TALENT SHOW– A Tucson TSC Tradition (Prepare a 1-2 minute contribution) – Urge people to prepare their dialogues and join us on Friday evening. Cash bar. Followed by:

NO - END OF CONSCIOUSNESS Party – Another Tucson TSC Tradition.

Special thanks to all our Sponsors for their support.

On behalf of the 2022 Program Committee.

Have a great time and enjoy the conference!

Stuart Hameroff, MD

TSC 2022 Co-Chair

Professor, Anesthesiology and Psychology Director, Center for Consciousness Studies; Banner-University Medical Center, The University of Arizona, Tucson, Arizona

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PROGRAM CHAIRS

Stuart Hameroff, MD
Co-Founder & Director, Center for Consciousness Studies
Professor Emeritus, Departments of Anesthesiology & Psychology
University of Arizona, Tucson, AZ

CO-CHAIR

George Mashour, MD
University of Michigan
Chair, Anesthesiology
Robert B. Sweet Professor of Anesthesiology
Faculty, Neuroscience Graduate Program
Professor, Neurosurgery Director, Michigan Psychedelic Collaborative
Scientific Director, Center for Consciousness Science
Professor of Anesthesiology, Neurosurgery, Pharmacology, and Psychology
Faculty, Neuroscience Graduate Program University of Michigan, Ann Arbor

PROGRAM COMMITTEE

Thomas Bever
Co-Director, CCS, Arizona Regents' Professor,
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Jay Sanguinetti
Associate Director, CCS
Director, SEMA Lab
University of Arizona

Dante Lauretta
CCS External Adviser, University of Arizona

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Stanford University

Abi Behar-Montefiore,
CCS Conference Manager & Assistant Director,
University of Arizona

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FOR INFORMATION CONTACT:

Conference Manager

Abi Behar-Montefiore, Center for Consciousness Studies, Assistant Director

PRESS/MEDIA: Thank you for joining us.

All press must apply for credentials and complete an online registration form.
No filming/podcasting or studio set ups without permission

Contact: Abi Behar-Montefiore 520-247-5785 center@email.arizona.edu

CCS - TSC PROGRAM VIDEOS

CCS

WEBSITE: www.consciousness.arizona.edu

TSC 2016-2022 - YOUTUBE

The Science of Consciousness (YouTube)

<https://www.youtube.com/channel/UCoNDcpgKXg2UioJKxTZI-ZA/videos>

UA Consciousness 2010-2016

YOUTUBE <https://www.youtube.com/user/UofAConsciousness?app=desktop>

Itunes TSC 2010-2016

<https://itunes.apple.com/itunes-u/center-for-consciousness-studies/id413136100?mt=10>

Recent Webinar: SCIENCE & ROGER PENROSE 2021

https://consciousness.arizona.edu/sites/consciousness.arizona.edu/files/FINAL%20Program%20Schedule%20Science_RogerPenrose_1.docx

Intro Reel - Penrose 2021

<https://www.youtube.com/watch?v=79MOK6Exgwo>

TSC 2020

Intro Reel: <https://www.youtube.com/watch?v=XDXfgkJDhVg>



HISTORY OF TSC

The Science of Consciousness' ('TSC') is the world's largest, longest-running and premier interdisciplinary conference on all aspects of the nature of conscious experience, awareness, feelings and existence. Questions include how the brain produces consciousness, whether consciousness is intrinsic to the universe, or an epiphenomenal illusion, how consciousness can causally affect brain processes, what are the best empirical theories, do we have free will, how did life and consciousness originate and evolve, what are the origins of moral and aesthetic values, how can we improve mental, physical and cognitive function, and can consciousness persist after bodily death, e.g. through 'uploading' to machines, or via mental processes tied to the natural world? These and other relevant questions are approached through many disciplines in science, philosophy, culture and contemplative practices. 'TSC' began at the University of Arizona in Tucson in 1994, and returns there in even-numbered years, alternating with TSC conferences around the globe (Italy, Denmark, Japan, Hungary, Hong Kong, Sweden, India, Czech Republic, Finland). TSC 2023 is planned for Taormina Italy.

Thank you to our international colleagues and friends who helped make the TSC alternate year conferences possible:

- 1995 Ischia, Italy – Chloe Taddei-Ferretti
- 1997 Elsinore, Denmark – Alwyn Scott
- 1999 Tokyo, Japan – UN University, Mari Jibu, Kunio Yasue
- 2001 Skövde, Sweden – University of Skövde, Paavo Pyykkänen
- 2003 Prague, Czech Republic – Ivan Havel
- 2005 Copenhagen, Denmark – Morten Overgard
- 2007 Budapest, Hungary – George Kampis
- 2009 Hong Kong, China – Gino Yu
- 2011 Stockholm, Sweden – Christer Perffjell
- 2013 Agra, India – Dayalbagh Educational Institute, Rev. Prof. P.S. Satsangi, Vishal Sahni
- 2015 Helsinki, Finland – University of Finland, Paavo Pyykkänen
- 2017 San Diego, La Jolla California - CCS-TSC University of Arizona, Stuart Hameroff
- 2019 Interlaken, Switzerland – Harald Atmanspacher
- 2023 Planned for Taormina, Sicily, Italy - May 22-28– Riccardo Manzotti, Pietro Perconti, Antonio Chella

Full List of TSC - Since 1994

- 1994 TSC 1 Apr 12-17, 1994 – Tucson, Arizona
- 1995 TSC 2 Ischia, Italy
- 1996 TSC 3 Apr 8-13, 1996 – Tucson, Arizona
- 1997 TSC 4 Aug 18-24, 1997 – Elsinore, Denmark
- 1998 TSC 5 Apr 27- May 2, 1998 – Tucson, Arizona
- 1999 TSC 6 May 28, 1999 – Tokyo, Japan
- 2000 TSC 7 Apr 10-15, 2000 – Tucson, Arizona
- 2001 TSC 8 Aug 6-11, 2001 – Skövde, Sweden
- 2002 TSC 9 Apr 8-12, 2002 – Tucson, Arizona
- 2003 TSC 10 July 6-10, 2003 – Prague, Czech Republic
- 2004 TSC 11 Apr 7-11, 2004 – Tucson, Arizona
- 2005 TSC 12 Aug 17-20, 2005 – Copenhagen, Denmark
- 2006 TSC 13 Apr 4-8, 2006 – Tucson, Arizona
- 2007 TSC 14 July 23-27, 2007 – Budapest, Hungary
- 2008 TSC 15 Apr 8-12, 2008 – Tucson, Arizona
- 2009 TSC 16 June 11-14, 2009 – Hong Kong, China
- 2010 TSC 17 Apr 12-17, 2010 – Tucson, Arizona
- 2011 TSC 18 May 2-8, 2011 – Stockholm, Sweden
- 2012 TSC 19 Apr 9-14, 2012 – Tucson, Arizona
- 2013 TSC 20 Mar 3-9, 2013 – Agra, India
- 2014 TSC 21 Apr 21-26, 2014 – Tucson, Arizona
- 2015 TSC 22 June 9-13, 2015 – Helsinki, Finland
- 2016 TSC 23 Apr 25-30, 2016 – Tucson, Arizona
- 2017 TSC 24 June 5-10, 2017 – San Diego, California
- 2018 TSC 25 Apr 2-7, 2018 – Tucson, Arizona
- 2019 TSC 26 June 25-28, 2019 – Interlaken, Switzerland
- 2020 TSC 27 Sept 14-18, 2020 Virtual rescheduled –
(originally planned for April 12-18, 2020) Tucson, Arizona
- 2021 Science and Sir Roger Penrose - Aug 3-6, 2021 4 day Webinar – virtual
- 2022 TSC 28 April 18-22, 2022 Tucson, Arizona - Hybrid
- 2023 Planned for Taormina, Sicily, Italy - May 22-28

For information contact:

Conference Manager
Abi Behar-Montefiore, Center for Consciousness Studies, Assistant Director

GENERAL CONFERENCE PROGRAM OUTLINE

Monday April 18 – Friday April 22, 2022

Hybrid Format In-Person and Remote Livestream
Loews Ventana Canyon Resort Tucson, Arizona

Workshops:

Monday morning, afternoon and evening sessions
(Kiva and Grand Ballroom A, B, C)

Plenary Sessions:

Tuesday, Wednesday, Thursday, Friday
(Kiva Ballroom)

Concurrent Sessions:

Tuesday, Wednesday, Friday
(Kiva and Grand Ballroom A, B, C, Executive Board Room)

Tuesday morning Meditation:

(Kiva Plaza)

Tuesday evening Welcome Reception:

(Kiva Plaza)

Tuesday evening Dialogue:

(Kiva Ballroom)

Poster Sessions/Receptions:

Wednesday, Friday evening
(Breakout Rooms by Category - near Grand Ballroom Lobby)

Art-Tech Health Demos:

Wednesday, Friday evening
(Catalina JK)

Exhibitors:

Daily Monday-Friday
(Grand Ballroom Lobby)

Talk with de Souza from Brazil:

(Cascade Terrace)

Optional Dinner Thursday evening

(Upper Terrace)

Poetry Slam: Friday evening

(Kiva Ballroom)

No-End of Consciousness Party:

Friday evening
(Kiva)



2022 PROGRAM SUMMARY BY SESSION

KEYNOTE & PLENARY SESSIONS

Kiva Ballroom

There are 3 Plenary Sessions per day,
Tuesday, April 19 through Friday, April 22

All sessions will be Livestreamed MST

TUESDAY, April 19, 2022 - Livestreamed - Mountain Standard Time MST

PLENARY 1 8:30 AM – 10:40 AM

SLEEP, WAKEFULNESS & ANESTHESIA

Giancarlo Vanini, University of Michigan

Matthew Larkum, Humboldt University

Alex Proekt, University of Pennsylvania

PLENARY 2 - KEYNOTE 1..... 11:10 AM – 12:30 PM

BRAIN & CONSCIOUSNESS

Christof Koch, Allen Institute for Brain Science

PLENARY 3 2:00 PM – 4:10 PM

BRAIN CONNECTIVITY

Jean-Rémi King, CNRS, Ecole Normale Supérieure de Lyon

Zirui Huang, University of Michigan

Anirban Bandyopadhyay, National Institute for Materials Science, Tsukuba,
Japan

WEDNESDAY, April 20, 2022

PLENARY 4 8:30 AM – 10:40 AM

ALTERED STATES OF CONSCIOUSNESS

Emma Huels, University of Michigan

Charlotte Martial, University of Liège

Elizabeth Krasnoff, California Institute for Human Science

KEYNOTE 2 – PLENARY 5 11:10 AM – 12:30 PM

PSYCHEDELICS

Robin Carhart-Harris, University of California, San Francisco

PLENARY 6 2:00 PM – 4:10 PM

PSYCHEDELIC MECHANISMS

George Mashour, MD, University of Michigan; Chair, Anesthesiology, Director,
Michigan Psychedelic Collaborative, Sci Dir., Ctr for Consciousness Science

Alex C Kwan, Yale University

Katrin Preller, University of Zurich | Yale University

THURSDAY, April 21, 2022

PLENARY 7 8:30 AM – 10:40 AM

TIME & CONSCIOUSNESS

Daniel Sheehan, University of San Diego

Paul Davies, Arizona State University

Sir Roger Penrose, Oxford University

PLENARY 8 KEYNOTE 3 11:10 AM – 12:30 PM

ASTROBIOLOGY & ASTROCONSCIOUSNESS

Avi Loeb, Harvard University

THURSDAY, April 21, 2022

PLENARY 9 2:00 PM – 4:10 PM

ORIGINS OF LIFE

Dante Laurotta, University of Arizona

Sara Walker, Arizona State University

Steen Rasmussen, University of Southern Denmark

FRIDAY, - April 22, 2022

PLENARY 10 8:30 AM – 10:40 AM

THEORIES OF CONSCIOUSNESS

Biyu J. He, New York University, Langone

Yuri B. Saalman, University of Wisconsin

Lucia Melloni, Max Planck Institute, Frankfurt

PLENARY 11 - KEYNOTE 4 11:10 AM – 12:30 PM

REALITY+ : FROM THE MATRIX TO THE METAVERSE

David Chalmers, New York University

PLENARY 12 2:00 PM – 4:10 PM

QUANTUM NEUROSCIENCE

Hartmut Neven, Google Quantum AI

Aarat Kalra, Princeton University

Travis Craddock, Nova Southeastern University

SUMMARY - SCHEDULE BY DAY
MONDAY APRIL 18
WORKSHOPS

MORNING WORKSHOPS:
8:30 AM – 12:30 PM
Kiva, Grand Ballroom A | B | C

PROGRESS ON DUAL-ASPECT THINKING Kiva Ballroom

Harald Atmanspacher, The Collegium Helveticum, ETH, Zurich
 Paavo Pyykkänen, University of Helsinki | University of Skövde
 Dean Rickles, University of Sydney
 Robert Prentner, University of Munich

TESTING ORCH OR Grand Ballroom B

Bruce Maclver, Stanford University
 Jack Tuszynski, University of Alberta/Politecnico di Torino
 Aarat Kalra, Princeton University
 Greg Scholes, Princeton University
 Aristide Dogariu, University of Central Florida
 Travis Craddock, Nova Southeastern University

CONSCIOUSNESS AND ULTRASONIC NEUROMODULATION Grand Ballroom A

Jay Sanguinetti, University of Arizona
 Alexander Bystritsky, UCLA
 Martin Monti, UCLA
 Seung-Schik Yoo, Harvard University

QUANTUM MECHANICS AND CONSCIOUSNESS Grand Ballroom C

Justin Riddle, University of North Carolina
 Johannes Kleiner, Ludwig Maximilian University of Munich
 Kelvin J. McQueen, Chapman University

AFTERNOON WORKSHOPS
2:00 PM – 6:00 PM

EMBEDDED INTELLIGENCE Grand Ballroom B

Bill Mensch, Western Design Center
 Dante Lauretta, University of Arizona
 Stuart Hameroff, University of Arizona
 Ted Humphrey, Arizona State University
 Andrew Maynard, Arizona State University

PLANTS AND CONSCIOUSNESS Kiva Ballroom

M. Bruce Maclver, Stanford University
 Deepak Chopra, Chopra Global
 Rainish Khanna, Ph.D., I-Cultiver
 Petrisia Gonzales, UArizona
 Dennis McKenna, Heffter Research Institute

CONSCIOUSNESS AND NON-LOCALITY Grand Ballroom C

Stephan A. Schwartz, Saybrook University
 Dean Radin, Institute of Noetic Science (IONS)
 Julia Mossbridge, University of San Diego, IONS, TILT
 Jeffrey Mishlove, New Thinking Allowed; Insight Associates

THE SCIENCE OF CONTEMPLATIVE EXPERIENCE Grand Ballroom A

Matthew Sacchet, Harvard University
 Daniel Ingram, Emergent Phenomenology Research Consortium
 Julieta Galante, Cambridge University
 Jay Sanguinetti, University of Arizona

EVENING WORKSHOP:
7:00 PM – 10:00 PM

NEUROSPIRITUALITY Grand Ballroom B

Michael Ferguson, Harvard Medical School
 Janae Nelson, Brigham Young University
 David Yaden, Johns Hopkins University
 Rick Strassman, University of New Mexico

TUESDAY, APRIL 19, 2022

MORNING MEDITATION WITH DEEPAK CHOPRA.....7:30 AM – 8:15 AM
Kiva Plaza

PLENARY & KEYNOTE SESSIONS8:30 AM – 4:10 PM
Kiva Ballroom

EXHIBITORS1:00 PM – 7:00 PM
Grand Ballroom Lobby (Daily)

PLENARY SESSIONS

PLENARY 1 Kiva
8:30 AM – 10:40 AM
SLEEP, WAKEFULNESS & ANESTHESIA
Giancarlo Vanini, University of Michigan
Matthew Larkum, Humboldt University
Alex Proekt, University of Pennsylvania

PLENARY 2 – KEYNOTE 1 Kiva
11:10 AM – 12:30 PM
BRAIN & CONSCIOUSNESS
Christof Koch, Allen Institute for Brain Science

PLENARY 3 Kiva
2:00 PM – 4:10 PM
BRAIN CONNECTIVITY
Jean-Rémi King, CNRS, Ecole Normale Supérieure de Lyon
Zirui Huang, University of Michigan
Anirban Bandyopadhyay, National Institute for Materials Science, Tsukuba, Japan

TUESDAY APRIL 19, 2022 CONCURRENT SESSIONS C1 – C4 5:00 PM – 7:00 PM

C1 - Hard problem:.....Grand Ballroom A
Silberstein, *Kouchakzadeh*, Gill, *Deiss*, Christian

C2 - Brain and consciousness:.....Grand Ballroom B
Agarwal, Pagel, *Gennaro*, Beran, Viirre

C3 - AI/Machine consciousness:..... Kiva Ballroom
Bach, *Chella*, O'Leary, *Ruffini*, *Besedin*

C4 - Quantum state reduction: Grand Ballroom C
Lloyd, Tagg, Brophy, Stroo, Thompson

SUMMARY - SCHEDULE BY DAY TUESDAY EVENING, APRIL 19, 2022

Welcome Reception.....7:00 PM – 9:00 PM
Kiva Plaza

Dialogue.....9:00 PM – 10:00 PM
Kiva Ballroom

Mystery of Existence. Why is there sentience?
A dialogue between Sue Blackmore and Deepak Chopra

WEDNESDAY, APRIL 20, 2022

Plenary & Keynote Sessions 8:30 AM – 4:10 PM
Kiva Ballroom

PLENARY 4 8:30 AM – 10:40 AM
ALTERED STATES OF CONSCIOUSNESS
 Emma Huels, University of Michigan
 Charlotte Martial, University of Liège
 Elizabeth Krasnoff, California Institute for Human Science

PLENARY 5 - Keynote 2 11:10 AM – 12:30 PM
PSYCHEDELICS
 Robin Carhart-Harris, University of California, San Francisco

PLENARY 6 2:00 PM – 4:10 PM
PSYCHEDELIC MECHANISMS
 George Mashour, University of Michigan
 Alex C Kwan, Yale University
 Katrin Preller, Univ. of Zurich | Yale University

WEDNESDAY, APRIL 20, 2022 CONCURRENT SESSIONS C5 – C9 5:00 PM – 7:00 PM

C5 - Panpsychism: Grand Ballroom C
 Pugliaro, Stoica, Beni, *Longinotti*, Basios

C6 - Psychedelics 1: Grand Ballroom A
 Denomme, Kargbo, Dourron, *Cardone*, Alnagger

C7 - Studying & measuring consciousness: Grand Ballroom B
 Blackmore, Hunt, *Mahn*, LaBerge, *McCann*, Voorhees

C8 - Theories of consciousness: Kiva Ballroom
 Hopkins, Arkhipov, DeLancey, Grasso, Nisbet, Awret, Blommestijn

C9 - Space, time and consciousness 1: Executive Board Room
 Lahav, Rulin Xiu, Ahmadkhaniou, C. *Yang*, Zabriskie, D. Holbrook

SUMMARY - SCHEDULE BY DAY

WEDNESDAY EVENING & FRIDAY EVENING 7:00 PM – 9:30 PM

POSTERS - EXHIBITORS - ART-TECH HEALTH - DEMOS – PERFORMANCE

POSTER EXHIBITORS

1.0 Philosophy Coronado & Rincon
 T. Roberts, A. Aris, J. Sugar, L. Vucolova, J. Strozier, *B. Torok-Szabo*,
 R.C. Schriener, J. Naskov, J. James, D. Trussell, J. Beck, M. Jawer, A. Rangarajan,
 K. Perkins, M. Baranowski, J. Olson, C. Acosta, G. Hodes, *P. Hurren*,
 M. Sundaram, N. Swami, M. Chakraborty, S.S. Pokharna,
 K. Noble, P. Soni, T. Kovacs, J. Camacho, F. Oyarzun

2.0 Neuroscience Rincon
 W. Leonard, A. Lorestani, S. Koshland, P. Maftoun, D. Beal,
 C. Rourk, M. Kutch, *I. Fredriksson*

3.0 Cog-Sci Psychology Santa Rita
 J. Kornmeier, M. Zegarac, J. Sanfrey, S. Atash, M. Lowe,
 C. Kaneshiro, M. Moradi, E. Stephens, E. Meshikova

4.0 Physical & Biological Sciences Sabino-Santa Rita
 A. Singh, *R. Sieb*, M. Brooks, C. Rudnitski, A. Fitzpatrick,
 D. Smolker, S. Loeth, *J. DeCarlo*, P. Saeedloo, R. Singh,
 B. Therner, F. Barancheshme, N. Nabavi, H. Gharacheh,
 G. Williams, B. Biradar, C. Gergely, S. Jarosek, J. Ma,
 A. Mahmoudi, S. Mousavi

5.0 Experiential Sonora
 M. Cremo, B. Meleski, S. Megumi, A. Mitchell, *O. Colbert*,
 R. Reynolds, R. Miller, C. Flygt

6.0 Culture & Humanities Catalina L
 K. Kohler, M. Valladares, S. Nelson, *A. MacDonald*, *A. Iribas-Rudin*,
 C. *Yahia-Cherif*, N. Rezaie

SUMMARY - SCHEDULE BY DAY
THURSDAY, APRIL 21, 2022

PLENARY & KEYNOTE SESSIONS 8:30 AM – 4:10 PM
 Kiva Ballroom

PLENARY 7 8:30 AM – 10:40 AM
TIME & CONSCIOUSNESS
Daniel Sheehan, University of San Diego
Paul Davies, Arizona State University
Sir Roger Penrose, Oxford University

PLENARY 8 - KEYNOTE 3 11:10 AM – 12:30 PM
ASTROBIOLOGY & ASTROCONSCIOUSNESS
Avi Loeb, Harvard University

PLENARY 9 2:00 PM – 4:10 PM
ORIGINS OF LIFE
Dante Lauretta, University of Arizona
Sara Walker, Arizona State University
Steen Rasmussen, University of Southern Denmark - Santa Fe Institute

EXHIBITORS 1:00 PM – 7:00 PM
 Grand Ballroom Lobby

TALK 5:00 PM – 6:00 PM
 Cascade Terrace (off main lobby)
Paolo Roberto Silva de Souza the leader of Brazil’s Church of Santo Daime will speak about ritualized use of the hallucinogenic Amazon brew ‘Ayahuasca’ for health and religious purposes.

OPTIONAL DINNER 6:30 PM – 10:00 PM
 Upper Terrace
 Tickets Required

FRIDAY, APRIL 22, 2022

PLENARY & KEYNOTE SESSIONS 8:30 AM – 4:10 PM
 Kiva Ballroom

PLENARY 10 8:30 AM – 10:40 AM
THEORIES OF CONSCIOUSNESS
Biyu J. He, New York University, Langone
Yuri B. Saalman, University of Wisconsin
Lucia Melloni, Max Planck Institute, Frankfurt

PLENARY 11 - KEYNOTE 4 11:10 AM - 12:30 PM
Reality+ : From the matrix to the metaverse
David Chalmers, New York University

PLENARY 12 2:00 PM - 4:10 PM
QUANTUM NEUROSCIENCE
Hartmut Neven, Google Quantum AI
Aarat Kalra, Princeton University
Travis Craddock, Nova Southeastern University

ART-TECH-HEALTH – SOCIAL / ENTERTAINMENT
TUESDAY THROUGH FRIDAY MORNING

TUESDAY MORNING, APRIL 19, 2022
MORNING MEDITATION WITH DEEPAK CHOPRA
 7:30 AM – 8:15 AM Kiva Plaza

HEALTH/WELLNESS
TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, APRIL 19, 20, 21, 22
TENNISCENTRIC WITH MARK VALLADARES
 7:00 AM – 8:00 AM Loews Ventana Canyon Tennis Courts

WEDNESDAY APRIL 20 AND THURSDAY APRIL 21
RICHARD RUDIS - A ‘GONG BATH’™
 7:30 AM – 8:30 AM Ventana Room 2nd floor

ART-TECH

WEDNESDAY, APRIL 20 AND FRIDAY APRIL 22

7:00 PM – 7:30 PM

KAREN KOHLER - Songs, Psychedelics and Seizures: A One-Woman Flow

7:30 PM – 8:00 PM

GISELLA BUSTILLOS - Narration, Time, Travel and Time Travel

8:00 PM – 8:30 PM

SKY NELSON - Musician, composer, author, physics educator

THURSDAY, APRIL 21, 2022

5:00 PM – 6:00 PM

TALK WITH PAOLO ROBERTO SILVA DE SOUZA..... Cascade Terrace

TUESDAY THROUGH FRIDAY EVENINGS

5:00 PM – 6:00 PM

AIR-COOL JENNYKiva Cascade Terrace, Catalina JK

6:30 PM – 9:00 PM

OPTIONAL DINNER - TICKETS REQUIRED..... Upper Terrace

FRIDAY, APRIL 22, 2022

9:15 PM – 10:15 PM

THE POETRY SLAM..... Kiva Ballroom

10:15 PM - XXX

NO-END OF CONSCIOUSNESS PARTY..... Kiva Ballroom

FRIDAY CONCURRENTS C10- C14 FRIDAY, APRIL 22 - 5:00 PM-7:00 PM

C10 - Representation and perception..... Executive Board Room
Robinson, Weger, Lecybyl, Langer, Schiffer

C11 - Psychedelics and altered states 2..... Grand Ballroom A
Glynos, Joy, Safron, Morley, Sielaff, M. Head

C12 - Subcellular correlates of consciousness:.....Grand Ballroom B
Mihelic, Alachkar, Ruggiero, Davis, Grinde, Egoyan, Todd

C13 - Space, time and consciousness 2.....Kiva Ballroom
Nishiyama, Mossbridge, Gruber, Raadnasab, Schick, Mender, Fitzpatrick

C14 Healing and altered states Grand Ballroom C
Woolcott, Wahbeh, Garland, Saegusa, Greven, Hanley, Joshi,

FRIDAY POSTER SESSION 2 SAME AS WEDNESDAY POSTER SESSION SEE PAGE 23

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KEYNOTE SPEAKERS

KEYNOTE 1 – TUESDAY, APRIL 19, 2022



CHRISTOF KOCH, PH.D.

Allen Institute for Brain Science

Brain Consciousness

11:10 AM – 12:30 PM – Kiva Ballroom

CHRISTOF KOCH, Ph.D., Chief Scientist and President, Allen Institute for Brain Science, Seattle, Washington and Chief Scientist of the MindScope Program.

Christof received his baccalaureate from the Lycée Descartes in Rabat, Morocco, his B.S. and M.S. in physics from the University of Tübingen in Germany and his Ph.D. from the Max-Planck Institute for biological Cybernetics in 1982. Subsequently, he spent four years as a postdoctoral fellow in the Artificial Intelligence Laboratory and the Brain and Cognitive Sciences Department at the Massachusetts Institute of Technology. From 1987 until 2013, Koch was a professor at the California Institute of Technology (Caltech) in Pasadena, from his initial appointment as Assistant Professor, Division of Biology and Division of Engineering and Applied Sciences in 1986, to his final position as Lois and Victor Troendle Professor of Cognitive & Behavioral Biology. Christof joined the Allen Institute for Brain Science as Chief Scientific Officer in 2011 and became President in 2015. Christof's passion are neurons – the atoms of perception, memory, behavior and consciousness – their diverse shapes, electrical behaviors, and their computational function within the mammalian brain, in particular in neocortex. The Allen Institute for Brain Science is engaged in a major effort to identify all the different types of neurons in the brains of mice and humans – the cell census effort. Christof discovered that in vivo cortical neurons do not integrate over large number of small inputs given their spiking variability, how neurons can multiply, the relationship between intra- and extra-cellular potential, and how this gives rise to the local field potential and the large-scale current sinks and sources and how weak extracellular fields can entrain spiking activity via ephaptic effects. He postulated the attentional saliency map hypothesis for biological and computer vision according to which one or more topographic organized spatial maps summarize bottom-up salient information in the visual system, he co-discovered, with Itzhak Fried, an high-level, invariant and abstract single neuron representation of familiar individuals and objects in the human medial temporal lobe (the so-called “Jennifer Aniston” or concept neurons) and developed the ‘continuous flashed suppression’ masking technique. In collaboration with Francis Crick, he initiated the modern search for the neuronal correlates of consciousness, a systematic experimental

program to identify the minimal bio-physical mechanisms jointly sufficient for any one specific conscious percept. In collaboration with Giulio Tononi, he co-developed the Integrated Information Theory of consciousness.

Brain and Consciousness, Christof Koch, Ph.D., Mindscope Program, Allen Institute, Tiny Blue Dot Foundation

I will discuss what we can reasonably state about consciousness and its neuronal footprints in the mammalian brain, in particular the cortex, how to detect its presence and how psychedelics might affect these footprints.

KEYNOTE 2 – WEDNESDAY, APRIL 20, 2022



ROBIN CARTHART-HARRIS

Psychedelics

11:10 AM – 12:30 PM – Kiva Ballroom

ROBIN CARHART-HARRIS, Ralph Metzner Distinguished Professor, Director of Neuroscape Psychedelics Division, Department of Neurology, University of California, San Francisco

Robin Carhart-Harris moved to Imperial College London in 2008 after obtaining a Ph.D. in Psychopharmacology from the University of Bristol, focused on the serotonin system, and an MA in Psychoanalysis from Brunel University, 2005. Robin has designed human brain imaging studies with LSD, psilocybin, MDMA and DMT, a clinical trial of psilocybin for treatment-resistant depression, a double-blind randomized controlled trial comparing psilocybin with the SSRI, escitalopram, for depression, published in the New England Journal of Medicine, and a multimodal imaging study in first time users of psilocybin. Robin has published over 100 scientific papers. He founded the Centre for Psychedelic Research at Imperial College London in April 2019, the first of its kind. In 2021, he was listed in TIME magazine's ‘100 Next’, a list of 100 rising stars shaping the future. Also in 2021, he moved to University of California, San Francisco, becoming the Ralph Metzner Distinguished Professor in Neurology and Psychiatry. At UCSF, Robin will serve as Director of the new Psychedelics Division within the translational neuroscience Centre, Neuroscape.

Psychedelics: Brain Mechanisms, Robin Carhart-Harris, UCSF

The talk takes a multi-level approach to the question of how psychedelics work in the brain. Key themes include: the pharmacology of classic serotonergic psychedelics, what this tells us about the current, developmental and evolutionary function of serotonin 2A receptor signaling, the acute brain effects of psychedelics as determined by functional brain imaging, current evidence for

psychedelic therapy, the 'REBUS' model of the action of psychedelics, and how this maps on to the phenomenology of the acute psychedelic experience and therapeutic outcomes. The talk will end with a focus on a recent double-blind RCT comparing psilocybin therapy with an established antidepressant drug in the treatment of depression.

KEYNOTE 3 – THURSDAY, APRIL 21, 2022



AVI LOEB

Harvard University

Astrobiology and Astroconsciousness

11:10 AM – 12:30 PM – Kiva Ballroom

ABRAHAM (AVI) LOEB is the Frank B. Baird, Jr., Professor of Science at Harvard University and a bestselling author (in lists of the New York Times, Wall Street Journal, Publishers Weekly, Die Zeit, Der Spiegel, L'Express and more).

Avi Loeb received a Ph.D. in Physics from the Hebrew University of Jerusalem in Israel at age 24 (1980-1986), led the first international project supported by the Strategic Defense Initiative (1983-1988), and was subsequently a long-term member of the Institute for Advanced Study (1988-1993). Loeb has written 8 books, including most recently, *Extraterrestrial* (Houghton Mifflin Harcourt, 2021), and about 800 papers (with an h-index of 117) on a wide range of topics, including black holes, the first stars, the search for extraterrestrial life and the future of the Universe. Loeb is the head of the Galileo Project in search for extraterrestrial intelligence, the Director of the Institute for Theory and Computation (2007-present) within the Harvard-Smithsonian Center for Astrophysics, and also serves as the Head of the Galileo Project (2021-present). He had been the longest serving Chair of Harvard's Department of Astronomy (2011-2020) and the Founding Director of Harvard's Black Hole Initiative (2016-2021). He is an elected fellow of the American Academy of Arts & Sciences, the American Physical Society, and the International Academy of Astronautics. Loeb is a former member of the President's Council of Advisors on Science and Technology (PCAST) at the White House, a former chair of the Board on Physics and Astronomy of the National Academies (2018-2021) and a current member of the Advisory Board for "Einstein: Visualize the Impossible" of the Hebrew University. He also chairs the Advisory Committee for the Breakthrough Starshot Initiative (2016-present) and serves as the Science Theory Director for all Initiatives of the Breakthrough Prize Foundation. In 2012, TIME magazine selected Loeb as one of the 25 most influential people in space and in 2020 Loeb was selected among the 14 most inspiring Israelis of the last decade.

Loeb's commentaries on innovation and diversity: <https://www.cfa.harvard.edu/~loeb/>

The Galileo Project: In Search for Technological Interstellar Objects - Avi Loeb, Professor of Science, Harvard University

The search for extraterrestrial life is one of the most exciting frontiers in science. First tentative clues were identified close to Earth in the form of the unusual interstellar object 'Oumuamua and Unidentified Aerial Phenomena (UAP) in the Earth's atmosphere. The recently announced "Galileo Project" ushers the new frontier of "space archaeology" in search of extraterrestrial technological relics. The lecture will feature content from my book "Extraterrestrial", as well as the textbook "Life in the Cosmos", both published in 2021. Related material was also featured in my weekly commentaries in Scientific American and Medium.

KEYNOTE 4 – THURSDAY, APRIL 22, 2022



DAVID CHALMERS

New York University

REALITY+ : From the Matrix to the Metaverse

11:10 AM – 12:30 PM – Kiva Ballroom

DAVID CHALMERS is University Professor of Philosophy and Neural Science and co-director of the Center for Mind, Brain, and Consciousness at New York University. He is the author of *The Conscious Mind* (1996) and of *Reality+: Virtual Worlds and the Problems of Philosophy* (2022). Here's an excerpt. He is known for formulating the "hard problem" of consciousness, for the idea of the "extended mind," and for the thesis that virtual reality is genuine reality. David Chalmers was featured in the New York Times Magazine, Dec. 10, 2021 - Interview with David Marchese - 'Can We Have a Meaningful Life in a Virtual World' - <http://consc.net/>

David is Former Director and Founder, Center for Consciousness Studies, University of Arizona. Faculty positions included, UC Santa Cruz, University of Arizona, Australian National University. Ph.D., Philosophy and Cognitive Science, Indiana University; McDonnell Fellow at Washington University; Rhodes Scholar in Pure Maths and Computer Science at the University of Adelaide in Australia. David Chalmers is Co-Founder, Center for Consciousness Studies, Tucson. Chalmers's writings include: *Philosophy of Mind*; *The Conscious Mind*; *The Character of Consciousness*; *Constructing the World*; *Mind and Consciousness*; *Facing Up to the Problem of Consciousness*.

Reality+: From the Matrix to the Metaverse**David Chalmers, Professor of Philosophy and Neural Science**

I'll argue that virtual reality is genuine reality. A simulated universe such as the Matrix could be indistinguishable from physical reality. Such a reality need not be illusory. The same goes for the Metaverse: the virtual worlds that we will create in coming decades with virtual and augmented reality technology. I will argue that Metaverse-style virtual worlds are genuine realities, and that we can live a meaningful life in these virtual worlds.

PLENARY SPEAKERS – BIOS/ABSTRACTS**TUESDAY, APRIL 19, 2022****PLENARY 1**

8:30 AM – 10:40 AM

SLEEP, WAKEFULNESS & ANESTHESIAGiancarlo Vanini, *University of Michigan*Matthew Larkum, *Humboldt University*Alex Proekt, *University of Pennsylvania***GIANCARLO VANINI***University of Michigan*

Giancarlo Vanini is an Assistant Professor in the Department of Anesthesiology and a member of the Center for Consciousness Science and Neuroscience Graduate Program at the University of Michigan. He has dual training in medicine and neuroscience. Research in the Vanini Laboratory focuses on understanding the brain circuitry underlying the regulation of arousal states of sleep and wakefulness, and

how these neural systems contribute to (1) the fluctuation of consciousness levels across spontaneous sleep-wake states, (2) the recovery of consciousness from general anesthesia, (3) the sleep-pain interface, and (4) the relationship between postoperative sleep disturbances and cognitive function. To this end, the lab combines behavioral assays, analysis of EEG rhythms and dynamics, neurochemical monitoring, recordings of calcium-dependent neuronal activity, viral tracing for identification of projection pathways, as well as chemogenetic/optogenetic tools to identify and probe neural networks controlling sleep,

wakefulness and pain.

Preoptic Hypothalamic Mechanisms Controlling Sleep-Wake States Do Not Influence the Loss and Recovery of Consciousness Associated with Isoflurane Anesthesia - Giancarlo Vanini, Department of Anesthesiology, University of Michigan Medical School.

Despite 175 years of continuous clinical use of general anesthetics, the precise mechanisms by which these drugs reversibly suppress consciousness remain unknown. One long-standing hypothesis in the field, which is largely supported by ample correlative evidence, is that anesthetics co-opt the brain circuits that regulate sleep. First, I will review evidence from several independent studies, including ours (Vanini et al., *Curr Biol* 2020; PMID:32084397), demonstrating that the preoptic area of the hypothalamus is a key component of the brain circuitry that controls sleep onset and sleep homeostasis. Additionally, I will present our recent work challenging the long-standing notion in sleep neurobiology that the preoptic area is exclusively somnogenic (Mondino et al., *J Neurosci* 2021; PMID: 33664133). In this study, we demonstrated that stimulation of a subset of glutamatergic neurons within the ventral-lateral portion of the preoptic area promote wakefulness, fragment sleep, suppress rapid eye movement sleep, and produce a shift in cortical rhythms and dynamics during sleep akin to a wake-like state (i.e., a “lighter” sleep). Last, I will discuss our study testing the hypothesis that selective activation of discrete neuronal subpopulations within the median preoptic nucleus (MnPO) and ventrolateral preoptic nucleus (VLPO) of the hypothalamus would modulate sleep/wake states and alter anesthetic induction and recovery time (Vanini et al., *Curr Biol* 2020; PMID:32084397). We showed that activating sleep-promoting (GABAergic, MnPO) and wake-promoting (glutamatergic, VLPO) neurons in the preoptic hypothalamus altered sleep-wake architecture but did not influence anesthetic state transitions. Collectively, our results suggest that the correlative evidence for a mechanistic overlap between sleep and anesthesia might not necessarily have strong causal significance.

**MATTHEW LARKUM***Humboldt University*

Professor Matthew Larkum, Neuroscientist & Director of the Larkum Lab, Berlin. He is Professor of “Neuronal Plasticity”, Department of Biology, Humboldt University of Berlin. Matthew Larkum graduated with a degree in physiology from the University of Sydney and completed his Ph. D. at the University of Bern, Switzerland.

I graduated from Sydney University with a thirst for solving the brain and was lucky to be a post-doc in the laboratory of Nobel

prize-winner Bert Sakmann for 6 years. It was here that I cut my teeth on hardcore electrophysiological and imaging techniques for understanding the computational properties of cortical neurons. I continued this focus upon starting up my own laboratory in Switzerland and more recently in Berlin where the laboratory has grown to accommodate a more comprehensive investigation of the contribution of single-cell computation to the process of cognition, learning and memory. The aims of the lab are based on a unifying hypothesis that the incredible cognitive power of the cortex derives from an associative mechanism built in at the cellular level such that the architecture of the cortex is tightly coupled with the computational capabilities of single cells. In essence, this hypothesis places new importance on the computational power of neurons that has ramifications for our understanding of cognition and for neurodegenerative diseases that disturb neuronal properties.



ALEX PROEKT

University of Pennsylvania, Associate Professor of Anesthesiology and Critical Care

I completed my Ph.D. work in the lab of Claude Weiss at Mount Sinai where I studied how simple neuronal networks of invertebrates are dynamically reconfigured to produce distinct behaviors. Upon completion of Anesthesiology residency at Weill Cornell, I was a post-doc at the Rockefeller University in Donald Pfaff's lab where I studied brain

arousal circuits and in Marcelo Magnasco's lab where I studied computational neuroscience. My lab at the University of Pennsylvania studies how neuronal dynamics give rise to adaptive behaviors and how these dynamics are altered by anesthetics. To this end we use a combination of experimental methods for recording and manipulating brain activity and mathematical modeling.

The scientific inquiry into mechanisms through which anesthetics act to induce a reversible state of unconsciousness are inextricably linked to the study of consciousness per se. Anesthetic mechanisms can be addressed at a number of levels from detailed understanding of molecular interactions between receptors and anesthetic compounds to their effects on individual neurons and neuronal circuits. In this talk, I will address mechanisms of anesthesia at a more macroscopic level, that of global brain dynamics. Consciousness emerges as a consequence of complex bidirectional interactions between the brain and the environment. At this level, the effect of anesthetics can be broadly conceptualized as decoupling the brain from the environment. In this talk, I will first offer a hypothesis that in order to enable the complex and flexible coupling between the brain and the environment, brain dynamics must be critical and provide some experimental support for this hypothesis using spontaneous brain activity in humans and nonhuman primates. I will then discuss our recent

results on effects of mechanistically distinct anesthetics on macroscopic brain dynamics evoked by simple visual stimuli in the mouse cortex.

KEYNOTE 1 – PLENARY 2

TUESDAY, APRIL 19, 2022

11:10 AM – 12:30 PM – Kiva Ballroom

BRAIN & CONSCIOUSNESS



CHRISTOF KOCH, PH.D.

Chief Scientist and President, Allen Institute for Brain Science, Seattle, Washington and Chief Scientist of the MindScope Program

Christof received his baccalaureate from the Lycée Descartes in Rabat, Morocco, his B.S. and M.S. in physics from the University of Tübingen in Germany and his Ph.D. from the Max-Planck Institute for biological Cybernetics in 1982.

Subsequently, he spent four years as a postdoctoral fellow in the Artificial Intelligence Laboratory and the Brain and Cognitive Sciences Department at the Massachusetts Institute of Technology. From 1987 until 2013, Koch was a professor at the California Institute of Technology (Caltech) in Pasadena, from his initial appointment as Assistant Professor, Division of Biology and Division of Engineering and Applied Sciences in 1986, to his final position as Lois and Victor Troendle Professor of Cognitive & Behavioral Biology. See here for Christof's academic pedigree and his students. Christof joined the Allen Institute for Brain Science as Chief Scientific Officer in 2011 and became President in 2015. Christof's passion are neurons – the atoms of perception, memory, behavior and consciousness – their diverse shapes, electrical behaviors, and their computational function within the mammalian brain, in particular in neocortex. The Allen Institute for Brain Science is engaged in a major effort to identify all the different types of neurons in the brains of mice and humans – the cell census effort. See the papers below. Christof discovered that in vivo cortical neurons do not integrate over large number of small inputs given their spiking variability, how neurons can multiply, the relationship between intra- and extra-cellular potential, and how this gives rise to the local field potential and the large-scale current sinks and sources and how weak extracellular fields can entrain spiking activity via ephaptic effects. He postulated the attentional saliency map hypothesis for biological and computer vision according to which one or more topographic organized spatial maps summarize bottom-up salient information in the visual system, he co-discovered, with Itzhak Fried, an high-level, invariant and abstract single neuron representation of familiar individuals and objects in the human medial temporal lobe (the so-called “Jennifer Aniston” or concept neurons) and developed the ‘continuous flashed suppression’ masking technique. In collaboration with

Francis Crick, he initiated the modern search for the neuronal correlates of consciousness, a systematic experimental program to identify the minimal bio-physical mechanisms jointly sufficient for any one specific conscious percept. In collaboration with Giulio Tononi, he co-developed the Integrated Information Theory of consciousness.

Brain and Consciousness

CHRISTOF KOCH, PH.D.,

Mindscope Program, Allen Institute, Tiny Blue Dot Foundation

I will discuss what we can reasonably state about consciousness and its neuronal footprints in the mammalian brain, in particular the cortex, how to detect its presence and how psychedelics might affect these footprints.

PLENARY 3

TUESDAY, APRIL 19, 2022

2:00 PM – 4:10 PM

BRAIN CONNECTIVITY



JEAN-RÉMI KING

CNRS - Ecole Normale Supérieure

I am a CNRS researcher at Ecole Normale Supérieure, currently in detachment at Facebook AI Research. My group focuses on understanding the computational bases of human cognition. For this, we develop paradigms, methods and models to analyze brain activity.



ZIRUI HUANG

University of Michigan, Department of Anesthesiology

Dr. Zirui Huang is a Research Assistant Professor in the Department of Anesthesiology and a member of the Center for Consciousness Science at the University of Michigan Medical School. He has a multidisciplinary background including psychology, biology, cognitive neuroscience and neuroimaging. His primary research interest lies in investigating the neural substrates of consciousness. He

studies the mechanistic role of large-scale brain networks in conscious cognition and its alteration by means of pharmacologic, neuropathologic and psychiatric manipulations of consciousness using functional MRI. He earned his Ph.D. in Cognitive Neuroscience from the Institute of Psychology, Chinese Academy

of Sciences. After his Ph.D., he continued his research for two postdoc periods at the University of Ottawa and the University of Michigan. To-date, he has published 45+ scientific articles. Among those, 20+ first/co-first author articles that have been published in Science Advances, Cell Reports, Neuroscience & Biobehavioral Reviews, The Journal of Neuroscience, Cerebral Cortex, NeuroImage, etc. He also serves as Ad Hoc Reviewer for prestigious scientific journals, such as Trends in Cognitive Sciences, Advanced Science, Molecular Psychiatry, The Neuroscientist, etc.

Media interviews:

The Scientist: <https://www.the-scientist.com/news-opinion/alternate-activation-of-two-brain-systems-tied-to-consciousness-67257>

MACROSCALE BRAIN DYNAMICS, GRADIENTS, AND THE GATE TO CONSCIOUSNESS

ZIRUI HUANG

University of Michigan Medical School, Department of Anesthesiology

Evidence from noninvasive functional neuroimaging studies has pointed to two distinct cortical systems that may mediate the ongoing stream of human consciousness, an internally directed system – default mode network and an externally directed system – dorsal attention network. During Dr. Huang's talk, he will discuss how the two systems unfold over time in the conscious brain, and how they are disrupted when consciousness is diminished. He will elaborate the concept of "temporal circuit," which is characterized by a set of trajectories along which the dynamic brain activity occurs (Huang et al., 2020, Science Advances). Next, Dr. Huang will present an extended work, in which the level and content of consciousness were manipulated using independent task-fMRI protocols. He will show that the anterior insula, situated between unimodal and transmodal cortical areas along the brain's primary functional gradient, regulates the default mode – dorsal attention network transitions, and gates conscious access of sensory information (Huang et al., 2021, Cell Reports). Finally, Dr. Huang will talk about the brain's multidimensional functional landscape and introduce a common macroscale neurofunctional framework that can account for both normal and altered states of consciousness. Evidence from noninvasive functional neuroimaging studies has pointed to two distinct cortical systems that may mediate the ongoing stream of human consciousness, an internally directed system – default mode network and an externally directed system – dorsal attention network. During Dr. Huang's talk, he will discuss how the two systems unfold over time in the conscious brain, and how they are disrupted when consciousness is diminished. He will elaborate the concept of "temporal circuit," which is characterized by a set of trajectories along which the dynamic brain activity occurs (Huang et al., 2020, Science Advances). Next, Dr. Huang

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ANIRBAN BANDYOPADHYAY PH.D.

Nano Characterization Unit, National Institute for Materials Science, NIMS, Tsukuba, Japan

Anirban Bandyopadhyay is Principal Research Scientist at the National Institute for Materials Science (NIMS), Tsukuba, Japan. He earned his Ph.D. in Supramolecular Electronics at the Indian Association for the Cultivation of Science (IACS), Kolkata, 2005. From 2005 to 2008 he was ICYS research fellow at the ICYS, NIMS, Japan, and worked on the brain-

like bio-processor building. In 2008, Anirban joined as a permanent scientist at NIMS, working on the cavity resonator model of human brain and design-synthesis of brain-like organic jelly. From 2013 to 2014 he was a visiting scientist at the Massachusetts Institute of Technology (MIT), USA. Awards include: Hitachi Science and Technology award 2010, Inamori Foundation award 2011–2012, Kurata Foundation Award, Inamori Foundation Fellow (2011–), and Sewa Society international member, Japan. www.anirbanlab.org

Filaments deep inside a neuron membrane is not silent, they fine tune precise spike time

Anirban Bandyopadhyay Ph.D., NIMS

For a century it was believed that everything inside the membrane remains silent when a nerve spike propagates. Using nanotechnology, a coaxial probe we measured that filaments contribute to neuron firing, not by initiating the firing but fine-tuning the spike timing, regulating the ion channel release. In the microscope the optical circuit that we see is not the true picture of the neural network, if we use dielectric resonance camera, we would see a very different picture of the brain circuit. Neural circuit is not a linear circuit as modelled for a century, on the contrary, it's a fractal like network where a scale free symmetry in vibrations of proteins extend to the entire brain body neural network.

1. Singh, P.; Sahoo, P.; Saxena, K.; Manna, J.S.; Ray, K.; Ghosh, S.; Bandyopadhyay, A. Cytoskeletal Filaments Deep Inside a Neuron Are Not Silent: They Regulate the Precise Timing of Nerve Spikes Using a Pair of Vortices.

Symmetry 2021, 13, 821. <https://doi.org/10.3390/sym13050821>

2. Pushpendra Singh, Komal Saxena, Pathik Sahoo, Subrata Ghosh, and Anirban Bandyopadhyay*. Electrophysiology using coaxial atom probe array: Live imaging reveals hidden circuits of a hippocampal neural network. Journal of Neurophysiology. Volume 125 Issue 6 June 2021, Pages 2107-2116 <https://doi.org/10.1152/jn.00478.2020>

3. Komal Saxena, Pushpendra Singh, Pathik Sahu, Satyajit Sahu, Subrata Ghosh, Kanad Ray, Daisuke Fujita and Anirban Bandyopadhyay; Fractal, scale free electromagnetic resonance of a single brain extracted microtubule nanowire, a single tubulin protein and a single neuron, Fractal and Fractional, 4, 11(2020). <https://doi.org/10.3390/fractalfract4020011>

WEDNESDAY, APRIL 20, 2022

PLENARY 4

8:30 AM – 10:40 AM

ALTERED STATES OF CONSCIOUSNESS



EMMA HUELS

University of Michigan

Emma Huels obtained her B.S. in Psychology from the University of Missouri-Saint Louis in 2016. Following graduation, Emma worked at Washington University School of Medicine in St. Louis examining brain activity in patients with postoperative delirium or those undergoing electroconvulsive therapy for treatment-resistant depression. Emma is a currently a doctoral candidate in the

Neuroscience Graduate Program at the University of Michigan, where is she is studying the role of prefrontal and parietal cortices in consciousness using psychedelic and anesthetic drugs in an animal model. She is also interested in non-pharmacological altered states of consciousness, with a focus on shamanic practice.

Neural Correlates of the Shamanic State of Consciousness

Emma Huels, U Michigan; Co-Authors: Hyoungkyu Kim; UnCheol Lee; Tarik Bel-Bahar; Angelo V. Colmenero; Amanda Nelson; Stefanie Blain-Moraes; George A. Mashour; Richard E. Harris

Psychedelics have been recognized as model interventions for studying altered states of consciousness. However, few empirical studies of the shamanic state of consciousness, which is anecdotally similar to the psychedelic state, exist. We investigated the neural correlates of shamanic trance using high-

density electroencephalography (EEG) in 24 shamanic practitioners and 24 healthy controls during rest, shamanic drumming, and classical music listening, followed by an assessment of altered states of consciousness. EEG data were used to assess changes in absolute power, connectivity, signal diversity, and criticality, which were correlated with assessment measures. We also compared assessment scores to those of individuals in a previous study under the influence of psychedelics. Shamanic practitioners were significantly different from controls in several domains of altered states of consciousness, with scores comparable to or exceeding that of healthy volunteers under the influence of psychedelics. Practitioners also displayed increased gamma power during drumming that positively correlated with elementary visual alterations. Furthermore, shamanic practitioners had decreased low alpha and increased low beta connectivity during drumming and classical music and decreased neural signal diversity in the gamma band during drumming that inversely correlated with insightfulness. Finally, criticality in practitioners was increased during drumming in the low and high beta and gamma bands, with increases in the low beta band correlating with complex imagery and elementary visual alterations. These findings suggest that psychedelic drug-induced and non-pharmacologic alterations in consciousness have overlapping phenomenal traits but are distinct states of consciousness, as reflected by the unique brain-related changes during shamanic trance compared to previous literature investigating the psychedelic state.



CHARLOTTE MARTIAL

University of Liège

Charlotte heads the projects on the phenomenon of near-death experiences (NDEs) at the Coma Science Group (GIGA-Consciousness, University of Liège, BE). More generally, Charlotte's work aims to investigate various states of disconnected consciousness (being conscious without experiencing the external world). She studies conditions in which people are outwardly unresponsive such as during general anesthesia or cardiac arrest, but 'disconnected' and/or 'connected' to the world, as testified by the detailed subjective reports upon awakening. She also explores the neural correlates of other altered or modified states of consciousness, such as disorders of consciousness and hypnosis (mainly using behavioral assessments, MRI and EEG techniques). She joined the Centre for Psychedelic Research (Division of Brain Sciences, Imperial College London, UK) in 2019 to investigate the overlap between the phenomenology of the classical psychedelic experiences and NDEs. Charlotte is also affiliated to the Psychology and Neuroscience of Cognition Research Unit (PsyNCog) from the University of Liège (BE). Next to her neuroscientific interest, she is also involved in the

clinical management of patients suffering from disorders of consciousness (e.g., vegetative/unresponsive state, minimally conscious state).

Near-death experience as a probe to explore (disconnected) consciousness

Charlotte Martial, Coma Science Group (GIGA-Consciousness), University of Liège, Liège, Belgium

Almost fifty years ago, the first evidence of near-death experience (NDE) during comatose state was provided, setting the stage for a new paradigm for studying disconnected consciousness and its underlying neurophysiological mechanisms. Although, historically, no thematic of research has been discussed more emotionally than the phenomenon of NDE, this is now changing and research on the phenomenon is currently increasing throughout the world. The talk provides an overview of the current state of the art in NDE research and where new opportunities for understanding the phenomenon may arise in the future.



ELIZABETH KRASNOFF

California Institute for Human Science

Elizabeth W. Krasnoff, Ph.D., was born and raised in New York, living now on the west coast in San Francisco and in NY city. Her doctorate is in Transformative Studies, with a focus in Consciousness Studies at the California Institute of Integral Studies (CIIS). Her dissertation reviews the transformative effects of sound, specifically "The Effects of Auditory Binaural Beats on Consciousness and the Human Nervous System."

In 2015, she became a certified Energy Healer through the Academy of Intuition Medicine® Master Certification program (MIM), and received her Sound Healing and Therapy Certificate from the Globe Institute. Elizabeth is also a certified Heartmath® Practitioner. Her MA is in Depth Psychology and Mythology from Pacifica Graduate Institute. Her BA in English with a Russian concentration was received from Boston College, Phi Beta Kappa, Summa cum laude. From 1994-1998 she lived abroad in Russia refining her comprehension of the Russian language.

Altered States of Consciousness and Sound: The Auditory Pathways of Binaural Beats

Elizabeth Krasnoff, California Institute for Human Science

In a time when the pursuit of altered states of consciousness is both leading edge science and a mainstream pursuit, the spotlight is on all available methods of consciousness alteration. Elizabeth investigates the power of sound to alter our states of consciousness, specifically the auditory pathways of binaural beats. Current theory in the Sound Healing field hypothesizes that binaural

beats filter through our Reticular Activating System, presenting consciousness altering data to the auditory brain. Binaural beats are a difference tone created by two slightly different pitches. Electrical brain wave patterns respond to these precise frequencies and appear to impact correlative states of consciousness. The Reticular Activating System is a neural network located in the brainstem responsible for modulating our three basic states of consciousness, awake, light sleep and deep sleep. Clinical studies continue to show positive outcomes in the leading edge field of binaural beats research, and the evidence is mounting for a powerful musical healing technology—music embedded with binaural beats. Moving forward, in her first double blind and controlled pilot study, Elizabeth has compared the effects of relaxation music to the effects of relaxation music plus inaudible binaural beats, measuring EEG, HRV, GSR, bioenergy and subjective questionnaire response. All 4 subjects experienced an improvement in brain function and had a calmer brain after adding BB to brown noise or to music plus brown noise. Most also show an improvement in microcirculation or cardiovascular score after listening to music plus brown noise and BB, probably due to relaxation. All of them also showed an increase in bioenergy after adding BB. BB seems to have profound effects on the physiology of subjects and since it is not audible, these effects cannot be attributed to the placebo effect. These results are encouraging in terms of developing musical products incorporating binaural beats to affect our neural rhythms and corollary states of consciousness and warrant further research with more subjects and different frequencies of BB and different music tracks. —Consciousness is an arousal and awareness of environment and self, which is achieved through action of the RAS on the brain stem and cerebral cortex (Daube, 1986; Paus, 2000; Zeman, 2001; Gosseries et al., 2011). In a time when the pursuit of altered states of consciousness is both leading edge science and a mainstream pursuit, the spotlight is on all available methods of consciousness alteration. Elizabeth investigates the power of sound to alter our states of consciousness, specifically the auditory pathways of binaural beats. Current theory in the Sound Healing field hypothesizes that binaural beats filter through our Reticular Activating System, presenting consciousness altering data to the auditory brain. Binaural beats are a difference tone created by two slightly different pitches. Electrical brain wave patterns respond to these precise frequencies and appear to impact correlative states of consciousness. The Reticular Activating System is a neural network located in the brainstem responsible for modulating our three basic states of consciousness, awake, light sleep and deep sleep. Clinical studies continue to show positive outcomes in the leading edge field of binaural beats research, and the evidence is mounting for a powerful musical healing technology—music embedded with binaural beats. Moving forward, in her first double blind and controlled pilot study, Elizabeth has compared the effects of relaxation music to the effects of relaxation music plus inaudible binaural beats, measuring EEG, HRV, GSR, bioenergy and subjective questionnaire response. All 4 subjects experienced

an improvement in brain function and had a calmer brain after adding BB to brown noise or to music plus brown noise. Most also show an improvement in microcirculation or cardiovascular score after listening to music plus brown noise and BB, probably due to relaxation. All of them also showed an increase in bioenergy after adding BB. BB seems to have profound effects on the physiology of subjects and since it is not audible, these effects cannot be attributed to the placebo effect. These results are encouraging in terms of developing musical products incorporating binaural beats to affect our neural rhythms and corollary states of consciousness and warrant further research with more subjects and different frequencies of BB and different music tracks. — Consciousness is an arousal and awareness of environment and self, which is achieved through action of the RAS on the brain stem and cerebral cortex (Daube, 1986; Paus, 2000; Zeman, 2001; Gosseries et al., 2011).

KEYNOTE 2 – PLENARY 5

WEDNESDAY, APRIL 20, 2022

11:10 AM – 12:30 PM

PSYCHEDELICS



ROBIN CARHART-HARRIS

*Ralph Metzner Distinguished Professor;
Director of Neuroscape Psychedelics Division,
Department of Neurology, University of California,
San Francisco*

Robin Carhart-Harris moved to Imperial College London in 2008 after obtaining a Ph.D. in Psychopharmacology from the University of Bristol, focused on the serotonin system, and an MA in Psychoanalysis from Brunel University, 2005. Robin has designed human brain imaging studies with LSD, psilocybin, MDMA and DMT, a clinical trial of psilocybin for treatment-resistant depression, a double-blind randomized controlled trial comparing psilocybin with the SSRI, escitalopram, for depression, published in the *New England Journal of Medicine*, and a multimodal imaging study in first time users of psilocybin. Robin has published over 100 scientific papers. He founded the Centre for Psychedelic Research at Imperial College London in April 2019, the first of its kind. In 2021, he was listed in *TIME* magazine's '100 Next', a list of 100 rising stars shaping the future. Also in 2021, he moved to University of California, San Francisco, becoming the Ralph Metzner Distinguished Professor in Neurology and Psychiatry. At UCSF, Robin will serve as Director of the new Psychedelics Division within the translational neuroscience Centre, Neuroscape.

Psychedelics: Brain Mechanisms**Robin Carhart-Harris, University of California, San Francisco**

The talk takes a multi-level approach to the question of how psychedelics work in the brain. Key themes include: the pharmacology of classic serotonergic psychedelics, what this tells us about the current, developmental and evolutionary function of serotonin 2A receptor signaling, the acute brain effects of psychedelics as determined by functional brain imaging, current evidence for psychedelic therapy, the 'REBUS' model of the action of psychedelics, and how this maps on to the phenomenology of the acute psychedelic experience and therapeutic outcomes. The talk will end with a focus on a recent double-blind RCT comparing psilocybin therapy with an established antidepressant drug in the treatment of depression.

PLENARY 6**WEDNESDAY, APRIL 20, 2022**

2:00 PM – 4:10 PM

PSYCHEDELIC MECHANISMS**GEORGE MASHOUR, MD***Robert B. Sweet Professor & Chair, Anesthesiology**Faculty, Neuroscience Graduate Program**Professor of Neurosurgery, Pharmacology, and Psychology**Director, Michigan Psychedelic Collaborative**Scientific Director, Center for Consciousness Science**University of Michigan, Ann Arbor, MI*

There has been a renaissance of rigorous investigation into psychedelic neuroscience and therapy, with a primary focus on canonical serotonergic drugs such as psilocybin, lysergic acid diethylamide, and dimethyltryptamine. However, it has been known since antiquity that subanesthetic doses or concentrations of general anesthetics can evoke psychedelic experiences. In this presentation, I will discuss some historical background of the use of anesthetics as psychedelics, then pivot to the neurobiology of ketamine and nitrous oxide. Drawing on studies by our research group in rodents, nonhuman primates, and humans, I will discuss the effects of subanesthetic ketamine and nitrous oxide on neuronal spike activity, cortical information transfer, and large-scale functional connectivity patterns in the brain. Lastly, I will discuss recent data that examines the phenomenon of increased neurophysiologic complexity during psychedelic drug exposure and the potential neurochemical underpinnings based on concomitant high-density electroencephalography and multi-site microdialysis in the rodent brain.

**ALEX C. KWAN, PH.D.***Yale University*

Alex Kwan is a neuroscientist whose work is focused on the neurobiology of antidepressants. He is known for using sophisticated optical imaging methods to show how drugs, such as ketamine and psilocybin, modify the structure and function of brain circuitry. His research has been published in top peer-reviewed journals including *Neuron*, *Nature Neuroscience*, and *Biological Psychiatry*. He has a Ph.D. in

Applied Physics from Cornell University and is currently an Associate Professor in the Department of Psychiatry at Yale University. Website: <http://alexkwanlab.org/> Twitter: @kwanalex

Visualizing the plasticity-promoting action of psilocybin**Alex C. Kwan, Yale University**

Psychedelics are compounds that produce an atypical state of consciousness characterized by altered perception, cognition, and mood. In addition to the subjective effects, it has long been recognized that these compounds have therapeutic potential for mood disorders. Among psychedelics, psilocybin has yielded highly promising results showing a relief of depression symptoms with rapid onset and long duration of weeks if not months. The long-lasting beneficial effects of psilocybin depend presumably on neural plasticity; however, the neural basis remains unclear. In this talk, I will describe a dendrite-based framework for understanding how psychedelics may promote neural plasticity. I will discuss recent experiments with psilocybin in mice to test key aspects of the cellular and circuit mechanisms.

**KATRIN PRELLER, PH.D.***University of Zurich; Yale University*

Katrin Preller received her M.Sc. (Neuropsychology and Clinical Psychology) from University of Konstanz, Germany. She joined the University of Zurich where she investigated the neurobiological long-term effects of cocaine, MDMA, and heroin use. After completing her Ph.D., she investigated the effects of psychedelics at the Neuropsychopharmacology and Brain Imaging Lab. She received a SNSF PostDoc

mobility fellowship and worked at the Wellcome Trust Centre for Neuroimaging, UCL, London, and Yale University, New Haven. Subsequently, she was appointed as Group Leader at the University of Zurich and holds a position as Visiting Assistant Professor at Yale University. She is investigating the mechanistic effects of psychedelics and their therapeutic potential in various clinical populations.

The neurobiology of altered states of consciousness

Katrin Preller, University of Zurich; Yale University

Due to their unique effects on consciousness, psychedelics offer the opportunity to investigate the neuropharmacological mechanisms underlying alterations in perception and cognition important for increasing our understanding of psychiatric disorders. Furthermore, renewed interest in the potentially beneficial clinical effects of psychedelics warrants a better understanding of their underlying neuropharmacological mechanisms. However, major knowledge gaps remain regarding the neurobiology of psychedelics in humans.

In our studies we show that LSD and psilocybin modulate brain connectivity and subjective effects via agonistic activity on the serotonin 2A receptor in humans. Furthermore, we elucidate the neuropharmacology of self-relevance and meaning processing, as well as the intertwined relationship between self-processing and social cognition via the administration of LSD and psilocybin. We additionally show that the neural correlates of psychedelic-induced states differ from non-pharmacologically induced altered states of consciousness.

Our results thus attenuate major knowledge-gaps regarding the neurobiology and neuropharmacology of psychedelics. Furthermore, they increase our mechanistic understanding of cognitive and emotional processes and therefore offer important directions regarding the development of novel therapeutics.

THURSDAY, APRIL 21, 2022

PLENARY 7

THURSDAY, APRIL 21, 2022

8:30 AM – 10:40 AM

TIME & CONSCIOUSNESS

Daniel Sheehan, University of San Diego

Paul Davies, Arizona State University

Sir Roger Penrose, Oxford University



DANIEL SHEEHAN

University of San Diego

Daniel P. Sheehan is Professor of Physics at the University of San Diego. His areas of interest include plasma physics, the foundations of thermodynamics, energy technology, nanotechnology, consciousness, and the physics of time and retrocausation.

Time's Broken Arrow: Consciousness and Temporal Bidirectionality

D.P. Sheehan, Department of Physics, University of San Diego

During the last 20 years it has become increasingly clear that our physical understanding of time is incomplete. Although the fundamental equations of physics are time-symmetric – that is, they equally admit time-forward (retarded) and time-reversed (advanced) solutions [1] – natural processes and our personal experiences generally demonstrate a forwardly-directed, temporally asymmetric 'arrow of time.' (The second law of thermodynamics is thought to underwrite most temporal asymmetries.) Human and animal precognition are at odds with this standard temporal arrow [2]; recent quantum laboratory experiments further press the issue. This presentation considers the case for temporal bidirectionality in the natural world and in human consciousness, focusing on precognition and retrocausation. Also considered is the possibility that precognitive effects might be demonstrated by non-sentient devices, i.e., informational time machines. It is argued that retrocausation and precognition are not at odds with standard physics but are in fact natural outcomes of it. Indeed, time may be losing its direction – but not its mind. In fact, it may finally be coming to its senses.

- 1) H.D. Zeh, *The Physical Basis of the Direction of Time*, Springer, Berlin (2001).
- 2) D.P. Sheehan (Editor), *AIP Conf. Vols. 863, 1408, 1841*; AIP Press (2006, 2011, 2017).



PAUL DAVIES

Arizona State University

Paul Davies is a theoretical physicist, cosmologist, astrobiologist and best-selling science author. He has published about 30 books and hundreds of research papers and review articles across a range of scientific fields. He is also well-known as a media personality and science popularizer in several countries. His research interests have focused mainly on quantum gravity, early universe cosmology, the theory of quantum black holes and the nature of time. He has also made important contributions to the field of astrobiology and was an early advocate of the theory that life on Earth may have originated on Mars. For several years he has also been running a major cancer research project and developed a new theory of cancer based on tracing its deep evolutionary origins. Among his many awards are the 1995 Templeton Prize, the Faraday Prize from The Royal Society, the Kelvin Medal and Prize from the Institute of Physics, the Robinson Cosmology Prize and the Bicentenary Medal of Chile. He was made a member of the Order of Australia in the 2007 Queen's birthday honours list and the asteroid 6870 Pauld Davies is named after him. His

more recent books include “What’s Eating the Universe?”, “The Demon in the Machine”, “About Time”, “The Origin of Life”, “The Goldilocks Enigma: Why Is the Universe Just Right for Life?”, “How to Build a Time Machine” and “The Eerie Silence: Are We Alone in the Universe?”

Education:

BSc First Class in Physics, University College London, 1967; Ph.D., Physics Department, University College London, 1970;

DSc honoris causa, Macquarie University, Sydney (2006); DSc honoris causa, Chapman University, California (2009)

DSc honoris causa, University of Newcastle upon Tyne (2019)

Time’s Flow Is An Illusion: Time Doesn’t Pass, Selves Do

Paul Davies, Arizona State University

The universal perception that time passes, or flows, is an illusion. Time cannot change; the world can. I shall demonstrate that the concept of a flow of time is meaningless, and instead trace the origin of this impression to the false tacit assumption that ‘the self,’ i.e. personal identity, is conserved in time. This error arises because of the large degree of mutual information between the self at earlier and later times. The fact that time (clearly) does not flow in no way undermines the existence of an arrow of time in the physical world, understood as an asymmetry in the evolution of physical states in time. An asymmetry of the world in time is not an asymmetry of time. The universal perception that time passes, or flows, is an illusion. Time cannot change; the world can. I shall demonstrate that the concept of a flow of time is meaningless, and instead trace the origin of this impression to the false tacit assumption that ‘the self,’ i.e. personal identity, is conserved in time. This error arises because of the large degree of mutual information between the self at earlier and later times. The fact that time (clearly) does not flow in no way undermines the existence of an arrow of time in the physical world, understood as an asymmetry in the evolution of physical states in time. An asymmetry of the world in time is not an asymmetry of time.



SIR ROGER PENROSE

University of Oxford – Nobel Laureate

Emeritus Rouse Ball Professor of Mathematics, Emeritus Fellow, Wadham College University of Oxford United Kingdom

Roger Penrose was born, August 8, 1931 in Colchester Essex UK. He earned a 1st class mathematics degree at University College London; a Ph.D. at Cambridge UK, and became assistant lecturer, Bedford College London, Research Fellow

St John’s College, Cambridge (now Honorary Fellow), a post-doc at King’s College London, NATO Fellow at Princeton, Syracuse, and Cornell Universities, USA. He also served a 1-year appointment at University of Texas, became a Reader then full Professor at Birkbeck College, London, and Rouse Ball Professor of Mathematics, Oxford University (during which he served several ½-year periods as Mathematics Professor at Rice University, Houston, Texas). He is now Emeritus Rouse Ball Professor, Fellow, Wadham College, Oxford (now Emeritus Fellow). He has received many awards and honorary degrees, including knighthood, Fellow of the Royal Society and of the US National Academy of Sciences, the De Morgan Medal of London Mathematical Society, the Copley Medal of the Royal Society, the Wolf Prize in mathematics (shared with Stephen Hawking), the Pomeranchuk Prize (Moscow), and one half of the **2020 Nobel Prize in Physics**, the other half shared by Reinhard Genzel and Andrea Ghez. He has designed many non-periodic tiling patterns including a large paving at entrance of Andrew Wiles Mathematics Building, Oxford, and the Transbay Center, San Francisco, California. Sir Roger is widely acclaimed for fundamental advances in understanding the universe. His 2020 Nobel Prize in Physics was bestowed for showing that black holes are robust predictions of Einstein’s theory of general relativity. Roger has also proposed a solution to the measurement problem in quantum mechanics (‘objective reduction’, ‘OR’), which he suggests is also the origin of consciousness, leading to a theory of brain function (‘orchestrated objective reduction’, ‘Orch OR’). And Roger’s concept of Conformal Cyclic Cosmology (‘CCC’) posits a serial, eternal universe, with the Big Bang preceded by a previous aeon which had its own Big Bang, that aeon preceded by another and so on.

KEYNOTE 3 – PLENARY 8

THURSDAY APRIL 21, 2022

11:10 AM – 12:30 PM

ASTROBIOLOGY & ASTROCONSCIOUSNESS



AVI LOEB

Harvard University

ABRAHAM (AVI) LOEB is the Frank B. Baird, Jr., Professor of Science at Harvard University and a bestselling author (in lists of the New York Times, Wall Street Journal, Publishers Weekly, Die Zeit, Der Spiegel, L’Express and more).

Avi Loeb received a Ph.D. in Physics from the Hebrew University of Jerusalem in Israel at age 24 (1980-1986), led the first international project supported by the Strategic

Defense Initiative (1983-1988), and was subsequently a long-term member of the Institute for Advanced Study (1988-1993). Loeb has written 8 books, including most recently, *Extraterrestrial* (Houghton Mifflin Harcourt, 2021), and about 800 papers (with an h-index of 117) on a wide range of topics, including black holes, the first stars, the search for extraterrestrial life and the future of the Universe. Loeb is the head of the Galileo Project in search for extraterrestrial intelligence, the Director of the Institute for Theory and Computation (2007-present) within the Harvard-Smithsonian Center for Astrophysics, and also serves as the Head of the Galileo Project (2021-present). He had been the longest serving Chair of Harvard's Department of Astronomy (2011-2020) and the Founding Director of Harvard's Black Hole Initiative (2016-2021). He is an elected fellow of the American Academy of Arts & Sciences the American Physical Society, and the International Academy of Astronautics. Loeb is a former member of the President's Council of Advisors on Science and Technology (PCAST) at the White House, a former chair of the Board on Physics and Astronomy of the National Academies (2018-2021) and a current member of the Advisory Board for "Einstein: Visualize the Impossible" of the Hebrew University. He also chairs the Advisory Committee for the Breakthrough Starshot Initiative (2016-present) and serves as the Science Theory Director for all Initiatives of the Breakthrough Prize Foundation. In 2012, TIME magazine selected Loeb as one of the 25 most influential people in space and in 2020 Loeb was selected among the 14 most inspiring Israelis of the last decade. Click here for Loeb's commentaries on innovation and diversity. <https://www.cfa.harvard.edu/~loeb/>

The Galileo Project: In Search for Technological Interstellar Objects

Avi Loeb, Professor of Science, Harvard University

The search for extraterrestrial life is one of the most exciting frontiers in science. First tentative clues were identified close to Earth in the form of the unusual interstellar object 'Oumuamua and Unidentified Aerial Phenomena (UAP) in the Earth's atmosphere. The recently announced "Galileo Project" ushers the new frontier of "space archaeology" in search of extraterrestrial technological relics. The lecture will feature content from my book "Extraterrestrial", as well as the textbook "Life in the Cosmos", both published in 2021. Related material was also featured in my weekly commentaries in Scientific American and Medium.

PLENARY 9

THURSDAY APRIL 21, 2022

2:00 PM – 4:10 PM

ORIGINS OF LIFE



DANTE LAURETTA

*University of Arizona, Regents Professor,
Planetary Science and Cosmochemistry
University of Arizona Lunar & Planetary Laboratory*

Dante Lauretta is principal investigator of the OSIRIS-REx mission and a regents professor of planetary science at the University of Arizona's Lunar and Planetary Laboratory. His research interests focus on the chemistry and mineralogy of asteroids and comets, and he is an expert in the analysis of extraterrestrial materials, including asteroid samples, meteorites and comet particles.

Dr. Lauretta fosters the advancement of the next generation of scientists, engineers, and other space leaders through mentorship and taught coursework which apply his expertise in planetary science and spacecraft mission design & implementation. Dr. Lauretta heads the OSIRIS-REx research team at UArizona working on this mission, which has included more than 100 undergraduate and graduate students. This project will help ensure that the University of Arizona remains at the forefront of planetary exploration for the next decade.

NASA's OSIRIS-REx Mission

The OSIRIS-REx mission was selected in 2011. The spacecraft launched in September 2016 and began its journey to Bennu, a carbon-rich, near-Earth asteroid. The spacecraft rendezvoused with Bennu in 2018 and successfully obtained a sample in October 2020. The spacecraft embarked on its return voyage to Earth on May 10, 2021. On Sept. 24, 2023, the spacecraft will jettison the sample capsule and send it onto a trajectory to touch down in the Utah desert. Sample analysis will continue until 2025. These samples will be the first for a U.S. mission and may hold clues to the origin of the solar system and the organic molecules that may have seeded life on Earth. The University of Arizona leads the mission for NASA and will provide sample analysis laboratories for the returned samples. NASA's Goddard Space Flight Center provides overall mission management. Lockheed Martin Space Systems built the spacecraft. United Launch Alliance built the mission's Atlas V launch vehicle. The mission is in an exciting phase right now as the OSIRIS-REx spacecraft continues its return journey to Earth. www.AsteroidMission.org

Testing Theories for the Origin of Life Using Samples of Near-Earth Asteroid (101955) Bennu

Dante Lauretta, University of Arizona, Lunar & Planetary Laboratory

On Oct. 20, 2020, NASA's OSIRIS-REx spacecraft descended to the surface of asteroid Bennu, contacted briefly, and collected a sample of carbonaceous material (Lauretta et al. 2021). These samples will return to Earth in 2023. Analyses of these samples promise advancement in our knowledge of the initial stages of planet formation and the origin of life (OOL). In particular, the samples will be analyzed to determine whether the building blocks required for the different OOL theories could have been delivered to Earth by carbonaceous asteroids. A leading theory in origin of life research is the RNA World Hypothesis, in which RNA is the first biomolecule and performs both reproductive and catalytic functions (Woese 1967; Eigen and Schuster 1977; Gilbert 1986). The sample analysis team (SAT) will analyze solvent extracts of Bennu samples for the presence of purines and pyrimidines (Callahan et al. 2011), and polyols including ribose and other bioessential sugars (Furukawa et al. 2019). Alternatively, the Protein World Hypothesis purports that proteins are amplified in the absence of any genetic function (Ikehara 2005). The SAT will analyze for both contemporary protein and non-protein amino acids and peptides to test this hypothesis. In addition, the team will determine if organic material contains enantiomeric excesses for chiral molecules that are of the same handedness as found in life (i.e., L-amino acids). A third approach is the Metabolism First Hypothesis, where self-reproducing and evolving proto-metabolic networks predate self-replicating molecules (Vasas et al. 2010). The SAT explores this concept by seeking signs of frozen chemical reaction networks, catalytic cycles, autocatalytic cycles, or pathways. (Aponte et al. 2017; Fernández-Garcia et al. 2017). The above hypotheses are driven by the principle that life is defined by a complex set of physicochemical processes and assume that consciousness evolved after life's origin. The Orchestrated Objective Reduction hypothesis proposes that consciousness preceded life. Consciousness, in this theory, is driven by self-collapse of the quantum wavefunction, producing "proto-conscious" moments (Hameroff 2017) that could have driven organic molecules to self-organize. The first molecules to enter the quantum coherent state may have been polyaromatic hydrocarbons. These hydrocarbon rings occur at the core of proteins, nucleic acids, and psychoactive compounds. While not part of the SAT plan, we are investigating quantum effects in the chemically complex, macromolecular organic material that likely contains the bulk of Bennu's carbon (Cody and Alexander 2005).

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 Gilbert (1986) Nature 319.6055: 618-618.
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 Vasas et al. (2010) PNAS 107.4: 1470-1475.
 Woese (1967) New York: Harper & Row, 200 pp.



SARA WALKER

Arizona State University

Professor Sara Walker is an astrobiologist and theoretical physicist interested in the origin of life and how to find life on other worlds. While there are many things to be solved, she is most interested in whether or not there are 'laws of life' - related to how information structures the physical world - that could universally describe life here on Earth and on other planets. At Arizona State University she is Deputy Director of the Beyond Center for Fundamental Concepts in Science, Associate Director of the ASU-Santa Fe Institute Center for Biosocial Complex Systems and Assistant Professor in the School of Earth and Space Exploration. She is also Co-founder of the astrobiology-themed social website SAGANet.org and is a member of the Board of Directors of Blue Marble Space. She is active in public engagement in science, with appearances at the World Science Festival and on "Through the Wormhole" and NPR's Science Friday.

Hard Problems: Life and Consciousness

Sara Walker, Arizona State University

Understanding what life is, and by extension how it originates may be the most difficult open question in science, rivaling only the problem of consciousness in its potential difficulty. Both seem to bend our current understanding of physics and chemistry as ill-equipped to solve them. This led to the notion of the 'hard problem' of consciousness, meant to precisely articulate the key feature of consciousness our current understanding of reality can't explain - the problem

of experience, that is why does it feel like anything to exist? Like consciousness, here I argue that explaining life can similar be reduced to a single focal hard problem, the hard problem of life, that is how can information affect the material world? I discuss new developments in a theory called assembly theory aiming to address this problem.



STEEN RASMUSSEN

University of Southern Denmark | Santa Fe Institute

Steen Rasmussen is currently a professor in physics and a center director at University of Southern Denmark and an external research professor at the Santa Fe Institute, USA. His studies the creative forces in nature and engineers minimal living and intelligent processes in computers, robots, and the lab. He has consulted on science and technology issues for the European Commission, the Danish Parliament, the

US Congress, as well as private organizations. He has received many rewards, starting with P. Gorm-Petersens Mindelegat in the presence of Her Majesty the Queen, Margrethe II of Denmark, and most recently a Lifetime Achievement Award from the International Society for Artificial Life. With his Co-PIs he has won \$39M in research grants to his home institutions and international research consortia across the US, EU and Denmark. For 20 years he worked at Los Alamos National Laboratory, USA. He returned to his current position in Denmark late 2007.

Assembly and evolution of minimal living materials

Steen Rasmussen, University of Southern Denmark | Santa Fe Institute

We use a systemic protocell design process as a starting point for exploring two fundamental questions: How may minimal living systems emerge from non-living materials? And how may minimal living systems support increasingly more evolutionary richness?

Living matter, as a minimum[1], is composed of (i) a metabolism that transforms energy to support the involved reactions e.g., to generate building, (ii) an informational system with inheritable information that at least in part controls the metabolism and (iii) a container that co-localizes the metabolism and the informational system. Further, the system exists in (iv) an environment that provides resources and free energy as well as absorbs waste. We present an experimental example of a protocellular system that satisfies the above.

Landauer's principle[2][3][4][5] states that an ability to copy and evolve information costs free energy. Therefore, available free energy must be a prerequisite for replication to occur, and thus the existence of a metabolism is a prerequisite as a converter of available free energy into the work needed in replication. Good molecular candidates to support simple metabolic processes

are complexes of polyaromatic hydrocarbons and metal. Information in modern life usually reefer to sequential information (e.g., in DNA and RNA or proteins), while compositional information[6] (e.g., the composition of an aggregate) is a less restrictive form of information that can also be replicated. We show how compositional information can be coupled to a metabolism experimentally as well as in simulation in the context of a minimal living protocell[7][8][9]. By examining data from systems in physics, biology, engineering, and economics it turns out that one can observe two different modes of evolution[10]: optimization and expansion. The former may occur in systems whose size and component interactions do not change substantially over time, while the latter is a key property of open-ended evolution, where components and component interactions change over time. Thus, to enhance the evolutionary richness in a system that only optimizes, e.g., the above presented protocellular system, the system must be enriched with new components, and thereby interactions, to expand its potential dynamics. We have applied this simple design idea[11] with some success to enhance the behavioral richness both for computational and experimental investigations, but it is only in retrospect one can be certain, which system expansions one should apply.

[1] <https://royalsocietypublishing.org/doi/10.1098/rstb.2015.0440>

[2] https://en.wikipedia.org/wiki/Landauer%27s_principle

[3] <https://www.nature.com/articles/ncomms8669>

[4] <https://arxiv.org/abs/1004.4732>

[5] <https://royalsocietypublishing.org/doi/10.1098/rsta.2016.0343>

[6] <https://www.pnas.org/content/pnas/97/8/4112.full.pdf>

[7] <https://royalsocietypublishing.org/doi/10.1098/rstb.2015.0440>

[8] <https://direct.mit.edu/isal/proceedings/isal2020/269/98487>

[9] <https://direct.mit.edu/isal/proceedings/isal/33/69/102946>

[10] <https://direct.mit.edu/artl/article-abstract/25/1/9/2914/>

[11] <https://direct.mit.edu/artl/article-abstract/7/4/329/2381/>

PLENARY 10**FRIDAY, APRIL 22, 2022**

8:30 AM – 10:40 AM

THEORIES OF CONSCIOUSNESS**BIYU J. HE***New York University, Langone*

Biyu received her Ph.D. in Neuroscience from Washington University in St. Louis. Prior to joining NYU, she led her own independent research group in the intramural research program of the NIH/NINDS, with an intramural equivalent of the NIH Director's Early Independence Award. Her laboratory uses a combination of invasive and non-invasive multimodal human brain imaging, brain stimulation, and computational

approaches to investigate the neural mechanisms of perceptual processing in the human brain. She has also made original contributions to understanding the organization, mechanisms and functional roles of spontaneous brain activity and aperiodic brain activity. She has received a Society for Neuroscience Trubatch Career Development Award, an NSF CAREER Award, and a Klingenstein-Simons Fellowship Award among other awards.

Neural mechanisms of conscious visual perception**Biyu He, New York University**

Despite intense interests and research over the past three decades, the neural mechanisms of conscious visual perception remain a mystery. In this talk, I will give an overview of our recent work tackling this fundamental question. Using a combination of high temporal resolution (E/MEG, electrocorticography) and high spatial resolution (e.g., 7T fMRI) techniques to record from the human brain, and employing multiple perceptual paradigms, we have found that: I) Conscious perception likely requires the coordination of large-scale brain dynamics across multiple brain networks, including both content-specific cortical activity and non-content-specific subcortical activity. II) The preexisting brain state, including both the connectivity patterns reflecting past experiences and the moment-to-moment spontaneous activity fluctuations, strongly shapes conscious perception. In addition, I will discuss the implications of these findings for theories of conscious perception.

**YURI B. SAALMANN***University of Wisconsin – Madison*

Yuri Saalmann is an Associate Professor in the Department of Psychology, UW-Madison, and Director of the Saalmann Lab, Wisconsin National Primate Research Center. He performed his doctoral work in neuroscience at the Australian National University, and postdoctoral research at the University of Melbourne, Australia, and Princeton University. His lab investigates the neural basis of cognitive control – the ability

to flexibly adapt behavior according to goals and context – and consciousness. This is done using a combination of neuroimaging and intracranial electrophysiology in non-human primates and human subjects. His research program is directed at understanding information processing in large-scale brain networks in healthy subjects and subjects with psychiatric disorders, such as schizophrenia and attention deficit hyperactivity disorder, and neurological disorders, such as deficits in awareness after stroke.

Putting theories of consciousness to the test, using intracranial electrophysiology and causal manipulations**Yuri B. Saalmann, University of Wisconsin – Madison**

Competing theories of consciousness disagree on the contribution of frontal versus posterior cortex and largely neglect subcortical influences. To test proposed neural correlates of consciousness (NCC), we simultaneously recorded neural activity from the frontal and parietal cortex, as well as subcortical areas in the basal ganglia and central thalamus, of awake, sleeping and anesthetized macaques. Further, we bidirectionally manipulated consciousness on a finer scale using thalamic deep brain stimulation, rousing macaques from continuously administered anesthesia or reducing consciousness in behaving macaques. I will discuss machine learning analyses of these neural data that show parietal cortex and subcortical areas contributed more than frontal cortex to decoding different conscious states. This work suggests that an integrated parietal-striatal-thalamic structure is important for consciousness. I will also discuss an ongoing adversarial collaboration testing the different NCC proposed by Global Neuronal Workspace Theory and Integrated Information Theory, using high-density electrophysiology and optogenetics in macaques and mice performing a similar sensory discrimination task.



LUCIA MELLONI
Max Planck Institute

Lucia Melloni is currently group leader at the Max Planck Institute for Brain Research in Frankfurt am Main, Germany, research assistant professor at New York University Langone Medical Center, and a research scientist at Columbia University College of Physicians and Surgeons in New York, NY. Her research centers on consciousness, electrophysiology, meditation, perceptual learning, and

predictive coding.

KEYNOTE 4 - PLENARY 11

11:10 AM – 12:30 PM

REALITY +: From the matrix to the metaverse



DAVID CHALMERS
New York University

DAVID CHALMERS is University Professor of Philosophy and Neural Science and co-director of the Center for Mind, Brain, and Consciousness at New York University. He is the author of *The Conscious Mind* (1996) and of *Reality+: Virtual Worlds and the Problems of Philosophy* (2022). He is known for formulating the “hard problem” of consciousness, for the idea of the “extended mind,” and for the thesis that virtual

reality is genuine reality. David Chalmers was featured in the New York Times Magazine, Dec. 10, 2021 - Interview with David Marchese - 'Can We Have a Meaningful Life in a Virtual World' - <http://consc.net/>

David is Former Director and Founder, Center for Consciousness Studies, University of Arizona. Faculty positions included, UC Santa Cruz, University of Arizona, Australian National University. Ph.D., Philosophy and Cognitive Science, Indiana University; McDonnell Fellow at Washington University; Rhodes Scholar in Pure Maths and Computer Science at the University of Adelaide in Australia. David Chalmers is Co-Founder, Center for Consciousness Studies, Tucson. Chalmers's writings include: *Philosophy of Mind*; *The Conscious Mind*; *The Character of Consciousness*; *Constructing the World*; *Mind and Consciousness*; *Facing Up to the Problem of Consciousness*.

Reality+: From the Matrix to the Metaverse

David Chalmers, Professor of Philosophy and Neural Science

I'll argue that virtual reality is genuine reality. A simulated universe such as the Matrix could be indistinguishable from physical reality. Such a reality need not

be illusory. The same goes for the Metaverse: the virtual worlds that we will create in coming decades with virtual and augmented reality technology. I will argue that Metaverse-style virtual worlds are genuine realities, and that we can live a meaningful life in these virtual worlds.

PLENARY 12
FRIDAY, APRIL 22, 2022
2:00 PM – 4:10 PM

QUANTUM NEUROSCIENCE



HARTMUT NEVEN
Google Quantum AI

Hartmut Neven is an Engineering Director at Google. He is the founder and manager of the Quantum Artificial Intelligence lab. The objective of the lab is to fabricate quantum processors and develop novel quantum algorithms to dramatically accelerate computational tasks for machine intelligence. Previously, Hartmut was head of the Visual Search team. His team developed the visual search service

which today is used by a large number of Google products including Image Search, Google Photos, YouTube, Street View and Google Goggles. His teams won a number of competitions designed to establish the best visual recognition software for faces (FERET 1996, FRVT 2002), objects (ImageNet 2014) and text (ICDAR 2013). Hartmut was also a co-founder of project Glass and led the team that built the first prototype. Prior to joining Google, Hartmut started two computer vision companies, the second one was acquired by Google in 2006. Hartmut obtained his Ph.D. in 1996 with a thesis on "Dynamics for vision-guided autonomous mobile robots". Then he became a research professor for computer science and theoretical neuroscience at the University of Southern California.


AARAT KALRA

Princeton University

Dr. Aarat Kalra is a postdoctoral scientist in the Scholes group at Princeton University. He is an expert on microtubules and works to determine the feasibility of excitonic energy transport within these biological nanowires. Dr. Kalra has previously worked with approaches from both physics and biology to determine the relevance of physical interactions in biological systems. His experiments have shown that the

electrostatic behaviour of microtubules is solvent dependent and can regulate local chemical environment. Light at the End of the Tunnel.


TRAVIS J.A. CRADDOCK

Institute for Neuro-Immune Medicine

Nova Southeastern University, Fort Lauderdale, FL, USA

*Departments of Psychology & Neuroscience,
Computer Science, and Clinical Immunology,
Nova Southeastern University, Fort Lauderdale FL, USA*

Microtubules are self-assembling biological nanotubes made of the protein tubulin that are essential for cell motility, cell architecture, cell division and intracellular trafficking. The

unique mechanical properties of microtubules give rise to a high resilience and stiffness due to their quasi-crystalline helical structure. It has been theorized that this hollow molecular nanostructure may function like a quantum wire where optical transitions can take place, where photo-induced changes in microtubule architecture may be mediated via changes in disulfide or peptide bonds or stimulated by photoexcitation of tryptophan, tyrosine or phenylalanine groups, resulting in subtle protein structural changes owing to alterations in aromatic flexibility. Here theories of light-matter interactions with aromatic amino acids in tubulin and microtubules are presented. Additionally, experimental evidence is presented of the Raman scattering spectra of microtubules and tubulin in both dry and aqueous states showing active Fano resonances which are indicative of quantum coupling between discrete phonon vibrational states and continuous excitonic many-body spectra.



WORKSHOPS - DESCRIPTIONS/BIOS

SESSION 1 - WORKSHOP 1

MONDAY MORNING, APRIL 18, 2022

9:00 AM – 12:30 PM – Kiva Ballroom

PROGRESS ON DUAL-ASPECT THINKING



HARALD ATMANSPACHER, ETH ZURICH

Physicist, The Collegium Helveticum (ETH Zurich, Switzerland)

Harald Atmanspacher, Ph.D., is a member of the Turing Center at ETH Zurich. After his Ph.D. in physics at Munich University (1986), he worked as a research scientist at the Max-Planck-Institute for Extraterrestrial Physics at Garching until 1998. Then he served as head of the theory group at the Institute for Frontier Areas of Psychology at Freiburg until 2013, and in the management board of Collegium Helveticum (ETH and University Zurich) until 2020. His fields of research are the theory of complex systems, conceptual and theoretical aspects of (algebraic) quantum theory, and mind-matter relations from interdisciplinary perspectives. He is the president of the Society for Mind-Matter Research and editor of the interdisciplinary international journal *Mind and Matter*. For more details see <https://www.mindmatter.de/about/board.html>.



PAAVO PYLKKÄNEN

University of Helsinki and University of Skövde

Paavo Pyykkänen, Ph.D., is Senior Lecturer in Theoretical Philosophy and Director of the Bachelor's Program in Philosophy at the University of Helsinki. He is also Associate Professor of Theoretical Philosophy (currently on leave) at the Department of Cognitive Neuroscience and Philosophy, University of Skövde, where he initiated a Consciousness Studies Program. His main research areas are philosophy of mind, philosophy of physics and their intersection. The central problem in philosophy of mind is how to understand the place of mind – and especially conscious experience – in the physical world. Pyykkänen has explored whether this problem can be approached in a new way in the framework of the new holistic and dynamic worldview that is emerging from quantum theory and relativity. He has in particular been inspired by the physicists David Bohm and Basil Hiley's interpretation of quantum theory and has collaborated with both of them.

In his 2007 book *Mind, Matter and the Implicate Order* (Springer) he proposed that Bohmian notions such as active information and implicate order provide new ways of approaching key problems in philosophy of mind, such as mental causation and time consciousness. The overall aim of his research is to develop a scientific metaphysics. Paavo Pyykkänen has been a visiting researcher in Stanford University, Oxford University, London University, Charles University Prague and Gothenburg University and is a member of the Academy of Finland Center of Excellence in the Philosophy of Social Sciences (TINT).



DEAN RICKLES

University of Sydney

Dean Rickles is Professor of History and Philosophy of Modern Physics at the University of Sydney and a Director of the Sydney Centre for Time. Dean Rickles was born in Hull, Yorkshire. He briefly trained as a concert pianist at the London College of Music, before switching to philosophy. He received an MA from the University of Sheffield (1999) and Ph.D. from the University of Leeds (2004). During a two-year postdoctoral fellowship at the University of Calgary in 2005, he worked on the application of complex systems theory to population health. [1][2] He took up a lectureship at the University of Sydney in 2007 and was awarded a five-year Australian Research Council fellowship in 2008 followed by an Australian Research Council Future Fellowship in 2014. Rickles primary focus is on string theory, quantum gravity, and symmetries.



ROBERT PRENTNER

University of Munich

Robert is an interdisciplinary scientist and philosopher interested in consciousness studies and the history and philosophy of science. He received a doctorate in physical chemistry in 2013 and a doctorate in philosophy in 2017 from ETH Zürich. His Erdős number is 4. Currently, he is a senior research fellow at the Center for the Future Mind at Florida Atlantic University and a postdoctoral fellow at the Munich Center for Mathematical Philosophy at LMU München.

MONDAY MORNING, APRIL 18, 2022

SESSION 1 - WORKSHOP 2

9:00 AM – 12:30 PM – Grand Ballroom B

TESTING ORCH OR**M. BRUCE MACIVER***Stanford University*

Professor MacIver explores the molecular and cellular mechanisms of sedatives and anesthetics and how these drugs alter higher nervous system functions to produce loss of consciousness. He was trained in neuroscience and pharmacology at the University of Calgary and began his career at Stanford over thirty years ago and has directed the Stanford Neuropharmacology Laboratory since then. Current

research is directed at the development of safer and more effect anesthetics using state-of-the-art electrophysiological approaches using in vitro brain slice preparations and freely moving animal models. He is also using newly developed EEG analysis techniques in animals and human subjects to quantify brain states associated with the loss and recovery of consciousness.

**JACK TUSZYŃSKI***University of Alberta/Politecnico di Torino*

Dr. Jack Tuszyński obtained his Ph.D. in condensed matter physics in 1983 from the University of Calgary. From 1983 to 1988 he was a faculty member at the Department of Physics of the Memorial University of Newfoundland in St. John's. He moved to the University of Alberta in 1988 as an assistant professor, between 1990 to 1993 he was an associate and then full professor at the Department of

Physics. As of 2005 he has held the prestigious Allard Chair in Experimental Oncology at the Cross Cancer Institute where he leads an interdisciplinary computational drug discovery group. He is also a Fellow of the National Institute for Nanotechnology of Canada. Dr. Tuszyński held visiting professorship and research positions in China, Germany, France, Israel, Denmark, Belgium and Switzerland. He has published over 500 peer-reviewed journal papers, and 12 books. He delivered almost 400 scientific talks at conferences on five continents, half of which were invited presentations. He submitted 15 reports of invention, 21 patent applications and obtained 4 patents in the USA, South Korea, Japan and Singapore. His research has been supported by over 100

research grants from Canadian, US and European funding agencies. He is on the editorial board of almost 30 international journals including the Journal of Biological Physics. He is an Associate Editor of The Frontiers Collection, Springer-Verlag, Heidelberg. Current affiliations are: Professore Ordinario, DIMEAS, Politecnico di Torino, Allard Endowed Research Chair, Department of Experimental Oncology, University of Alberta. Full Professor, Department of Physics, University of Alberta.

**AARAT KALRA***Princeton University*

Dr. Aarat Kalra is a postdoctoral scientist in the Scholes group at Princeton University. He is an expert on microtubules and works to determine the feasibility of excitonic energy transport within these biological nanowires. Dr. Kalra has previously worked with approaches from both physics and biology to determine the relevance of physical interactions in biological systems. His experiments have shown that the

electrostatic behaviour of microtubules is solvent dependent and can regulate local chemical environment. Light at the End of the Tunnel.

**GREG SCHOLES***Princeton University*

A big question at the interface of fields is whether “non-trivial” quantum-mechanical phenomena underly function in biology—perhaps even relating to mysteries of how our brains work. I will outline the challenges and issues of the field, then describe some relevant recent studies of microtubules. Microtubules are long, slender cylindrical polymers of the protein α , β - tubulin that play a variety of

intracellular roles, from acting as ‘railroads’ for macromolecular transport to providing mechanical forces for chromosomal segregation and forming cilia and flagella for cell motility. Microtubules bind to anesthetic molecules, provoking questions about the role of this interaction on anesthetic induced consciousness loss. Anesthetics have been modelled to alter excitonic states within tubulin aromatic amino acids, leading to downstream effects on information processing and consciousness. However, experimental evidence for an exciton-based mechanism of action has remained elusive. New studies in this direction will be reported.

**ARISTIDE DOGARIU***University of Central Florida*

Aristide Dogariu received his Ph.D. from Hokkaido University and he is currently University Trustee Chair and Pegasus Professor at CREOL, the College of Optics and Photonics, University of Central Florida. His research interests include optical physics, electrodynamics, wave propagation, and complex media. Professor Dogariu is a Fellow of the Optical

Society of America, the Physical Society of America and he is the recipient of the International Society for Optics and Photonics' G. G. Stokes Award.

**TRAVIS J.A. CRADDOCK***Institute for Neuro-Immune Medicine, Nova Southeastern University*

The Orch OR theory suggests consciousness depends on quantum processes in microtubules inside brain neurons. Here we describe two sets of never-before-performed crucial experiments designed to attempt to decisively demonstrate quantum processes in microtubules, and if demonstrated, to test their sensitivity to anesthetic molecules.

The average effective dose for anesthetic molecules to cause loss of consciousness is defined by the minimal alveolar concentration ('MAC' –

in equilibrium with lungs, blood and brain), so anesthetic potency correlates with $1/\text{MAC}$. Orch OR predicts that quantum processes in microtubules become dampened by all anesthetic molecules, and this effect should be proportional to their potency ($1/\text{MAC}$). As anesthesia is the most direct observable effect on consciousness, experimental evidence for comparable effects on quantum processes in microtubules would corroborate the major tenet of Orch OR and constitute a turning point toward acceptance of this theory as a fundamental scientific framework for consciousness. Towards this end, we will conduct two sets of independent experiments aimed at demonstrating the existence of long-range and long-lived collective quantum states in microtubules, and investigate how the presence of anesthetic molecules may influence these states. The first set of experiments will examine Tryptophan excitations in tubulin compared to microtubules to show if spatially-delocalized quantum states exist in these systems and if they can be quenched by anesthetics. This would be analogous to the demonstration of quantum states in photosynthetic systems that launched quantum biology. If successful, this experiment will reveal the presence/absence of quantum collective states in microtubules as a function of anesthetic action. The second set of experiments will study delayed luminescence in microtubules to determine decoherence times of electronic excitations in microtubules. This type of experimental interrogation examines the duration of electronic quantum states in microtubules, which can be photo-excited but possibly quenched by anesthetics. Most importantly, this will address the much-contested question of the existence of long-lived quantum states in biological systems, which has cast doubt on the ability of these states to affect human cognitive processes. Delayed luminescence on the order of seconds or beyond will remove these doubts. In this workshop, a progress report will be provided by the participants in the Templeton project who will discuss the results obtained to date and their significance for the quantum model of consciousness that inspired these investigations.

Presenters will include: Stuart Hameroff, Jack Tuszynski, Travis Craddock, Aarat Kalra, Bruce Maclver and others.

SESSION 1 - WORKSHOP 3**MONDAY MORNING, APRIL 18, 2022**

9:00 AM – 12:30 PM - GRAND BALLROOM A

CONSCIOUSNESS AND ULTRASONIC NEUROMODULATION**JAY SANGUINETTI***University of Arizona*

Dr. Jay Sanguinetti is an Adjunct Professor at the University of Arizona and a Research Assistant Professor at the University of New Mexico. His training was in philosophy, neuroscience, and cognitive psychology, and his dissertation investigated the neural processes of conscious and unconscious visual perception. Dr. Sanguinetti specializes in psychophysiological measures (EEG, fMRI, eye-tracking) of visual perception,

emotion, and mindfulness meditation. His team investigates novel forms of brain stimulation, including the use of ultrasound and light-based stimulation to enhance memory, perception, and well-being. Dr. Sanguinetti has published widely, from topics on the neural basis of vision and the temporal dynamics of perception to understanding how the brain changes in Parkinson's disease and schizophrenia. His current interests include using noninvasive brain stimulation to enhance cognition and well-being. Jay is presently investigating whether focused ultrasound neuromodulation can augment mindfulness practice in collaboration with Shinzen Young. They recently launched the Sonication Enhanced Mindful Awareness (SEMA) lab at the University of Arizona in collaboration with the Center for Consciousness Studies. The SEMA lab is developing accelerated mindfulness protocols for therapeutic interventions to treat addiction, chronic pain, and depression. Dr. Sanguinetti is the Assistant Director for the Center for Consciousness Studies, which runs the largest international conference on consciousness studies.

**SASHA BYSTRITSKY***University of California, Los Angeles*

Alexander (Sasha) Bystritsky, M.D., Ph.D. is Co-Founder and Executive Director of Tiny Blue Dot consciousness research foundation and president of the Institute for Advanced Consciousness Studies. He graduated from Pavlov Medical Institute (currently Pavlov Medical University) in St. Petersburg, Russia (former Soviet Union) with M.D. degree in 1977 and then rapidly completed his Ph.D. in

Pharmacology in 1979. As a student he worked in the famous former Pavlov's laboratory of the Institute of Experimental Medicine. In 1976 his paper won the Gold Medal for the Best Student Scientific Paper in the USSR among all

sciences. He emigrated to the US in 1979 to New York where he completed NYU-Belleview residency program in Psychiatry in 1985 and moved to UCLA as a Robert Wood Johnson Clinical Scholar. He completed RWJ Clinical Scholars program in 1987. Dr. Bystritsky has been on the UCLA Faculty since 1987. He is currently a Professor of Psychiatry and Biobehavioral Sciences in Jane and Terry Semel Institute for Neuroscience and Human Behavior Lynda and Stewart Resnick Neuropsychiatric Hospital, David Geffen School of Medicine, University of California, Los Angeles where he directs the Anxiety Disorders Program and Brainstimulation Laboratory. Dr. Bystritsky published over 200 peer-reviewed papers and has served as the PI and Co-PI on many NIH, foundations and industry sponsored grants. Over the years he earned several honors and awards including OCD Foundation Research Award (2006) and NARSAD Distinguished Investigator Award (2009). He is also listed in the Best Doctors in America for the last 17 years. For several years he has been a Visiting Professor at a Full Professor level in the Brigham and Women's Hospital Harvard University School of Medicine Boston, Massachusetts working with Professor Ferenc Jolesz and Professor Seung-Schik Yoo investigating Focused Ultrasound Pulsation effects on brain using fMRI. Dr. Bystritsky authored several patents on image-guided neuromodulation of brain neurons using Focused Ultrasound Pulsation. His current area of interest is neuroimaging guided brain stimulation. He is a part of collaborative research program on image-guided DBS with the department of Neurosurgery at UCLA. He is also participates at UCLA LIFUP Center that studies the use of this new technology in brainmapping and treatment of epilepsy and other brain disorders with Drs Engrl and Stern. This collaborative group together with Brainsonix Corp. has recently began the first Human Trials of this technology. Dr. Bystritsky is also collaborates with physicists and mathematicians around the world in an attempt of creating mathematical models helping to understand how the brain works.

MARTIN MONTI, UCLA (R)

Seung-Schik Yoo, Harvard University(R)

Martin Monti, UCLA (R)

Dr. Martin M. Monti is currently an assistant professor in the Departments of Psychology and Neurosurgery at UCLA. Prior to joining the faculty at UCLA, in 2011, he received his doctorate in Psychology and Neurosciences at Princeton University (Princeton, NJ, USA), and spent three years as a Career Development Fellow at the MRC Cognition and Brain Sciences Unit in Cambridge, UK. His research is mainly centered on the neural basis of consciousness. In particular, Dr. Monti's research focuses on the mechanisms that accompany loss and recovery of consciousness in patients who, after severe brain injury, enter a Coma, Vegetative State, or Minimally Conscious State. Dr. Monti's research has been featured in a number of prestigious. international journals, including

The New England Journal of Medicine, the British Medical Journal, Annals of Neurology, and Brain, among others, and has often been featured in popular media outlets, including both television (e.g., CNN, BBC, CBS) and print (e.g., Time Magazine, LA Times, Technology Report, Huffington Post). Dr. Monti was recently recognized as a "Rising Star" by the Association for Psychological Science (APS; April 2013). His work on the mechanisms of loss of consciousness in anesthesia was recognized, in 2014, with the UCLA Life Science Faculty Award for Outstanding Research Publication; and, in 2011, his work on patients with disorders of consciousness was recognized by the Discover Magazine as top story #41 of the year 2010. Finally, in 2014, Dr. Monti was invited, as an external expert, to perform a specialized neuroimaging assessment of the former Israeli prime minister Ariel Sharon who was, as the time, suffering from a disorder of consciousness. <https://tinybluedotfoundation.org/our-team/martin-m-monti/>

SEUNG-SCHIK YOO

Harvard University (R)

Seung-Schik is an associate professor of Radiology at Harvard Medical School, and is a director of Neuromodulation and Tissue Engineering Laboratory (NTEL), Brigham and Women's Hospital . He also serves as a faculty member of Mind Brain Behavior at Harvard University. He has done early pioneering works in developing real-time functional magnetic resonance imaging that are used to interpret the human mind, and applied the technology to interface the brain function with machines and computers. Later, he developed a new mode of non-invasive brain stimulation modality which utilizes the focused ultrasound waves to control regional neural functions, including the activity of the brain. He is primarily interested in advancing the technique for various neurotherapeutics, but also likes to seek out new ways to link thought/brain processes between individuals. Seung-Schik also developed a three-dimensional bioprinter that can 'print out' artificial brain tissues and organoids for potential applications in neural computers and medical applications. <https://projects.iq.harvard.edu/ntel/people/seung-schik-yoo>

SESSION 1 - WORKSHOP 4

MONDAY MORNING, APRIL 18, 2022

9:00 AM – 12:30 PM - GRAND BALLROOM C

QUANTUM MECHANICS AND CONSCIOUSNESS

The fields of biology and computer science have increasingly recognized a role for quantum mechanics. Quantum biology now explains how the interactions of proteins is critical to realistic models of vital biological functions. Quantum

computation is on the horizon and will revolutionize cybersecurity and expand the ability to find solutions to difficult problems in a practical timeframe. However, mainstream understanding of the human mind has not been updated to reflect the paradigm shift at play in science and technology. During this workshop, Justin Riddle, Johannes Kleiner, and Kelvin McQueen will survey current theories on how quantum mechanics may explain consciousness, the unity of self, the question of freewill, human understanding of mathematics, and the experience of time.

JUSTIN RIDDLE

University of North Carolina



Justin Riddle is a cognitive neuroscientist at the University of North Carolina at Chapel Hill where he investigates how low-frequency neural oscillations contribute to human cognition. He uses electric and magnetic stimulation concurrent with electrophysiology and fMRI to probe the causal role of neural activity in specific cognitive processes and how these network oscillations become impaired in psychiatric illness. Justin taught a course on Quantum Consciousness at UC

Berkeley and now runs a podcast on the topic that can be found on YouTube.

JOHANNES KLEINER

Ludwig Maximilian University of Munich



Johannes Kleiner is a physicist and mathematician whose research focuses on formal theories of consciousness, the calculus of variations, mathematical physics, foundations of physics and unified physical theories. He is currently based at the Munich Center for Mathematical Philosophy (MCMP) and the LMU Graduate School of Systemic Neurosciences and is a visiting researcher at the Mathematical Institute of Oxford University. Prior to joining the MCMP, he was a postdoc at the

Institute for Theoretical Physics of Leibniz University of Hanover. Previously, he has completed a Ph.D. in mathematics at the University of Regensburg, awarded summa cum laude. He was a visiting scholar at the Department of Computer Science of Oxford University, the Harvard Center of Mathematical Sciences and Applications and the Centre de Physique Théorique of Aix-Marseille Université. Johannes is a member of the Foundational Questions Institute and of the German Physical Society, and a co-founder of the Basic Research Community for Physics and the Association for Mathematical Consciousness Science.



KELVIN J. MCQUEEN

Chapman University

Kelvin McQueen is an Assistant Professor of Philosophy and affiliate of the Institute for Quantum Studies at Chapman University. He is a philosopher of science whose interdisciplinary research focuses on the neuroscience of consciousness and the foundations of quantum physics. His current projects in the neuroscience of consciousness include experimentally testing the integrated information

theory (IIT) using filled/non-filled pairs; extending IIT to quantum mechanics to render the consciousness-causes-collapse hypothesis testable; and libertarian accounts of free will. His current projects in the foundations of quantum mechanics include extending the class of dynamical collapse theories; clarifying the status of probability and locality in many worlds theories; and extending Bell's theorem beyond quantum theory.

Break

Lunch on own

SESSION 2 - WORKSHOP 5

MONDAY AFTERNOON, APRIL 18, 2022

2:00 PM – 6:00 PM - Grand Ballroom B

EMBEDDED INTELLIGENCE

Embedded Intelligence (EI) is defined as the ability of a Thing to sense, processed what is sensed both of itself and others, communicate internally and externally and actuate (SPCA), doing something with the Thing's EI. This is explained within the context of manmade Embedded Intelligence Technology (EIT) aka AI that is then translated to all Things in the infinitely large and infinitely long lasting period of time the universe has and will remain in existence as described in The Theory of Embedded Intelligence (EI) (The Theory). This workshop with panel discussion will explore the concepts of The Theory to better understand and explain humanity's individual selves and position in specific and global consciousness, awareness and understanding of oneself and the world in which we live.

**BILL MENSCH**

Western Design Center

Mr. Bill Mensch will introduce the Embedded Intelligence Workshop and panel as one of 250 recognized leaders over a 500 year period as listed in Leaders of the Information Age, holder of twenty two (22) patents on Embedded Intelligence Technology (EIT) in the form of Motorola 68xx Microprocessor (MPU) Integrated Circuits (IC), MOS Technology 65xx MPU ICs and The Western Design Center, Inc. (WDC) 65xx 8- and 16-bit MPU Family of ICs and supporting business models and technologies.

Bill Mensch is considered a pioneer in information technology (IT), microprocessor Intellectual Property (IP) business model and pioneer of the fabless semiconductor business model for microprocessors for which ARM was inspired in 1983 during a visit to WDC's offices in Mesa, Arizona. It is from his fifty (50) years and ongoing career in EIT that Mr. Mensch proposes The Theory for a continuum of intelligences for every non-living and living Thing in the Universe, from lowly quantum units of the energies to the Universe itself. He received his BSEE from The UArizona in 1971 and received the Lifetime Achievement Award from UArizona in 2005. Bill Mensch will explain his thinking and plans for The Bill and Dianne Mensch Foundation, Inc. an Arizona 501c3 not-for-profit education foundation plans for perpetual support of ongoing learning and innovative doing with the concepts in The Theory for the Colleges of Engineering, Barrett, The Honors College and W. A. Franke Honors College. Mr. Mensch will explain plans for Mensch Prizes in Engineering Multidisciplinary Design and Honors Thesis scholarship.

**ANDREW MAYNARD**

Arizona State University

Dr. Maynard will explore the value of The Theory in The Future of Innovation in Society and Global Futures research and teaching. Aligned with this perspective, Dr. Maynard will explore the concepts associated with injecting mythologies and false information in the individual and collective consciousness of a democratic system of governance.

Andrew Maynard is Associate Dean of Curricula and Student Success for the College of Global Futures and Professor in the School for the Future of Innovation in Society at Arizona State University, and director of the Risk Innovation Lab – a unique center focused on transforming how we think about and act on risk, in the pursuit of increasing and maintaining “value”. He was previously Chair of the Environmental Health Sciences Department in the University of Michigan School of Public Health. Maynard's research

and professional activities focus on risk innovation, and the responsible development and use of emerging technologies, including nanotechnology and synthetic biology. He is widely published, has testified before congressional committees, has served on National Academy panels and is co-chair of the World Economic Forum Global Agenda Council on Nanotechnology. He also writes a regular column for the journal Nature Nanotechnology, and the news website The Conversation. Courses taught by Maynard have included risk assessment, risk innovation, science communication, environmental health policy, and entrepreneurial ethics. He also lectures widely on technology innovation and responsible development. Maynard a well-known science communicator and works closely with and through conventional and new media to connect with audiences around the world on technology innovation and the science or risk. He is the creator of the YouTube channel Risk Bites, and blogs at <http://2020science.org>. His Twitter handle is @2020science.

**TED HUMPHREY**

Arizona State University

Dr. Humphrey will explore the value of The Theory and the concepts as described by Dr. Maynard for a human bounded infinity in philosophy.

Ted Humphrey is an Emeritus Professor at Arizona State University. He retired in May 2015. He was affiliated with Barrett, the Honors College at ASU as President's Professor and Barrett Professor, the Lincoln Center as a Lincoln

Professor of Ethics and Latin American Intellectual History, and the School of Historical, Philosophical and Religious Studies as professor of philosophy. Professor Humphrey chaired ASU's Philosophy Department from 1974 to 1983, during which time he was responsible for appointing several now internationally eminent philosophers, including Jeffrie G. Murphy, Jane Maienschein, J. Richard Creath and Michael J. White. From 1983 he directed ASU's Honors Program, guiding it to collegiate status, becoming the founding dean of the Barrett, the Honors College in 1988, a position he held until 2003. He is past president of the National Collegiate Honors Council. Professor Humphrey is a member of Arizona State University's Distinguished Teaching Academy. Numerous organizations have awarded him their highest honors for teaching excellence, and the Arizona Republic cited him as a force for excellent undergraduate education in Arizona.

During the 2009-10 academic year, under the auspices of grants from Amazon and the Office of the Provost at ASU and the support of Hackett Publishing Co., Inc., Professor Humphrey conducted a pilot program using the Kindle DX reading device for teaching HON 171-272, The Human Event. The pilot sought to evaluate the efficiency and effectiveness of providing primary text materials for use in seminar level humanities courses.

**DANTE LAURETTA**

University of Arizona, Lunar & Planetary Laboratory

Regents Professor, Planetary Science and Cosmochemistry •
University of Arizona Lunar & Planetary Laboratory

Dr. Lauretta will explore the value of The Theory as a platform for understanding the infinite and continuum of possible outcomes for his work and teaching of the Origins of Life from a planetary perspective.

Dante Lauretta is principal investigator of the OSIRIS-REx mission and a regents professor of planetary science at the University of Arizona's Lunar and Planetary Laboratory. His research interests focus on the chemistry and mineralogy of asteroids and comets, and he is an expert in the analysis of extraterrestrial materials, including asteroid samples, meteorites and comet particles. Dr. Lauretta fosters the advancement of the next generation of scientists, engineers, and other space leaders through mentorship and taught coursework which apply his expertise in planetary science and spacecraft mission design & implementation. Dr. Lauretta heads the OSIRIS-REx research team at UArizona working on this mission, which has included more than 100 undergraduate and graduate students. This project will help ensure that the University of Arizona remains at the forefront of planetary exploration for the next decade.

**STUART HAMEROFF**

University of Arizona, College of Medicine, Anesthesiology and Psychology, Center for Consciousness Studies, SBS

Dr. Hameroff will discuss the Orch OR theory, information processing and memory in intra-neuronal microtubules in relation to the theory of Embedded Intelligence

Stuart Hameroff MD is a clinical anesthesiologist and researcher on how the brain produces consciousness, and how anesthetics act to erase it. In medical school in the

early 1970s, Hameroff became interested in consciousness, and in protein structures called microtubules inside brain neurons which he came to believe processed information supporting consciousness. In the mid- 1990s he teamed with Sir Roger Penrose to develop the controversial 'Orch OR' theory in which consciousness derives from "orchestrated" ("Orch") microtubule quantum vibrations linked to processes in spacetime geometry, the fine scale structure of the universe, leading to "Penrose objective reduction" ("OR", hence "Orch OR"). And he has further proposed the 'microtubule quantum vibration' theory of anesthetic action. Hameroff organizes the well-known conference series 'The Science of Consciousness', has written or edited 5 books and over a hundred scientific articles, and appeared in films and various TV shows about

consciousness. With University of Arizona colleagues Jay Sanguinetti, John JB Allen and Shinzen Young, Hameroff is developing transcranial ultrasound ('TUS') for treatment of mental and cognitive dysfunction (TUS may resonate endogenous megahertz vibrations in brain microtubules). Penrose- Hameroff Orch OR is one of a group of major theories of consciousness in the Templeton World Charity Foundation project 'Accelerating Research on Consciousness' and is currently being tested experimentally.

SESSION 2 - WORKSHOP 6

MONDAY AFTERNOON, APRIL 18, 2022

2:00 PM - 6:00 PM – GRAND BALLROOM C

CONSCIOUSNESS AND NON-LOCALITY**STEPHAN A. SCHWARTZ**

Saybrook University; BIAL Foundation Fellow

Stephan A. Schwartz is a Distinguished Consulting Faculty of Saybrook University, and a BIAL fellow. He is an award winning author of both fiction and non-fiction, columnist for the journal Explore, and editor of the daily web publication Schwartzreport.net in both of which he covers trends that are affecting the future. He also writes regularly for The Huffington Post. His other academic and research

appointments include: Senior Samueli Fellow for Brain, Mind and Healing of the Samueli Institute; founder and Research Director of the Mobius laboratory; Director of Research of the Rhine Research Center; and Senior Fellow of The Philosophical Research Society. Government appointments include: Special Assistant for Research and Analysis to the Chief of Naval Operations, consultant to the Oceanographer of the Navy. He has also been editorial staff member of National Geographic, Associate Editor of Sea Power. And staff reporter and feature writer for The Daily Press and The Times Herald. For 40 years he has been studying the nature of consciousness, particularly that aspect independent of space and time. Schwartz is part of the small group that founded modern Remote Viewing research, and is the principal researcher studying the use of Remote Viewing in archaeology. Using Remote Viewing he discovered Cleopatra's Palace, Marc Antony's Timonium, ruins of the Lighthouse of Pharos, and sunken ships along the California coast, and in the Bahamas. He also uses remote viewing to examine the future. Since 1978, he has been getting people to remote view the year 2050, and out of that has come a complex trend analysis. His submarine experiment, Deep Quest, using Remote Viewing helped determine that nonlocal consciousness is not an electromagnetic phenomenon.



JEFFREY MISHLOVE

Author; Host and Producer at New Thinking Allowed and CEO, Insight Associates, Inc.

Jeffrey Mishlove is an American licensed clinical psychologist, author, and radio and television interviewer. Between 1986 and 2002, Mishlove hosted and co-produced the American public television series, Thinking Allowed. As of 2015, Mishlove hosts the YouTube channel New Thinking Allowed, conducting interviews related to parapsychology

and consciousness studies. Other publications include The PK Man, Psi Development Systems and The Roots of Consciousness. He is past director of Association for Humanistic Psychology.



JULIA MOSSBRIDGE

University of San Diego, IONS, TILT

Dr. Mossbridge’s current interest is in the science underlying the physical and psychological applications of informational time travel: receiving information in the present about events that have not yet occurred, and potentially influencing events in the past. She is an affiliate professor in the Dept. of Biophysics and Physics at University of San Diego, a fellow at the Institute of Noetic Sciences, and the co-founder

and executive director of the nonprofit TILT: The Institute for Love and Time, which currently receives funding from the Bial Foundation (currently grant 369/20) and the Robert Wood Johnson Foundation. An author and co-author of multiple books related to this topic, notably Bial she is the co-author with Imants Baruss of Transcendent mind: Rethinking the science of consciousness (2017), one of the few of the American Psychological Association’s textbooks to include evidence-based discussion about the human abilities of precognition and telepathy. Dr. Mossbridge also invented and patented Choice Compass, a physiologically based decision-making app, and was the project lead for and creator of the Loving AI project with Hanson Robotics’ humanoid robot, Sophia. She completed her Ph.D. in Communication Sciences and Disorders and her postdoc in Psychology at Northwestern University, her MA degree in Neuroscience is from UC San Francisco, and was awarded her BA in Neuroscience with highest honors from Oberlin College.



DEAN RADIN

Institute of Noetic Sciences

Dean Radin, MS, Ph.D., is Chief Scientist at the Institute of Noetic Science (IONS) and Associated Distinguished Professor of Integral and Transpersonal Psychology at the California Institute of Integral Studies (CIIS). His original career track as a concert violinist shifted into science after earning a BSEE degree in electrical engineering, magna cum laude and with honors in physics, from the University of Massachusetts,

Amherst, and then an MS in electrical engineering and a Ph.D. in psychology from the University of Illinois, Urbana-Champaign. For a decade he worked on advanced R&D at AT&T Bell Laboratories and GTE Laboratories. For over three decades he has been engaged in research on the frontiers of consciousness. Before joining the research staff at IONS in 2001, he held appointments at Princeton University, SRI International, and other academic and industrial facilities.

SESSION 2 - WORKSHOP 7

MONDAY AFTERNOON, APRIL 18, 2022

2:00 PM – 6:00 PM – Kiva Ballroom

PLANTS AND CONSCIOUSNESS

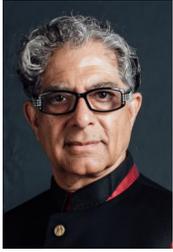


M. BRUCE MACIVER

Stanford University

Professor MacIver explores the molecular and cellular mechanisms of sedatives and anesthetics and how these drugs alter higher nervous system functions to produce loss of consciousness. He was trained in neuroscience and pharmacology at the University of Calgary and began his career at Stanford over thirty years ago and has directed the Stanford Neuropharmacology Laboratory since then. Current

research is directed at the development of safer and more effect anesthetics using state-of-the-art electrophysiological approaches using in vitro brain slice preparations and freely moving animal models. He is also using newly developed EEG analysis techniques in animals and human subjects to quantify brain states associated with the loss and recovery of consciousness.

**DEEPAK CHOPRA**

Chopra Foundation and Chopra Global

DEEPAK CHOPRA™ MD, FACP, founder of The Chopra Foundation, a non-profit entity for research on well-being and humanitarianism, and Chopra Global, a modern-day health company at the intersection of science and spirituality, is a world-renowned pioneer in integrative medicine and personal transformation. Chopra is an Adjunct Professor of Urology at Mount Sinai, Professor of Internal Medicine at University of

Central Florida, Clinical Professor of Family Medicine and Public Health at the University of California, San Diego and serves as a senior scientist with Gallup Organization. He is the author of over 90 books translated into over forty-three languages, including numerous New York Times bestsellers. His latest book, *Abundance – The Inner Path to Wealth* unlocks how you can cultivate a sense of abundance in times of fear and insecurity and will be available on March 1, 2022. TIME magazine has described Dr. Chopra as “one of the top 100 heroes and icons of the century.” www.deepakchopra.com

**RAINISH KHANNA**

i-Cultiver

A plant photobiologist, Rajnish is examining how informational light signal is perceived and translated by organisms into biological responsivity and could these basic molecular and biochemical mechanisms help us better understand the hidden reality of consciousness and its relationship to the universe. Occupationally, Rajnish is the founder of i-Cultiver, Inc. A strategic biotechnology consultant, plant

and soil health scientist applying multidisciplinary approaches for research and development. Known for empowering the industry through strategic partnerships and leveraging advanced technologies to increase product impact, governmental regulatory process and marketing support. Rajnish obtained his doctorate in Plant Molecular Biology at Purdue University, he is well published. Rajnish has served as a lead scientist in biotechnology industry and has worked at the University of California, Berkeley and Carnegie Institution for Science at Stanford University.

**DENNIS MCKENNA**

President, Principal Founder, Heffter Research Institute

Dennis McKenna has conducted research in ethnopharmacology for over 40 years. He is a founding board member of the Heffter Research Institute, and was a key investigator on the Hoasca Project, the first biomedical investigation of ayahuasca. He is the younger brother of Terence McKenna. From 2000 to 2017, he taught courses on Ethnopharmacology and Plants in Human affairs as an adjunct

Assistant Professor in the Center for Spirituality and Healing at the University of Minnesota. He emigrated to Canada in the spring of 2019 together with his wife Sheila, and now resides in Abbotsford.

Since 2019, he has been working with colleagues to manifest a long-term dream: the McKenna Academy of Natural Philosophy, a non-profit organization founded in the spirit of the ancient Mystery Schools and dedicated to the study of plant medicines, consciousness, intelligence in nature, preservation of indigenous knowledge and a re-visioning of humanity's relationship with Nature. Dr. McKenna is author or co-author of 6 books and over 50 scientific papers in peer-reviewed journals.

SESSION 2 - WORKSHOP 8

MONDAY AFTERNOON, APRIL 18, 2022

2:00 PM – 6:00 PM - Grand Ballroom A

The Science of Contemplative Experience**MATTHEW SACCHET**

Harvard University

Dr. Matthew D. Sacchet, Ph.D., is an Assistant Professor at Harvard Medical School and the Director of Meditation Research within the CDASR at McLean Hospital. Dr. Sacchet and his team, the Meditation Research Group, advance the science meditation. Since 2012, Dr. Sacchet has authored over 75 publications and his research has been presented over 125 times and cited over 3500 times. Dr. Sacchet has been awarded funding from the National Science Foundation (NSF), National Institute of Mental Health (NIMH), National Center for Advancing Translational Sciences (NCATS), Ad Astra Chandaria Foundation, Phyllis & Jerome Lyle Rappaport Foundation, Brain & Behavior Research Foundation (BBRF), BIAL Foundation, Gatto Foundation, and The Ride for Mental Health. His research has received coverage by major media outlets including CBS, NBC, NPR, TIME, and The Wall Street Journal, and in 2017 Forbes Magazine named him as one of its “30 Under 30”. The Meditation Research Group uses a multidisciplinary approach to advance our understanding of meditation in

both clinical and non-clinical contexts. The Group's studies span and integrate affective and cognitive neuroscience, clinical psychology and psychiatry, computer science and related computational disciplines, contemplative and religious studies, neuro- and micro-phenomenology, human neuroimaging, and psychoneuroimmunology including epigenetics and stress physiology. Current projects include (1) mechanism-focused clinical trials of mindfulness meditation training for mood and anxiety disorders that will help to clarify "why" and "for who" meditation training is helpful; and (2) studies of meditative development and advanced meditation that promise to inform a more comprehensive understanding of the course and trajectory of meditation training. Together this research promises to contribute to reducing suffering and improving well-being by informing the development of improved meditation training and meditation-based interventions that are more effective, efficient, and targeted. <https://www.linkedin.com/in/matthew-sacchet>

DANIEL INGRAM

Emergent Phenomenology Research Consortium, EPRC

Daniel is an advanced meditator and controversially a self-described Arahant, one who has become fully "enlightened" in Buddhist terms. He holds an MD, MSPH in Epidemiology, and BA in English Literature all from UNC Chapel Hill. Daniel wrote *Mastering the Core Teachings of the Buddha: An Unusually Hardcore Dharma Book*, widely regarded as one of the most complete meditation books ever written. In this book, Daniel lays out in very rational terms the exact series of steps that can lead to the profound transformations that he has attained. He also criticizes current western meditation as often "hiding the ball" about awakening and being too caught up in psychological material, rather than practical training. An emergency room physician, Daniel co-founded the Practical Dharma Movement, with the objective of "stripping away dogma and unhelpful taboos, having people share with others in ways that are down-to-earth, helpful, and pragmatic, and the vision that it can be done, rather than a dharma world that is mysterious, artificially hierarchical, dogmatic, and secretive." <https://www.fitmind.co/podcast-collection/daniel-ingram-meditation-interview>

JULIETA GALANTE

Cambridge University

Dr Julieta Galante is an NIHR Postdoctoral Fellow at the Department of Psychiatry, a Research Associate at the Centre of Latin American Studies, and a member of the Public Health at Cambridge Strategic Research Initiative. Julieta is a qualified medical doctor specialized in public mental health research. Her interests lie on mental health promotion and the effects of lifestyle on

health. Her main focus has been studying the effects of meditation on mental health, which recently involved a randomized controlled trial of a pilot scheme to provide mindfulness courses to students at the University of Cambridge. Currently, her main project is an individual participant data meta-analysis of mindfulness-based interventions for mental health promotion. She is also involved in projects to measure and improve the mental health of vulnerable populations in Latin America. Julieta's expertise on randomized controlled trials, mixed-methods research, and meta-analyses can positively impact the lives of the world's poorest 3 billion people. She is also passionate about open science and participatory action research involving stakeholders. Julieta's personal motivation to contribute to the Sustainable Development Goals through her participation in Cambridge Global Challenges stems from experiences in her native Argentina. <https://www.gci.cam.ac.uk/people/members/dr-julieta-galante>

JAY SANGUINETTI

University of Arizona

Dr. Jay Sanguinetti is an Adjunct Professor at the University of Arizona and a Research Assistant Professor at the University of New Mexico. His training was in philosophy, neuroscience, and cognitive psychology, and his dissertation investigated the neural processes of conscious and unconscious visual perception. Dr. Sanguinetti specializes in psychophysiological measures (EEG, fMRI, eye-tracking) of visual perception, emotion, and mindfulness meditation. His team investigates novel forms of brain stimulation, including the use of ultrasound and light-based stimulation to enhance memory, perception, and well-being. Dr. Sanguinetti has published widely, from topics on the neural basis of vision and the temporal dynamics of perception to understanding how the brain changes in Parkinson's disease and schizophrenia. His current interests include using noninvasive brain stimulation to enhance cognition and well-being. Jay is presently investigating whether focused ultrasound neuromodulation can augment mindfulness practice in collaboration with Shinzen Young. They recently launched the Sonication Enhanced Mindful Awareness (SEMA) lab at the University of Arizona in collaboration with the Center for Consciousness Studies. The SEMA lab is developing accelerated mindfulness protocols for therapeutic interventions to treat addiction, chronic pain, and depression. Dr. Sanguinetti is the Assistant Director for the Center for Consciousness Studies, which runs the largest international conference on consciousness studies.

SESSION 3 - WORKSHOP 9**MONDAY EVENING, APRIL 18, 2022**

Time: 7:00 PM – 9:30 PM - Grand Ballroom B

NEUROSPIRITUALITY**MICHAEL FERGUSON***Harvard Medical School*

Dr. Michael Ferguson, Ph.D., (a.k.a., NeuroMichael) is a Harvard and Cornell-trained neuroscientist and an academic pioneer in the emerging fields of neurospirituality and spiritual therapeutics. Dr. Ferguson is an Instructor in Neurology at Harvard Medical School and a Lecturer at Harvard Divinity School. Prior to this he was a Course Instructor in Human Development at Cornell University. Dr. Ferguson is preparing to launch the new Laboratory for Neurospirituality in tandem with the Center for Brain Circuit Therapeutics in Boston. He is also organizing a Spiritual Therapeutics medical science research program at Brigham and Women's Hospital, a teaching hospital for Harvard Medical School. In Fall semester 2021, Dr. Ferguson will be introducing a new course at Harvard titled Neurospirituality. <https://neuromichael.com/about/>

JANAE NELSON*Brigham Young University (R)*

Janae Nelson received a Ph.D. in Developmental Psychology from Brigham Young University. Nelson uses diverse methodological approaches to study the development of transcendence, virtues, religiosity, and compassion in adolescence and emerging adulthood. Specifically, she is interested in the contributions of unitive consciousness, spiritual perception, God proximity, and sacred rituals in psychosocial maturation.

DAVID YADEN Ph.D.*Ph.D. Johns Hopkins University*

David B. Yaden, Ph.D., studies the measurement and experimental manipulation of mental states called altered states of consciousness. These mental states are often among the most transformative and meaningful moments in people's lives, yet little is known about how they are triggered, the neurophysiological processes that underlie them, or how they impact the beliefs and behavior of those who have them. His research is currently focused on the therapeutic potential of psychedelic substances for mood and substance use disorders. His scientific research and scholarly writing generally aim to provide a quantitative and empirical 21st-century update to William James's classic book on the topic, *The Varieties of Religious Experience*, using: 1) psychometric instruments,

2) computational linguistic analysis, 3) neuroimaging, 4) non-invasive brain stimulation, and 5) psychopharmacology. Psychopharmacologist Roland R. Griffiths, Ph.D. is his current Postdoctoral advisor. He previously studied with neuroscientist Andrew B. Newberg, MD and completed his doctoral training with psychologist Martin E. P. Seligman, Ph.D. at the University of Pennsylvania. He has authored over 40 scientific and scholarly publications and edited two books that provide a scientific perspective on practices and experiences traditionally associated with religion/spirituality: *Rituals and Practices in World Religions and Being Called*. His research has been covered by *The New York Times*, *The Wall Street Journal*, *The Washington Post*, *New York Magazine*, *Scientific American*, *CNN*, *BBC*, and *NPR*. <https://hopkinspsychedelic.org/yaden>

RICK STRASSMAN*University of New Mexico*

At UNM, Dr. Strassman performed clinical research investigating the function of the pineal hormone melatonin in which his research group documented the first known role of melatonin in humans. He also began the first new US government approved clinical research with psychedelic drugs in over twenty years, focusing on DMT and to a lesser extent, psilocybin. He received grant support from the National Institutes of Health's National Institute on Drug Abuse, as well as from the Scottish Rite Foundation for Schizophrenia Research. Before leaving the University in 1995, he attained the rank of tenured Associate Professor of Psychiatry and was awarded the UNM General Clinical Research Center's Research Scientist Award. In 1984, he received lay ordination in a Western Buddhist order, and co-founded, and for several years administered, a lay Buddhist meditation group associated with the same order. Dr. Strassman underwent a four-year personal psychoanalysis in New Mexico between 1986 and 1990. From 1996 to 2000, while living in the Pacific Northwest of the United States, Dr. Strassman worked in community mental health centers in Washington State in Bellingham and Port Townsend. For the next four years, he had a solo private practice in Taos, New Mexico. After two years working near the Navajo Nation in Gallup NM, he returned to northern New Mexico in 2006, where he provided psychiatric services at a mental health center in Espanola. Since mid-2008, he has been writing full-time. Dr. Strassman's "DMT: The Spirit Molecule," an account of his DMT and psilocybin studies, has sold a quarter-million copies as of mid-2021, and been translated into over a dozen languages, including Mandarin. He co-produced an independent documentary by the same name, which was the most-streamed independent drug documentary on Netflix. He also is the author of "DMT and the Soul of Prophecy," "Joseph Levy Escapes Death," and a co-author of "Inner Paths to Outer Space." He has published over 40 peer-reviewed scientific papers and has served as a reviewer for 20 psychiatric research journals. He has been a consultant to the US Food and Drug Administration, National Institute on Drug Abuse, Veteran's Administration

TAXONOMY 2022

Hospitals, Social Security Administration, and other state and local agencies. He has provided consultation to many of the psychedelic startups that began appearing in 2020, including Atai, MindMed, and The Noetic Fund. He is on the Scientific Advisory Boards for Alexander Shulgin Research Institute and Ninnion Therapeutics. He currently is Clinical Associate Professor of Psychiatry at the University of New Mexico School of Medicine and lives in Gallup, New Mexico. <https://www.rickstrassman.com/biography/>

TUESDAY EVENING DIALOGUE

APRIL 19, 2022 9:00 PM - KIVA BALLROOM

MYSTERY OF EXISTENCE. WHY IS THERE SENTIENCE?

A DIALOGUE BETWEEN SUE BLACKMORE AND DEEPAK CHOPRA”.

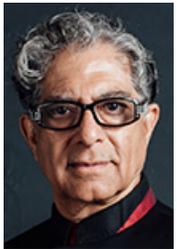


SUE BLACKMORE

University of Plymouth UK

Sue Blackmore is a psychologist, lecturer and writer researching consciousness, memes, and anomalous experiences, and a Visiting Professor at the University of Plymouth. She is a TED lecturer, blogs for the Guardian, and often appears on radio and television. The Meme Machine (1999) has been translated into 16 other languages; more recent books include Conversations on Consciousness (2005), Zen

and the Art of Consciousness (2011), Seeing Myself: The new science of out-of-body experiences (2017) and a textbook Consciousness: An Introduction (3rd Ed 2018).



DEEPAK CHOPRA™ MD, FACP

Chopra Foundation and Chopra Global

Founder of The Chopra Foundation, a non-profit entity for research on well-being and humanitarianism, and Chopra Global, a modern-day health company at the intersection of science and spirituality, is a world-renowned pioneer in integrative medicine and personal transformation. Chopra is an Adjunct Professor of Urology at Mount Sinai, Professor of Internal Medicine at University of Central Florida, Clinical

Professor of Family Medicine and Public Health at the University of California, San Diego and serves as a senior scientist with Gallup Organization. He is the author of over 90 books translated into over forty-three languages, including numerous New York Times bestsellers. His latest book, Abundance – The Inner Path to Wealth unlocks how you can cultivate a sense of abundance in times of fear and insecurity and will be available on March 1, 2022. TIME magazine has described Dr. Chopra as “one of the top 100 heroes and icons of the century.” www.deepakchopra.com

PHILOSOPHY

- 01.01 The concept of consciousness
- 01.02 Materialism and dualism
- 01.03 Panpsychism and cosmopsychism
- 01.04 Ontology of consciousness
- 01.05 Qualia
- 01.06 Machine consciousness
- 01.07 Mental causation and the function of consciousness
- 01.08 The "hard problem" and the explanatory gap
- 01.09 Philosophical theories of consciousness
- 01.10 Epistemology and philosophy of science
- 01.11 Personal identity and the self
- 01.12 Free will and agency
- 01.13 Intentionality and representation
- 01.14 Philosophy of perception
- 01.15 Neutral monism and idealism
- 01.16 Miscellaneous

NEUROSCIENCE

- 02.01 Neural correlates of consciousness (general)
- 02.02 Methodologies (fMRI, EEG etc.)
- 02.03 Neuroscience of vision
- 02.04 Other sensory modalities
- 02.05 Motor control
- 02.06 Memory and learning
- 02.07 Blindsight
- 02.08 Neurology, neuropsychology and neuropathology
- 02.09 Coma and vegetative states
- 02.10 Anesthesia
- 02.11 Cellular and sub-neural processes

- 02.12..... Quantum brain biology
- 02.13..... Brain networks, synchrony and scale
- 02.14..... Emotion
- 02.15..... Sleep and waking
- 02.16..... Brain stimulation techniques
- 02.17..... Specific brain areas
- 02.18..... Neurolinguistics
- 02.19..... Psychedelics and psychopharmacology
- 02.20..... Neurobiological theories of consciousness
- 02.21..... Pharmacology and psychopharmacology
- 02.22..... Miscellaneous

COGNITIVE SCIENCE AND PSYCHOLOGY

- 03.01..... Attention
- 03.02..... Vision
- 03.03..... Other sensory modalities
- 03.04..... Memory, learning and synaptic plasticity
- 03.05..... Emotion
- 03.06..... Language
- 03.07..... Mental imagery
- 03.08..... Implicit and explicit processes
- 03.09..... Unconscious/conscious processes
- 03.10..... Sleep and dreaming
- 03.11..... Cognitive development
- 03.12..... Artificial intelligence and robotics
- 03.13..... Neural networks and connectionism
- 03.14..... Cognitive architectures
- 03.15..... Ethology
- 03.16..... Self-consciousness and metacognition
- 03.17..... Temporal consciousness
- 03.18..... Intelligence and creativity
- 03.19..... Cognitive theories of consciousness
- 03.20..... Miscellaneous

PHYSICAL AND BIOLOGICAL SCIENCES

- 04.01..... Quantum physics, collapse and the measurement problem
- 04.02..... Quantum field approaches
- 04.03..... Space, time and the nature of reality
- 04.04..... Cosmology and integrative models
- 04.05..... Emergence, nonlinear dynamics and complexity
- 04.06..... Hierarchies, scale-invariance and 1/f systems
- 04.07..... Logic and computational theory
- 04.08..... Quantum brain biology
- 04.09..... Biophysics and coherence
- 04.10..... Origin and nature of life
- 04.11..... Consciousness and evolution
- 04.12..... Medicine and healing
- 04.13..... Brain stimulation techniques
- 04.14..... Quantum theories of consciousness
- 04.15..... Photons and entanglement in the brain
- 04.16..... Miscellaneous

EXPERIENTIAL APPROACHES

- 05.01..... Phenomenology
- 05.02..... Meditation and mindfulness
- 05.03..... Hypnosis
- 05.04..... Psychedelic and other altered states of consciousness
- 05.05..... Transpersonal and humanistic psychology
- 05.06..... Psychoanalysis and psychotherapy
- 05.07..... Lucid dreaming
- 05.08..... Near-death and anomalous experiences
- 05.09..... Parapsychology
- 05.10..... Contemplation and mysticism
- 05.11..... Virtual reality
- 05.12..... Miscellaneous

CULTURE AND HUMANITIES

- 06.01..... Literature and hermeneutics
- 06.02 Aesthetics
- 06.03 Music
- 06.04 Religion and spirituality
- 06.05..... Mythology
- 06.06 Sociology
- 06.07 Anthropology
- 06.08 Information technology
- 06.09 Ethics and legal studies
- 06.10..... Education
- 06.11..... Entertainment
- 06.12..... Visual Art Forms
- 06.13..... Poetry
- 06.14..... Dance
- 06.15..... Miscellaneous

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UA CCS TSC

EXHIBITORS

Grand Ballroom Lobby

ANT-NEURO

Exaptive

CosmoIntel Inc.

Conscious Matrix

Relax Saunas of Momentum

TennisCentric

A ‘Gong Bath™’ (Ventana Room 2nd fl)

Vibme LLC

Earthfire Institute

TSC 2023 - Taormina

Academy for the Advancement of Postmaterialist Sciences

Center for Consciousness Studies

Center for Consciousness Science

Society for Mind-Matter Research

The Journal of Consciousness Studies-Imprint Academic

ABSTRACTS BY SESSION

INDEX TO PLENARY SESSIONS

Plenary
Concurrent
Posters

TAXONOMY 2022

1.0 Philosophy
2.0 Neuroscience
3.0 Cog Sci-Psychology
4.0 Physical & Biological Sciences
5.0 Experiential Approaches
6.0 Culture & Humanities

PLENARY & KEYNOTE SESSION ABSTRACTS

PLENARY Section: 1 - SLEEP, WAKEFULNESS & ANESTHESIA

Name: Giancarlo Vanini

Email: gvanini@umich.edu

Organization: University of Michigan, Department of Anesthesiology

Primary Topic: [02.10].....Anesthesia

Abstract Title: Preoptic Hypothalamic Mechanisms Controlling Sleep-Wake States Do Not Influence the Loss and Recovery of Consciousness Associated with Isoflurane Anesthesia

Abstract: Despite 175 years of continuous clinical use of general anesthetics, the precise mechanisms by which these drugs reversibly suppress consciousness remain unknown. One long-standing hypothesis in the field, which is largely supported by ample correlative evidence, is that anesthetics co-opt the brain circuits that regulate sleep. First, I will review evidence from several independent studies, including ours (Vanini et al., Curr Biol 2020; PMID:32084397), demonstrating that the preoptic area of the hypothalamus is a key component of the brain circuitry that controls sleep onset and sleep homeostasis. Additionally, I will present our recent work challenging the long-standing notion in sleep neurobiology that the preoptic area is exclusively

somnogenic (Mondino et al., J Neurosci 2021; PMID: 33664133). In this study, we demonstrated that stimulation of a subset of glutamatergic neurons within the ventral-lateral portion of the preoptic area promote wakefulness, fragment sleep, suppress rapid eye movement sleep, and produce a shift in cortical rhythms and dynamics during sleep akin to a wake-like state (i.e., a “lighter” sleep). Last, I will discuss our study testing the hypothesis that selective activation of discrete neuronal subpopulations within the median preoptic nucleus (MnPO) and ventrolateral preoptic nucleus (VLPO) of the hypothalamus would modulate sleep/wake states and alter anesthetic induction and recovery time (Vanini et al., Curr Biol 2020; PMID:32084397). We showed that activating sleep-promoting (GABAergic, MnPO) and wake-promoting (glutamatergic, VLPO) neurons in the preoptic hypothalamus altered sleep-wake architecture but did not influence anesthetic state transitions. Collectively, our results suggest that the correlative evidence for a mechanistic overlap between sleep and anesthesia might not necessarily have strong causal significance.

PLENARY Section: 1 - SLEEP, WAKEFULNESS & ANESTHESIA

Name: Matthew Larkum

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Organization: Humboldt University

Primary Topic: [02.10].....Anesthesia

PLENARY Section: 1 - SLEEP, WAKEFULNESS & ANESTHESIA

Name: Alexander Proekt

Email: proekta@uphs.upenn.edu

Organization: University of Pennsylvania, Associate Professor of Anesthesiology & Critical Care

Primary Topic: [02.10].....Anesthesia

Abstract: The scientific inquiry into mechanisms through which anesthetics act to induce a reversible state of unconsciousness are inextricably linked to the study of consciousness per se. Anesthetic mechanisms can be addressed at a number of levels from detailed understanding of molecular interactions between receptors and anesthetic compounds to their effects on individual neurons and neuronal circuits. In this talk, I will address mechanisms of anesthesia at a more macroscopic level, that of global brain dynamics. Consciousness emerges as a consequence of complex bidirectional interactions between the brain and the environment. At this level, the effect of anesthetics can be broadly conceptualized as decoupling the brain from the environment. In this talk, I will first offer a hypothesis that in order to enable the complex and flexible coupling

between the brain and the environment, brain dynamics must be critical and provide some experimental support for this hypothesis using spontaneous brain activity in humans and nonhuman primates. I will then discuss our recent results on effects of mechanistically distinct anesthetics on macroscopic brain dynamics evoked by simple visual stimuli in the mouse cortex.

KEYNOTE 1 (Plenary 2): BRAIN & CONSCIOUSNESS

Name: Christof Koch, Ph.D.

Email: christofk@alleninstitute.org

Organization: Chief Scientist and President, Allen Institute for Brain Science, Seattle, Washington and Chief Scientist of the MindScope Program.

Primary Topic: [02.19].....Psychedelics and psychopharmacology

Abstract Title: Brain and Consciousness

Abstract: I will discuss what we can reasonably state about consciousness and its neuronal footprints in the mammalian brain, in particular the cortex, how to detect its presence and how psychedelics might affect these footprints

PLENARY Section 3 - BRAIN CONNECTIVITY

Name: Jean-Rémi King

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Organization: CNRS - Ecole Normale Supérieure de Lyon

Other Authors:

Primary Topic: [02.13].....Brain networks, synchrony and scale

Abstract Title:

Abstract:

PLENARY Section 3: BRAIN CONNECTIVITY

Name: Zirui Huang

Email: huangzu@med.umich.edu

Organization: University of Michigan Medical School

Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: Macroscale brain dynamics, gradients, and the gate to consciousness

Abstract: Evidence from noninvasive functional neuroimaging studies has

pointed to two distinct cortical systems that may mediate the ongoing stream of human consciousness, an internally directed system – default mode network and an externally directed system – dorsal attention network. During Dr. Huang's talk, he will discuss how the two systems unfold over time in the conscious brain, and how they are disrupted when consciousness is diminished. He will elaborate the concept of "temporal circuit," which is characterized by a set of trajectories along which the dynamic brain activity occurs (Huang et al., 2020, Science Advances). Next, Dr. Huang will present an extended work, in which the level and content of consciousness were manipulated using independent task-fMRI protocols. He will show that the anterior insula, situated between unimodal and transmodal cortical areas along the brain's primary functional gradient, regulates the default mode – dorsal attention network transitions, and gates conscious access of sensory information (Huang et al., 2021, Cell Reports). Finally, Dr. Huang will talk about the brain's multidimensional functional landscape and introduce a common macroscale neurofunctional framework that can account for both normal and altered states of consciousness.

PLENARY Section 3: BRAIN CONNECTIVITY

Name: Anirban Bandyopadhyay Ph.D.

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Organization: National Institute for Materials Science, NIMS, Tsukuba, Japan

Primary Topic: [04.08].....Quantum brain biology

Abstract Title: Filaments deep inside a neuron membrane is not silent, they fine tune precise spike time

Abstract: For a century it was believed that everything inside the membrane remains silent when a nerve spike propagates. Using nanotechnology, a coaxial probe we measured that filaments contribute to neuron firing, not by initiating the firing but fine-tuning the spike timing, regulating the ion channel release. In the microscope the optical circuit that we see is not the true picture of the neural network, if we use dielectric resonance camera, we would see a very different picture of the brain circuit. Neural circuit is not a linear circuit as modelled for a century, on the contrary, it's a fractal like network where a scale free symmetry in vibrations of proteins extend to the entire brain body neural network. 1. Singh, P.; Sahoo, P.; Saxena, K.; Manna, J.S.; Ray, K.; Ghosh, S.; Bandyopadhyay, A. Cytoskeletal Filaments Deep Inside a Neuron Are Not Silent: They Regulate the Precise Timing of Nerve Spikes Using a Pair of Vortices. *Symmetry* 2021, 13, 821. <https://doi.org/10.3390/sym13050821> 2. Pushpendra Singh, Komal Saxena, Pathik Sahoo, Subrata Ghosh, and Anirban Bandyopadhyay*. Electrophysiology using coaxial atom probe array: Live imaging reveals hidden circuits of a hippocampal neural network. *Journal of Neurophysiology*. Volume 125 Issue 6 June 2021, Pages 2107-2116 <https://>

doi.org/10.1152/jn.00478.2020 3. Komal Saxena, Pushpendra Singh, Pathik Sahu, Satyajit Sahu, Subrata Ghosh, Kanad Ray, Daisuke Fujita and Anirban Bandyopadhyay; Fractal, scale free electromagnetic resonance of a single brain extracted microtubule nanowire, a single tubulin protein and a single neuron, Fractal and Fractional, 4, 11(2020). <https://doi.org/10.3390/fractalfract4020011>

PLENARY Section 4: ALTERED STATES OF CONSCIOUSNESS

Name: Emma Huels

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Organization: University of Michigan

Co-Authors: Hyoungkyu Kim; UnCheol Lee; Tarik Bel-Bahar; Angelo V. Colmenero; Amanda Nelson; Stefanie Blain-Moraes; George A. Mashour; Richard E. Harris

Primary Topic: [05.04].....Psychedelic and other altered states of consciousness

Abstract Title: Neural Correlates of the Shamanic State of Consciousness

Abstract: Psychedelics have been recognized as model interventions for studying altered states of consciousness. However, few empirical studies of the shamanic state of consciousness, which is anecdotally similar to the psychedelic state, exist. We investigated the neural correlates of shamanic trance using high-density electroencephalography (EEG) in 24 shamanic practitioners and 24 healthy controls during rest, shamanic drumming, and classical music listening, followed by an assessment of altered states of consciousness. EEG data were used to assess changes in absolute power, connectivity, signal diversity, and criticality, which were correlated with assessment measures. We also compared assessment scores to those of individuals in a previous study under the influence of psychedelics. Shamanic practitioners were significantly different from controls in several domains of altered states of consciousness, with scores comparable to or exceeding that of healthy volunteers under the influence of psychedelics. Practitioners also displayed increased gamma power during drumming that positively correlated with elementary visual alterations. Furthermore, shamanic practitioners had decreased low alpha and increased low beta connectivity during drumming and classical music and decreased neural signal diversity in the gamma band during drumming that inversely correlated with insightfulness. Finally, criticality in practitioners was increased during drumming in the low and high beta and gamma bands, with increases in the low beta band correlating with complex imagery and elementary visual alterations. These findings suggest that psychedelic drug-induced and non-pharmacologic alterations in consciousness have overlapping phenomenal traits but are distinct states of consciousness, as reflected by the unique brain-related

changes during shamanic trance compared to previous literature investigating the psychedelic state.

PLENARY Section 4: ALTERED STATES OF CONSCIOUSNESS

Name: Charlotte Martial

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Organization: Coma Science Group (GIGA-Consciousness) University of Liège

Primary Topic: [05.08].....Near-death and anomalous experiences

Abstract Title: Near-death experience as a probe to explore (disconnected) consciousness

Abstract: Almost fifty years ago, the first evidence of near-death experience (NDE) during comatose state was provided, setting the stage for a new paradigm for studying disconnected consciousness and its underlying neurophysiological mechanisms. Although, historically, no thematic of research has been discussed more emotionally than the phenomenon of NDE, this is now changing and research on the phenomenon is currently increasing throughout the world. The talk provides an overview of the current state of the art in NDE research and where new opportunities for understanding the phenomenon may arise in the future.

PLENARY Section 4: ALTERED STATES OF CONSCIOUSNESS

Name: Elizabeth Krasnoff

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Organization: California Institute for Human Science

Primary Topic: [02.16].....Brain stimulation techniques

Abstract Title: Altered States of Consciousness and Sound: The Auditory Pathways of Binaural Beats

Abstract: In a time when the pursuit of altered states of consciousness is both leading edge science and a mainstream pursuit, the spotlight is on all available methods of consciousness alteration. Elizabeth investigates the power of sound to alter our states of consciousness, specifically the auditory pathways of binaural beats. Current theory in the Sound Healing field hypothesizes that binaural beats filter through our Reticular Activating System, presenting consciousness altering data to the auditory brain. Binaural beats are a difference tone created by two slightly different pitches. Electrical brain wave patterns respond to these precise frequencies and appear to impact correlative states of consciousness. The Reticular Activating System is a neural network located in the brainstem responsible for modulating our three basic states of

consciousness, awake, light sleep and deep sleep. Clinical studies continue to show positive outcomes in the leading edge field of binaural beats research, and the evidence is mounting for a powerful musical healing technology—music embedded with binaural beats. Moving forward, in her first double blind and controlled pilot study, Elizabeth has compared the effects of relaxation music to the effects of relaxation music plus inaudible binaural beats, measuring EEG, HRV, GSR, bioenergy and subjective questionnaire response. All 4 subjects experienced an improvement in brain function and had a calmer brain after adding BB to brown noise or to music plus brown noise. Most also show an improvement in microcirculation or cardiovascular score after listening to music plus brown noise and BB, probably due to relaxation. All of them also showed an increase in bioenergy after adding BB. BB seems to have profound effects on the physiology of subjects and since it is not audible, these effects cannot be attributed to the placebo effect. These results are encouraging in terms of developing musical products incorporating binaural beats to affect our neural rhythms and corollary states of consciousness and warrant further research with more subjects and different frequencies of BB and different music tracks. —Consciousness is an arousal and awareness of environment and self, which is achieved through action of the RAS on the brain stem and cerebral cortex (Daube, 1986; Paus, 2000; Zeman, 2001; Gosseries et al., 2011).

KEYNOTE 2 (Plenary 5): PSYCHEDELICS

Name: Robin Carhart-Harris, Ph.D.

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Organization: University of California, San Francisco

Primary Topic: [02.19].....Psychedelics and psychopharmacology

Abstract Title: Psychedelics: Brain Mechanisms

Abstract: The talk takes a multi-level approach to the question of how psychedelics work in the brain. Key themes include: the pharmacology of classic serotonergic psychedelics, what this tells us about the current, developmental and evolutionary function of serotonin 2A receptor signaling, the acute brain effects of psychedelics as determined by functional brain imaging, current evidence for psychedelic therapy, the 'REBUS' model of the action of psychedelics, and how this maps on to the phenomenology of the acute psychedelic experience and therapeutic outcomes. The talk will end with a focus on a recent double-blind RCT comparing psilocybin therapy with an established antidepressant drug in the treatment of depression.

PLENARY Section 6: PSYCHEDELIC MECHANISMS

Name: George A. Mashour, M.D.

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Organization: University of Michigan, Director, Michigan Psychedelic Collaborative Scientific Director, Center for Consciousness Science Professor of Anesthesiology, Neurosurgery, Pharmacology, and Psychology Faculty, Neuroscience Graduate Program University of Michigan, Ann Arbor

Primary Topic: [02.19].....Psychedelics and psychopharmacology

Abstract Title: Anesthetics as Psychedelics

Abstract: There has been a renaissance of rigorous investigation into psychedelic neuroscience and therapy, with a primary focus on canonical serotonergic drugs such as psilocybin, lysergic acid diethylamide, and dimethyltryptamine. However, it has been known since antiquity that subanesthetic doses or concentrations of general anesthetics can evoke psychedelic experiences. In this presentation, I will discuss some historical background of the use of anesthetics as psychedelics, then pivot to the neurobiology of ketamine and nitrous oxide. Drawing on studies by our research group in rodents, nonhuman primates, and humans, I will discuss the effects of subanesthetic ketamine and nitrous oxide on neuronal spike activity, cortical information transfer, and large-scale functional connectivity patterns in the brain. Lastly, I will discuss recent data that examines the phenomenon of increased neurophysiologic complexity during psychedelic drug exposure and the potential neurochemical underpinnings based on concomitant high-density electroencephalography and multi-site microdialysis in the rodent brain.

PLENARY Section 6: PSYCHEDELIC MECHANISMS

Name: Alex C. Kwan

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Organization: Yale University

Primary Topic: [02.19].....Psychedelics and psychopharmacology

Abstract Title: Visualizing the plasticity-promoting action of psilocybin

Abstract: Psychedelics are compounds that produce an atypical state of consciousness characterized by altered perception, cognition, and mood. In addition to the subjective effects, it has long been recognized that these compounds have therapeutic potential for mood disorders. Among psychedelics, psilocybin has yielded highly promising results showing a relief of depression symptoms with rapid onset and long duration of weeks if not months. The long-lasting beneficial effects of psilocybin depend presumably

on neural plasticity; however, the neural basis remains unclear. In this talk, I will describe a dendrite-based framework for understanding how psychedelics may promote neural plasticity. I will discuss recent experiments with psilocybin in mice to test key aspects of the cellular and circuit mechanisms.

PLENARY Section 6: PSYCHEDELIC MECHANISMS

Name: Katrin Preller

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Organization: University of Zurich; Yale University

Primary Topic: [02.19].....Psychedelics and psychopharmacology

Abstract Title: The neurobiology of altered states of consciousness

Abstract: Due to their unique effects on consciousness, psychedelics offer the opportunity to investigate the neuropharmacological mechanisms underlying alterations in perception and cognition important for increasing our understanding of psychiatric disorders. Furthermore, renewed interest in the potentially beneficial clinical effects of psychedelics warrants a better understanding of their underlying neuropharmacological mechanisms. However, major knowledge gaps remain regarding the neurobiology of psychedelics in humans. In our studies we show that LSD and psilocybin modulate brain connectivity and subjective effects via agonistic activity on the serotonin 2A receptor in humans. Furthermore, we elucidate the neuropharmacology of self-relevance and meaning processing, as well as the intertwined relationship between self-processing and social cognition via the administration of LSD and psilocybin. We additionally show that the neural correlates of psychedelic-induced states differ from non-pharmacologically induced altered states of consciousness. Our results thus attenuate major knowledge-gaps regarding the neurobiology and neuropharmacology of psychedelics. Furthermore, they increase our mechanistic understanding of cognitive and emotional processes and therefore offer important directions regarding the development of novel therapeutics.

PLENARY Section 7: ORIGINS OF LIFE

Name: Dante Lauretta

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Organization: University of Arizona, Regents Professor, Planetary Science and Cosmochemistry; University of Arizona Lunar & Planetary Laboratory

Co-Authors: Daniel P. Glavin

Primary Topic: [04.10].....Origin and nature of life

Abstract Title: Testing Theories for the Origin of Life Using Samples of Near-Earth Asteroid (101955) Bennu

Abstract: On Oct. 20, 2020, NASA's OSIRIS-REx spacecraft descended to the surface of asteroid Bennu, contacted briefly, and collected a sample of carbonaceous material (Lauretta et al. 2021). These samples will return to Earth in 2023. Analyses of these samples promise advancement in our knowledge of the initial stages of planet formation and the origin of life (OOL). In particular, the samples will be analyzed to determine whether the building blocks required for the different OOL theories could have been delivered to Earth by carbonaceous asteroids. A leading theory in origin of life research is the RNA World Hypothesis, in which RNA is the first biomolecule and performs both reproductive and catalytic functions (Woese 1967; Eigen and Schuster 1977; Gilbert 1986). The sample analysis team (SAT) will analyze solvent extracts of Bennu samples for the presence of purines and pyrimidines (Callahan et al. 2011), and polyols including ribose and other bioessential sugars (Furukawa et al. 2019). Alternatively, the Protein World Hypothesis purports that proteins are amplified in the absence of any genetic function (Ikehara 2005). The SAT will analyze for both contemporary protein and non-protein amino acids and peptides to test this hypothesis. In addition, the team will determine if organic material contains enantiomeric excesses for chiral molecules that are of the same handedness as found in life (i.e., L-amino acids). A third approach is the Metabolism First Hypothesis, where self-reproducing and evolving proto-metabolic networks predate self-replicating molecules (Vasas et al. 2010). The SAT explores this concept by seeking signs of frozen chemical reaction networks, catalytic cycles, autocatalytic cycles, or pathways. (Aponte et al. 2017; Fernández-García et al. 2017). The above hypotheses are driven by the principle that life is defined by a complex set of physicochemical processes and assume that consciousness evolved after life's origin. The Orchestrated Objective Reduction hypothesis proposes that consciousness preceded life. Consciousness, in this theory, is driven by self-collapse of the quantum wavefunction, producing "proto-conscious" moments (Hameroff 2017) that could have driven organic molecules to self-organize. The first molecules to enter the quantum coherent state may have been polyaromatic hydrocarbons. These hydrocarbon rings occur at the core of proteins, nucleic acids, and psychoactive compounds. While not part of the SAT plan, we are investigating quantum effects in the chemically complex, macromolecular organic material that likely contains the bulk of Bennu's carbon (Cody and Alexander 2005). References: Aponte et al. (2017) ACS Earth Space Chem. 1.1: 3-13. Callahan et al. (2011) PNAS 108.34: 13995-13998. Cody and Alexander (2005) GCA 69.4: 1085-1097. Eigen and Schuster (1977) Naturwissenschaften, 64(11), 541-565. Fernández-García et al. (2017) Chem. Commun., 53: 4919-4921. Furukawa et al. (2019) PNAS 116.49: 24440-24445. Gilbert (1986) Nature 319.6055: 618-618. Hameroff (2017) In: On Human Nature (pp. 333-353). Academic Press. Ikehara (2005) Chem Rec 5.2:

107-118. Laurretta et al. (2021) In: Sample Return Missions. Elsevier, 163-194. Pross (2004). OLEB 34.3: 307-321. Vasas et al. (2010) PNAS 107.4: 1470-1475. Woese (1967) New York: Harper & Row, 200 pp.

PLENARY Section 7: ORIGINS OF LIFE

Name: Sara Walker

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Organization: Arizona State University

Primary Topic: [04.10].....Origin and nature of life

Abstract Title: Hard Problems: Life and Consciousness

Abstract: Understanding what life is, and by extension how it originates may be the most difficult open question in science, rivaling only the problem of consciousness in its potential difficulty. Both seem to bend our current understanding of physics and chemistry as ill-equipped to solve them. This led to the notion of the 'hard problem' of consciousness, meant to precisely articulate the key feature of consciousness our current understanding of reality can't explain - the problem of experience, that is why does it feel like anything to exist? Like consciousness, here I argue that explaining life can similar be reduced to a single focal hard problem, the hard problem of life, that is how can information affect the material world? I discuss new developments in a theory called assembly theory aiming to address this problem.

PLENARY Section 7: ORIGINS OF LIFE

Name: Steen Rasmussen

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Organization: University of Southern Denmark | Santa Fe Institute

Primary Topic: [04.02].....Quantum field approaches

Abstract Title: Assembly and evolution of minimal living materials

Abstract: We use a systemic protocell design process as a starting point for exploring two fundamental questions: How may minimal living systems emerge from non-living materials? And how may minimal living systems support increasingly more evolutionary richness? Living matter, as a minimum[1], is composed of (i) a metabolism that transforms energy to support the involved reactions e.g., to generate building, (ii) an informational system with inheritable information that at least in part controls the metabolism and (iii) a container that co-localizes the metabolism and the informational system. Further, the system exists in (iv) an environment that provides resources and free energy as well as absorbs waste. We present an experimental example of a protocellular system

that satisfies the above. Landauer's principle[2][3][4][5] states that an ability to copy and evolve information costs free energy. Therefore, available free energy must be a prerequisite for replication to occur, and thus the existence of a metabolism is a prerequisite as a converter of available free energy into the work needed in replication. Good molecular candidates to support simple metabolic processes are complexes of polyaromatic hydrocarbons and metal. Information in modern life usually refers to sequential information (e.g., in DNA and RNA or proteins), while compositional information[6] (e.g., the composition of an aggregate) is a less restrictive form of information that can also be replicated. We show how compositional information can be coupled to a metabolism experimentally as well as in simulation in the context of a minimal living protocell[7][8][9]. By examining data from systems in physics, biology, engineering, and economics it turns out that one can observe two different modes of evolution[10]: optimization and expansion. The former may occur in systems whose size and component interactions do not change substantially over time, while the latter is a key property of open-ended evolution, where components and component interactions change over time. Thus, to enhance the evolutionary richness in a system that only optimizes, e.g., the above presented protocellular system, the system must be enriched with new components, and thereby interactions, to expand its potential dynamics. We have applied this simple design idea[11] with some success to enhance the behavioral richness both for computational and experimental investigations, but it is only in retrospect one can be certain, which system expansions one should apply. [1] <https://royalsocietypublishing.org/doi/10.1098/rstb.2015.0440> [2] https://en.wikipedia.org/wiki/Landauer%27s_principle [3] <https://www.nature.com/articles/ncomms8669> [4] <https://arxiv.org/abs/1004.4732> [5] <https://royalsocietypublishing.org/doi/10.1098/rsta.2016.0343> [6] <https://www.pnas.org/content/pnas/97/8/4112.full.pdf> [7] <https://royalsocietypublishing.org/doi/10.1098/rstb.2015.0440> [8] <https://direct.mit.edu/isal/proceedings/isal2020/269/98487> [9] <https://direct.mit.edu/isal/proceedings/isal/33/69/102946> [10] <https://direct.mit.edu/artl/article-abstract/25/1/9/2914> [11] <https://direct.mit.edu/artl/article-abstract/7/4/329/2381>

KEYNOTE 3 (Plenary 8): ASTROBIOLOGY & ASTROCONSCIOUSNESS

Name: Avi Loeb

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Organization: Harvard University

Primary Topic: [04.04].....Cosmology and integrative models

Abstract Title: The Galileo Project: In Search for Technological Interstellar Objects

Abstract: The search for extraterrestrial life is one of the most exciting frontiers

in science. First tentative clues were identified close to Earth in the form of the unusual interstellar object 'Oumuamua and Unidentified Aerial Phenomena (UAP) in the Earth's atmosphere. The recently announced "Galileo Project" ushers the new frontier of "space archaeology" in search of extraterrestrial technological relics. The lecture will feature content from my book "Extraterrestrial", as well as the textbook "Life in the Cosmos", both published in 2021. Related material was also featured in my weekly commentaries in Scientific American and Medium.

PLENARY Section 9: TIME & CONSCIOUSNESS

Name: Daniel P. Sheehan

Email: dsheehan@sandiego.edu

Organization: Department of Physics, University of San Diego

Primary Topic: [04.02].....Quantum field approaches

Abstract Title: Time's Broken Arrow: Consciousness and Temporal Bidirectionality

Abstract: During the last 20 years it has become increasingly clear that our physical understanding of time is incomplete. Although the fundamental equations of physics are time-symmetric -- that is, they equally admit time-forward (retarded) and time-reversed (advanced) solutions [1] -- natural processes and our personal experiences generally demonstrate a forwardly-directed, temporally asymmetric 'arrow of time.' (The second law of thermodynamics is thought to underwrite most temporal asymmetries.) Human and animal precognition are at odds with this standard temporal arrow [2]; recent quantum laboratory experiments further press the issue. This presentation considers the case for temporal bidirectionality in the natural world and in human consciousness, focusing on precognition and retrocausation. Also considered is the possibility that precognitive effects might be demonstrated by non-sentient devices, i.e., informational time machines. It is argued that retrocausation and precognition are not at odds with standard physics but are in fact natural outcomes of it. Indeed, time may be losing its direction -- but not its mind. In fact, it may finally be coming to its senses. 1) H.D. Zeh, *The Physical Basis of the Direction of Time*, Springer, Berlin (2001). 2) D.P. Sheehan (Editor), *AIP Conf. Vols. 863, 1408, 1841*; AIP Press (2006, 2011, 2017). Daniel P. Sheehan is Professor of Physics at the University of San Diego. His areas of interest include plasma physics, the foundations of thermodynamics, energy technology, nanotechnology, consciousness, and the physics of time and retrocausation.

PLENARY Section 9: TIME & CONSCIOUSNESS

Name: Paul Davies

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Organization: Arizona State University

Primary Topic: [01.11].....Personal identity and the self

Abstract Title: Time's Flow Is An Illusion: Time Doesn't Pass, Selves Do

Abstract: The universal perception that time passes, or flows, is an illusion. Time cannot change; the world can. I shall demonstrate that the concept of a flow of time is meaningless, and instead trace the origin of this impression to the false tacit assumption that 'the self,' i.e. personal identity, is conserved in time. This error arises because of the large degree of mutual information between the self at earlier and later times. The fact that time (clearly) does not flow in no way undermines the existence of an arrow of time in the physical world, understood as an asymmetry in the evolution of physical states in time. An asymmetry of the world in time is not an asymmetry of time.

PLENARY Section 9: TIME & CONSCIOUSNESS

Name: Sir Roger Penrose

Organization: Oxford University

PLENARY Section 10: THEORIES OF CONSCIOUSNESS

Name: Biyu J. He

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Organization: New York University, Langone

Primary Topic: [01.09].....Philosophical theories of consciousness

Abstract Title: Neural mechanisms of conscious visual perception

Abstract: Despite intense interests and research over the past three decades, the neural mechanisms of conscious visual perception remain a mystery. In this talk, I will give an overview of our recent work tackling this fundamental question. Using a combination of high temporal resolution (E/MEG, electrocorticography) and high spatial resolution (e.g., 7T fMRI) techniques to record from the human brain, and employing multiple perceptual paradigms, we have found that: I) Conscious perception likely requires the coordination of large-scale brain dynamics across multiple brain networks, including both content-specific cortical activity and non-content-specific subcortical activity. II) The preexisting brain state, including both the connectivity patterns reflecting past experiences and the moment-to-moment spontaneous activity fluctuations, strongly shapes conscious perception. In addition, I will discuss the implications of these findings for theories of conscious perception.

PLENARY Section 10: THEORIES OF CONSCIOUSNESS**Name:** Yuri B. Saalman**Email:** saalman@wisc.edu**Organization:** University of Wisconsin – Madison**Primary Topic:** [02.01].....Neural correlates of consciousness (general)**Abstract Title:** Putting theories of consciousness to the test, using intracranial electrophysiology and causal manipulations

Abstract: Competing theories of consciousness disagree on the contribution of frontal versus posterior cortex and largely neglect subcortical influences. To test proposed neural correlates of consciousness (NCC), we simultaneously recorded neural activity from the frontal and parietal cortex, as well as subcortical areas in the basal ganglia and central thalamus, of awake, sleeping and anesthetized macaques. Further, we bidirectionally manipulated consciousness on a finer scale using thalamic deep brain stimulation, rousing macaques from continuously administered anesthesia or reducing consciousness in behaving macaques. I will discuss machine learning analyses of these neural data that show parietal cortex and subcortical areas contributed more than frontal cortex to decoding different conscious states. This work suggests that an integrated parietal-striatal-thalamic structure is important for consciousness. I will also discuss an ongoing adversarial collaboration testing the different NCC proposed by Global Neuronal Workspace Theory and Integrated Information Theory, using high-density electrophysiology and optogenetics in macaques and mice performing a similar sensory discrimination task.

PLENARY Section 10: THEORIES OF CONSCIOUSNESS**Name:** Lucia Melloni**Email:** lucia.melloni@ae.mpg.de**Organization:** Max Planck Institute, Frankfurt**Primary Topic:** [01.09].....Philosophical theories of consciousness**KEYNOTE 4 (Plenary 11): REALITY +: From the Matrix to the Metaverse****Name:** David Chalmers**Organization:** New York University

David Chalmers is University Professor of Philosophy and Neural Science and co-director of the Center for Mind, Brain, and Consciousness at New York University

Primary Topic: [01.09].....Philosophical theories of consciousness**Abstract Title:** Reality+: From the Matrix to the Metaverse

Abstract: I'll argue that virtual reality is genuine reality. A simulated universe such as the Matrix could be indistinguishable from physical reality. Such a reality need not be illusory. The same goes for the Metaverse: the virtual worlds that we will create in coming decades with virtual and augmented reality technology. I will argue that Metaverse-style virtual worlds are genuine realities, and that we can live a meaningful life in these virtual worlds.

PLENARY Section 12: QUANTUM NEUROSCIENCE**Name:** Hartmut Neven**Email:** neven@google.com**Organization:** Google Quantum AI**PLENARY Section 12: QUANTUM NEUROSCIENCE****Status:** Plenary**Name:** Aarat Kalra**Organization:** Princeton University**PLENARY Section 12: QUANTUM NEUROSCIENCE****Name:** Travis Craddock**Organization:** Nova Southeastern University**Title:** Quantum Optical Properties of Microtubules: Theory and Experiment

Abstract: Microtubules are self-assembling biological nanotubes made of the protein tubulin that are essential for cell motility, cell architecture, cell division and intracellular trafficking. The unique mechanical properties of microtubules give rise to a high resilience and stiffness due to their quasi-crystalline helical structure. It has been theorized that this hollow molecular nanostructure may function like a quantum wire where optical transitions can take place, where photo-induced changes in microtubule architecture may be mediated via changes in disulfide or peptide bonds or stimulated by photoexcitation of tryptophan, tyrosine or phenylalanine groups, resulting in subtle protein structural changes owing to alterations in aromatic flexibility. Here theories of light-matter interactions with aromatic amino acids in tubulin and microtubules are presented. Additionally, experimental evidence is presented of the Raman scattering spectra of microtubules and tubulin in both dry and aqueous states showing active Fano resonances which are indicative of quantum coupling between discrete phonon vibrational states and continuous excitonic many-body spectra.

CONCURRENT SESSION – ABSTRACTS

Tuesday, April 19, 2022

5:00 – 7:00 PM MST | (R) = Remote

C 1 - Hard Problem

Silberstein, Kouchakzadeh (R) , Gill, Deiss, Christian
Grand Ballroom A

C 2 – Brain & Consciousness

Agarwal, Pagel, Gennaro (R), Beran, Viirre
Grand Ballroom B

C 3 - Ai/Machine Consciousness

Bach, Chella, O'Leary, Ruffini, Besedin
Kiva Ballroom

C 4 - Quantum State Reduction

Lloyd, Tagg, Brophy, Stroo, Thompson
Grand Ballroom C

Wednesday, April 20, 2022

5:00 – 7:00 PM MST

C 5 – Panpsychism

Pugliaro, Beni (R) Stoica, Longinotti (R), Basios (R)
Grand Ballroom C

C 6 - Psychedelics 1

Denomme, Kargbo, Dourron, Cardone, Alnagger
Grand Ballroom A

C 7 - Studying and measuring consciousness

Blackmore, Hunt, Mahn, LaBerge, Mccann (R), Voorhees, H. Mahn (R)
Grand Ballroom B

C 8 - Theories of consciousness

Hopkins, Arkhipov, DeLancey, Grasso, Nisbet, Awret, Blommestijn
Kiva Ballroom

C 9 - Space, Time and Consciousness 1

Lahav, R. Xiu, Ahmadkhanlou, Yang, Zabriskie, D. Holbrook
Executive Board Room

CONCURRENT SESSION

Friday, April 22, 2022

5:00 – 7:00 PM MST

C 10 - Representation and Perception

Robinson (R), Weger, Lecybyl (R), Langer (R), Schiffer (R)
Executive Board Room

C 11 - Psychedelics and altered states 2

Glynos, Joy, Safron, Morley, Pagni, Sielaff, Head (R)
Grand Ballroom A

C 12 - Subcellular correlates of consciousness

Mihelic, Alachkar, Ruggiero, Davis, Grinde, Egoyan, Todd
Grand Ballroom B

C 13 - Space, Time and Consciousness 2

Nishiyama (R), Gruber, Raadnasab, Schick, Mender, Fitzpatrick (R), Mossbridge
Kiva Ballroom

C 14 - Healing and altered states

Woollcott (R), Wahbeh (R), Garland, Saegusa, Greven, Hanley, Joshi
Grand Ballroom C

CONCURRENT ABSTRACTS IN SESSION ORDER

TUESDAY EVENING, APRIL 19, 2022

C 1 - Hard Problem

Silberstein, Kouchakzadeh (R) , Gill, Deiss, Christian
Grand Ballroom A

Section: C 1

Status: Concurrent

Name: Michael Silberstein

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Organization: Elizabethtown College

Co-Authors: Michael David Silberstein

Primary Topic: [01.15].....Neutral monism and idealism

Abstract Title: The Cognitive Neuroscience and the Metaphysics of Consciousness: What should a Science of Consciousness Look Like Now?

Abstract: In reaction to the failure to find an NCC, as well as the failure of computational accounts like GWT, information-theoretic accounts such as IIT, and other complexity-based accounts, a less ambitious brand of biological naturalism has arisen (Seth, 2021). This neo-biological naturalism (NBN) abandons trying to resolve the hard problem (HP) and the search for a NCC but seeks instead various necessary neural conditions in the form of neural mechanisms underlying specific contents of conscious experience such as color perception, global states of consciousness such as dreaming, or overarching features of consciousness such as self-awareness. As Seth puts it: “The challenge is to build increasingly sturdy explanatory bridges between mechanism and phenomenology, so that the relations we draw are not arbitrary but make sense” (p. 279). Thus, NBN wants to do the cognitive neuroscience of consciousness the way we do biology in general, hunt for mechanisms that provide “explanation, prediction, and control.” However, as Seth notes, the final goal is much the same as before, “As we get on with explaining the various properties of consciousness in terms of their underlying mechanisms, perhaps the fundamental mystery of ‘how consciousness happens’ will fade away, just as the mystery of ‘what is life’ also faded away” (p. 32). What NBN is selling us is a science of consciousness project that does not run afoul of the HP, is metaphysically neutral and yet provides fundamental scientific explanation, i.e., why answers for everything short of the HP itself but without any metaphysical presuppositions or consequences. All of this raises several questions, does neuroscience truly provide the why answers they seek via mechanistic

explanations? Is the explanatory framework in question truly metaphysically neutral? Can one turn neural correlates into full-blooded (mechanistic) explanations without making any metaphysical assumptions? And relatedly, does the framework in question truly avoid all conceptual, epistemological, and metaphysical concerns that plague other projects in the science of consciousness? It will be argued that the answer to all these questions is ‘no.’ Is there an account of consciousness and its relationship to matter that fully supports the broader project of consciousness science that NBN advocates for, one that doesn’t leave any fundamental metaphysical mysteries or explanatory danglers? Yes, the account is the neutral monism of James and Russell. This account not only helps turn neural correlates into possible explanations (though not simplistic causal or mechanistic ones), neutral monism, also shows how to properly parse the relationship between prediction, control, explanation, and understanding, which in fact often come apart in science. For example, with their various body, brain, and mind-altering techniques, Hindu, Buddhist, and Shamanic traditions (they would call them ‘sciences’) have been besting Western civilization at the control and prediction of conscious states for thousands of years. The idea that one can fully separate paradigms of scientific explanation from metaphysical assumptions and vice-versa is a fantasy, one that ignores underdetermination of several sorts. It will be argued that neural monism and the science thereof is a much more unifying and expansive basis for the future of consciousness studies.

Section: C 1

Status: Concurrent

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Co-Authors: Shahriar Gharibzadeh

Primary Topic: [01.08].....The "hard problem" and the explanatory gap

Abstract Title: The Nature of Human Reports and the Possibility for Hardness of the Meta Problem

Abstract: The hard problem of consciousness is the problem of explaining subjective experience. This problem is based on the notion that explaining brain functions cannot lead to explaining experience (Chalmers, 1995). The meta problem of consciousness is the problem that why we think there is a hard problem of consciousness. David Chalmers suggests that solving the meta problem deals with human reports of the hard problem- named problem reports. He notes that since problem reports are facts of human behavior we

can consider them explainable by functional terms. Therefore, the meta problem is an easy problem (Chalmers, 2018). In this article, we are trying to question the nature of human reports, and to leave open the possibility for hardness of the meta problem. First, the nature of human reports: Chalmers (2018) suggests that in order to solve the meta problem, we should explain dispositions to make specific problem reports and judgments. He names those dispositions as “problem intuitions”. It is not clear for us why Chalmers narrowed the view of problem reports to the problem intuitions. We think that the nature of human reports cannot be summarized in intuitions. At least, we can consider there have been lots of thoughts about the given subject before the examination of a specific intuition. This notion can be further developed to concurrent conceptual phenomenal states while making reports. If we pose an inclusivist position about those states, it is not clear that why we should eliminate them from the explanation. Second, the possibility for hardness of the meta problem: An explanatory solving of the meta problem through explaining reports, requires a complete picture of what happens during a single report. In order to have a complete picture, it should be considered that various phenomenal states exist at that moment when a human makes a single problem report. It seems to us that those phenomenal states are at least parts of a complete explanation for the question that why she thinks there is a hard problem. Therefore, in order to solve the meta problem, phenomenal aspects of the answering moments should also be explained. Thus, if it is true that explaining brain functions of problem reports will not lead to explaining problem reports, a hard problem will rise for the meta problem. References Chalmers, D. (1995). Facing up to the problem of consciousness. *Journal of Consciousness Studies*, 2(3), 200-219. Chalmers, D. (2018). The meta-problem of consciousness. *Journal of Consciousness Studies*, 25(9-10), 6-61.

Section: C 1

Status: Concurrent

Name: Richard Gill

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Organization: 3WH

Primary Topic: [01.08].....The "hard problem" and the explanatory gap

Abstract Title: Evolution of the explanatory gap

Abstract: When he considered the puzzle of consciousness, Levine introduced the idea of an explanatory gap which can be thought of as the difficulty of reconciling our extensive knowledge of the physical and scientific worlds with our daily phenomenological experiences which do not seem to fit into a physical understanding or a philosophical description of our world. This paper will

consider, in a new way, where and when this gap has arisen. An evolutionary approach will be taken in which the transition from animals species to those of humans will be considered. Although animals can communicate, they cannot talk to each other, and this distinction separates us from them. Although there is no proof, it is not conceivable that this transition also coincides with the emergence of conscious minds. At least according to Darwin, animals can experience and express emotions and are similar to us in this way. Without the use of language, the gap cannot be considered, and it has therefore come into being since the development of speech and subsequent philosophy. It will be argued that our present-day difficulties with the gap also arose after speech was able to express abstract ideas, and that the gap that emerged was between what can or cannot be completely communicated. Although speech can induce simple ideas in others, we cannot create in others the totality of our experience. So there is always a gap between our experience and that which we manage to produce in others. We can never overcome this, and we have to live and accept it. For example, the word tiger can invoke a response in you, but the response is generated by you. I cannot produce a response in you that is the same as that produced by your seeing a tiger, although the word itself can be exactly transmitted. This gap gave an opportunity for the development of the arts and the point where they split off from science. The artist uses the means at her disposal to produce the greatest sensation that she can that is over and above what you can create for yourself. The sciences, and particularly mathematics, concentrate on those things that can be exactly described and communicated to others. We are now left in the position of having experiences that we cannot adequately describe; this is a result of language being a later addition to our repertoire and the flow of information from experience to language. There is no escape from this.

Section: C 1

Status: Concurrent

Name: Stephen Deiss

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Organization: University of California at San Diego, Institute for Neural Computation

Primary Topic: [01.08].....The "hard problem" and the explanatory gap

Abstract Title: So is there something it is like or not? The 'Real Problem' of Physicalism

Abstract: Dave Chalmers defined for us the controversial hard problem and the easy problems of consciousness. The zombies among us were thus exposed. Anil Seth has just introduced us to what he calls the real problem

of consciousness and the assumption that, like the phlogiston of vitalism often cited by the Churchlands, our perplexity about the physical basis of consciousness will dissipate as neuroscience research advances. He predicts that as science becomes more thoroughly able to predict and control phenomenal states in our prediction-machine brains the mystery of how these brain states become phenomenal will simply be replaced by an appreciation of the mechanisms that conscious states supervene on. Your phenomenal experience will happen if and only if x, y and z are happening in your brain. Few of us doubt that, but it leaves the hard problem untouched. For Seth, consciousness is ultimately only a real physical process as the Churchlands, Dennet, and other eliminativists have argued. I will offer a very different perspective on where we are today. By explaining how we evolved to be such accomplished prediction machines and thereby ensure our position at the top of the food chain, we are inbred to think in terms of causal mechanisms underlying everything that happens. This human overwhelming motivation to predict and control got us to where we are today with the accomplishments of science and technology but also enabled our slash and burn economies leading the entire planet to a MAD tipping point. Our reptilian brain with basal ganglia guided by our amygdale and nucleus accumbens is greatly enhanced by a superior hippocampus which in turn guides the overrated and expanded cortices we all have. To understand how we approach consciousness, we need to understand how we approach every problem as hunting predators. More importantly, it will be explained how this habitual style of thinking overlooks major presuppositions that all physicalists hold onto somewhat blindly for which there is arguably no ontological justification. Similar to Don Hoffman's analysis of how computer desktop icons work for us to be productive users, physicalism enables us to predict and control our world to a fault. However, physicalism has no explanation of where the fire in the equations comes from, nor why one thing leads to another. There is an alternative view that is based upon realizing the analogical origins of the concept of what-it-is-like. We can use mechanistic explanation to reveal its own origins and faults and open the door to a more realistic way of thinking about what we know and what is real. The unexpected result is that panpsychism is a viable alternative in spite of the combination problem that haunts it just as the overlooked problems of locus of causal necessity and hierarchy haunt physicalism.

Section: C 1

Status: Concurrent

Name: Isaac Ray Christian

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Organization: Princeton University

Co-Authors: Andrew I. Wilterson, Michael S. A. Graziano

Primary Topic: [03.16].....Self-consciousness and metacognition

Abstract Title: Simulating the Mechanisms of Meta-awareness Using an Artificial Reinforcement Learning Agent in an Endogenous Visuo-spatial Attention Task: Support for the Attention Schema Theory

Abstract: Attentional lapses have long since spurred meaningful debate as to what is considered conscious. Most well studied is when attention toward briefly presented external stimuli blinks out, illustrating information processing that can occur without self-reported awareness. A similar lapse occurs when individuals are told to track the contents of their own minds. Such tasks (e.g. focused attention meditation) produce two distinct states: one where participants are aware of what is on mind, and another where they are not. These distinct periods have been explained as fluctuations in meta-awareness, a process by which internal mental contents are explicitly represented (Schooler, 2002). Critically, meta-awareness is dissociable from a number of other automatic processes that can, for example, track goals, select strategies, and modulate the contents of thought without explicit knowledge that these processes are occurring. Mechanistic accounts of attention suggest that the lapse period is due to a failure of a supervisory attention control system to represent the state of attention and adjust a control signal based on the state's similarity to a task goal. The attention schema theory is one such theory that posits a representation, or model of attention, is a fundamental aspect of attentional control, and that when this model of attention is impaired, awareness and control are compromised. However, the attention schema has yet to be tested in a meta-cognitive context, that is, a task where an explicit representation of attention is necessary for effective control. To explore this question, we trained an artificial, deep Q-learning neural network agent on an analog of an endogenous visuospatial attention task. We tested how a descriptive model of attention (the attention schema), added to the agent, might support two control functions: tracking a visual stimulus and boosting attention when a lapse occurs. We tested the agent's performance with and without the attention schema. With a schema present, the agent achieved near maximum task performance, but without access to a model of attention, the agent failed to correctly track a stimulus or re-instantiate its attention following an attentional lapse. Thus, a model of attention, defined in this basic design as information about the spatial location and magnitude of attention, appears

to assist in learning a visual task and correcting attentional failures when they occur. We propose that a model of attention is critical for initiating, monitoring, and correcting the endogenous control of attention and that when top down supervisory mechanisms fail to access the attention schema, cognition operates according to other routine procedures, such as mind wandering during meditation paradigms. If the relationship between representation and control hypothesized by the Attention Schema Theory is correct, the ability for an agent to exert control is improved with a model of attention. These results provide a novel interpretation of the mechanisms underlying attention directed at attention and provide a framework for modeling efforts that can evaluate theoretical aspects of meta-awareness that are otherwise challenging to test.

C 2 Brain & Consciousness

Agarwal (R), Pagel, Gennaro (R), Beran, Viirre
Grand Ballroom B

Section: C 2

Status: Concurrent

Name: Gautam Agarwal

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Co-Authors: Brian Lustig, Eva Pastalkova, Albert Lee, Friedrich Sommer

Primary Topic: [02.13].....Brain networks, synchrony and scale

Abstract Title: Strong vs. wise: two distinct theta rhythms in the hippocampus

Abstract: Brains exhibit oscillations, which are thought to aid communication among neurons and are useful as a biomarker of brain state. Particularly well-studied is the theta rhythm of the hippocampus, a prominent 8-hz oscillation that coordinates the activity of place cells, neurons that represent an animal's position in space. We recorded from up to 256 electrodes implanted in the hippocampus of rats navigating a maze and found that spatiotemporal patterns in the multi-electrode theta rhythm could be used to accurately estimate an animal's position in space, rivaling the information found in place cells (Agarwal et al. Science 2014). However, the accuracy of our estimate plummeted when the animal was still, a state in which theta power decreases. We speculated that this is because our analysis assumed the presence of a single rhythmic component that carries behavioral information. We have therefore designed a novel neural network-based approach that can identify oscillations based solely on the information they carry about the animal's position, without the need for a carrier wave. Our network identifies a previously undescribed theta

rhythm that is present during both running and stillness. This form of theta is much weaker than the waveform that is classically observed in recordings; however, it contains much more information about the animal's position. Our work demonstrates the importance of distinguishing "strong" (high variance) from "wise" (high information) oscillations, significant because many approaches conflate these two metrics.

Section: C 2

Status: Concurrent

Name: James Pagel

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Organization: Rocky Mt. Sleep

Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: Electrophysiologic Aspects of Conscious States

Abstract: Little electrophysiology has been incorporated into the study of consciousness. Yet discrete forms of consciousness in both wake and sleep can be phenomenologically grouped based on their association with physiologic frequency-based electrical fields. Starting at lowest frequency, these systems include: 1) Sub-Delta (0.5-0.9 HZ) - considerable recent work addresses the association of this EEG frequency with both dreaming and waking mind wandering. Sub-delta has been shown to facilitate communication between widely separated components of the CNS default network involved in stimulus-independent and task-unrelated thought. 2) 1 HZ delta (the defining characteristic of deep sleep) is associated with somnambulism, night terrors, and confusional arousals, states sharing characteristics of fragmentary recall, extreme emotion, and disorientation and autonomic behavior on arousal. 3) Theta frequency (5-8 HZ) dominates the EEG of REM sleep in mammals (including humans when recorded intrathecally). Associated parasomnias including nightmares, sleep paralysis, and REM behavior disorder share characteristics of high dream recall, narrative sequencing, longer report length, intense emotions, and the potential for lucidity. An altered QEEG theta/alpha ratio is noted in meditators trained in perceptual dissociation, and relaxation. 4) Alpha frequency (9-11 HZ), the dominate CNS electrical field, when present at >50% of the EEG, defines sleep onset (Stage 1) a state associated with high dream recall, and the parasomnias: sleep starts, sleep paralysis, and hypnagogic hallucinations. Stage 1 consciousness is characterized by intense visual content, limited story, strong emotion, and potential lucidity. Alpha is also dominate in daydreaming, useful as a marker of adaptation to creative tasks after priming, and as the marker for drowsiness. 5) Sigma (13-15 HZ) defines Stage 2 sleep with bursts of spindles, is associated with sleep-talking

and sleep panic attacks and characterized by low recall of day-reflective mentation. 6) Beta/Gamma (30-50 HZ) occurs in bursts during REM sleep and states of waking focus/attention. When present in sleep gamma is associated with high dream recall, and increased potential for both lucidity and waking. Gamma is noted to occur in recurrent waves in some high-level meditators. The functioning of these electrophysiologic fields in the CNS is described by a series of enfolded formulas that illustrate the capacity for electromagnetic waves to transmit energy into electrochemical biokinetics through cellular ATP. While most of these formally described interactions are generally accepted, many neuroscientists still view these fields as non-functional and secondary to neural-network interactions. When brain scanning systems address alterations in electric fields (ex. MRI, QEEG, Squid), the results attained focus on associated alterations in neuroanatomy, an approach that works well when used to address motor function, perceptions, and memory, but flounders when used to explain brain meta-processing and executive functions -- including consciousness. Current widely discussed models of consciousness including neuroconsciousness, complexity, global platform theory, quantum theory, and multi-dimensional continuous processing, avoid integrating the added complexity of brain electrophysiology into their theoretic constructs. At the least, these CNS electromagnetic fields are non-conscious components of conscious states of mind -- essential to any attempt at developing an overall comprehension of consciousness.

Section: C 2

Status: Concurrent

Name: Rocco Gennaro

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Organization: University of Southern Indiana

Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: Consciousness and the Prefrontal Cortex

Abstract: There is a continuing debate about whether or not the prefrontal cortex (PFC) is necessary for having conscious mental states including typical first-order conscious perceptual states. I explore some of the evidence with attention to brain imaging and lesion studies relevant to various conscious states, subjective reports, memory, and the effects of anesthesia. I also examine the findings with an eye toward how the data might bear on the empirical plausibility of the higher-order thought (HOT) theory of consciousness which says that what makes a mental state conscious is that there is a suitable higher-order thought directed at the mental state. It is not at all clear to me that the PFC is required for conscious states or that HOT theory should be committed

to the view that the PFC is required for having conscious states, contrary to the claim of some HOT theorists and non-HOT theorists alike.

Section: C 2

Status: Concurrent

Name: James Beran

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Primary Topic: [04.11].....Consciousness and evolution

Abstract Title: Explicit Scale-specific Quantum Effects (e.g. Nonlocal Correlations)--Better Multiscale Hypotheses for Biological Evolution of Consciousness?

Abstract: Since quantum mechanics governs motion of subatomic particles, it follows that quantum effects occur among subatomic particles in the brain. It seems plausible that quantum effects also occur at larger scales and that they change through biological evolution. For example, quantum effects could occur in proteins, the macromolecules that play the predominant part in most biological processes: Recent research shows that conformational transitions of proteins (also called “folding”) can be understood as quantum phenomena (Luo et al., 2017, p. 143); many processes in the cell are directed by protein folding, such as transitions back and forth between open and closed conformations of an ion channel (Alberts et al., 6th Ed., 2015, pp. 6, 151, 613-614); therefore, it is not surprising that evolution has changed protein folding (and other quantum effects in proteins). (See, e.g., Xu et al., 2015, pp. 16630-16631) Meanwhile, multiscale hypotheses provide a promising new approach to biological evolution of consciousness. Up to now, however, multiscale hypotheses have not explicitly included evolutionary changes in quantum effects. (see, e.g., Beran, 2020) This work studies ways to add quantum effects (such as nonlocal correlations) to multiscale hypotheses for evolution. We first review important features of multiscale hypotheses, proposing a new form for five-scale hypotheses. Then we assume that quantum effects occur continuously across a range of scales up to at least brain scales; this seems consistent with “a continuous transition between [the] total quantum reality and the large scale world of ordinary experience”. (Bohm & Hiley, 1993, pp. 160 and 179-180) Further, we guess that such quantum effects might be approximated by a combination of discrete (but related) scale-specific quantum effects aligned with scales in a set that spans the range. In our new form for five-scale hypotheses, for example, one can begin by adding tubulin-related quantum effects in protein folding interactions at sub-neuron scales; then one can add related scale-specific quantum effects at neuron scales, at super-neuron scales, and at brain scales. Without delving into the mathematics, we examine how brain-scale quantum effects added in this way might correspond with changes in a hypothetical organism’s conscious experience; in a resulting hypothesis, propagation of underlying genome

variations to further generations would result in evolution of consciousness. Finally, we consider pros and cons of multiscale hypotheses with explicit scale-specific quantum effects; we conclude that they compare favorably with multiscale hypotheses that lack quantum effects.

Section: C 2

Status: Concurrent

Name: Erik Viirre

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Organization: University of California, San Diego

Co-Authors: Gabriel Silva

Primary Topic: [02.13].....Brain networks, synchrony and scale

Abstract Title: The Refraction Ratio: Means of Binding Neuronal Activity at Scales from Cell Assemblies to the Entire Human Brain

Abstract: Silva (Neural Computation 31, 2492–2522 (2019)) described an organizing principle of systems of neurons where the dynamics of signals in a given network of connected neurons are managed for time and distance. The network principle is that for a given node, timing is managed so that signals from disparate sources arrive simultaneously. Experimentally, the timing phenomena of this management principle appears to be true in studies of cell assemblies from a variety of in vitro and in vivo preparations. In computational models of neural networks, the principle's operation appears to have profound implications for computational efficiency. Computational neural networks show vastly increased speed of network learning because far fewer network training cycles are needed for a network to then exhibit pattern recognition. Thus this theoretical principle derived from neurophysiology may have great importance for machine learning. However, for the science of consciousness, this principle, called the “Refraction Ratio” may assist with the “Binding Problem”, where signals across the brain from widely physically and functionally separated sources are coordinated in order to result in a cohesive, synchronous neural representation of a neural “object”, such as say the percept of an apple, with visual, haptic, audio and other sensory and labeling modalities. In ongoing research, we are examining signal propagation for visual sources that while appearing to be completely smoothly integrated, such as the perceptible visual field, actually arise from sources that have vastly different signal transmission distances, from local Intrahemispheric signal binding to signals that have to cross to the opposite hemisphere. In the paper to be presented, we will describe the Refraction Ratio, the various data from small assemblies demonstrating timing synchronicity, the computational models and our human level experimental designs and results. The implications of this organizing principle will be described for experimental validation across modalities within

the conscious mind and for further theory and implications for the failure of this finely tuned mechanism will also be mentioned. Huge numbers of operations go in the brain in a “parallel” fashion, including the vast numbers of unconscious activities. How and when are they “bound”, both for unconscious operations such as motor control as well as for items when we are “thinking”? Do diseases or pharmaceuticals that interrupt consciousness act by disrupting the control of simultaneity? For example, do stimulants or depressants alter the timing ratio value and do disorders of consciousness come from its widespread failure? While this concept has been derived from neurophysiologic principles, what is the actual mechanism enacting this control? Can computational models both be improved by enacting the Refraction Ratio and be used for modeling the action and failures of action of the nervous system? The Refraction Ratio is another step in formalizing the long sought descriptors of linking brain activities to its actions. Through its mathematical description, the sources of the timing control may be found as well as the means of organizing the conscious brain.

C 3 – AI/Machine Consciousness:

Bach, Chella, O'Leary, Ruffini, Besedin

Kiva Ballroom

Section: C 3

Status: Concurrent

Name: Joscha Bach

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Organization: Intel Labs, California

Primary Topic: [01.07].....Mental causation and the function of consciousness

Abstract Title: The Origin of Consciousness in the Evolution of Governance in the Society of Mind

Abstract: The most fascinating questions about the organization of the human brain include: How can relatively few genes give rise to such massively detailed organization? Why do people with very similar genes show so much difference in the organization of their neurons? And why is the organization of the brain so robust against developmental disturbances? The neuroscientist Gerald Edelman proposed the hypothesis of ‘Neural Darwinism’ as an answer to these questions: our genes do not contain a blueprint for the entire neural structure, but a recipe for setting up an evolutionary competition among possible neural organizations, over which the most stable and efficient organization wins out. I would like us to consider this hypothesis in the context of the formation of consciousness via intelligent self-organization. The purpose of our nervous system is the homeostatic control of the organism along many dimensions,

which include the creation of complex models of the role of the organism in the environment, the structure of the universe containing the organism, and the nature and needs of the organism itself. Our nervous system implements our sentient agency; the computer scientist Marvin Minsky describes the architecture of that agency as a society composed of many negotiating agents, a 'Society of Mind'. The Society of Mind perspective echoes Edelman's Neural Darwinism perspective on the next level of structural organization. Here, I discuss the related idea that consciousness is not the result of specifically wired neural circuitry, but of the formation of self-organizing agency in an evolutionary competition within the neocortex. A minimal agent can be understood as a cybernetic control system (controller, sensor and effector, minimizing a setpoint deviation) that is capable of modeling the future. By integrating over future setpoint deviations, an agent gains representations of valenced events, preferences for some event trajectories over others, and its control turns into decision making. The ability to predict makes agents more robust and affords more complexity than simple control systems. Agents can control their environment via open loops (action without calibration), closed loops (using feedback to calibrate actions) and extending loops (creating new feedback to colonize their environment). Extending loop agents gain the ability to control and even create other agents. Agents can be combined into more complex agents, and the evolutionary competition between organizations of agents gives rise to structures of governance. We can understand a government as an agent that imposes an offset on the reward function of other agents to shift their Nash equilibrium towards cooperation. To remain dominant, the structures of government need to retain coherence in their model of the environment they act upon, extract at least as much reward from their environment as the cost of imposing governance, and overpower competing and aspiring alternative governments. In agreement with many current theories on the role and function of consciousness, such as Michael Graziano's concept of consciousness as a control model of attention and Yoshua Bengio's notion of consciousness as a function that strives to create an optimum in the energy function describing perceptual modeling, I see consciousness as a process that complements perception by actively constructing a coherent, unified model of reality. While perception is driven bottom-up, the construction of coherent reality is driven top-down, from a controlling 'core agent' that is the result of a competition in which it has discovered its own ability to observe and govern, and developed tools to subjugate its neural substrate, to extend its organization into the behavior of the organism, and into the world beyond.

Section: C 3

Status: Concurrent

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Primary Topic: [01.06].....Machine consciousness

Abstract Title: When Machine Consciousness meets Software Industry: The Project ALTEREGO

Abstract: People worldwide are struggling with increased levels of anxiety and depression due to COVID-19. The global pandemic has exacerbated mental health issues in the workplace. The impact is not limited to work-life - people are feeling the effects at home too; people want more from technology than collaboration tools and instead want technology to support their mental health. There is a gap between current technologies and what people expect from remote human-machine interaction and human-machine interaction. The groundbreaking idea of the project ALTEREGO in course of development by the University of Palermo, IULM, Milan and University of Messina is to analyze and consider many aspects from machine consciousness research to implement an avatar able to sustain effective online interaction. The ALTEREGO avatar will have a virtual presence and conversational capabilities based on the listed aspects: - Intentionality, i.e., the avatar's ability to associate its symbols with purposes, goals, and intentions. - Theory of mind, i.e., the avatar's capability to appropriately relate to the others in social contexts by considering one's own and the other's mental states. - Embodiment, i.e., the avatar's capability to be collocated in the user's first-person perspective, emulates its body. More specifically, the project will model 3 different kinds of communicative contexts as a formal presentation (e.g., conference), formal interaction, and informal interaction. Celebrities represent an ideal case study for ALTEREGO because they are well-known, stereotypical, tend to follow a script, and are usually well-sampled by publicly available sample data (video, audio, textual). A further application of ALTEREGO might be that of fictional characters representing one more step in the same direction. The ethical issues related to ALTEREGO will also be considered and analyzed.

Section: C 3**Status:** Concurrent**Name:** Tahua O’Leary**Email:** tahua01@gmail.com**Organization:** Strong Artificial Intelligence Lab, University of Auckland**Co-Authors:** Joshua Bensemann**Primary Topic:** [01.06].....Machine consciousness**Abstract Title:** Evolved Virtual Consciousness

Abstract: We will present our proposed approach the issue of AI cognition and consciousness. There is mounting evidence that sociality and the solving of other niche specific problems played a significant if not pivotal role in the evolution of human consciousness and cognition. We will aim to build an experimental environment in which to replicate and test these conditions. The first element of our proposed strategy will be to build a virtual analogue of an ecology in which to place sub-agential and agential AI groups into. This environment will replicate resource gathering and predation problems. The AI of various types will be designed to navigate and solve these problems in that environment. Our initial approach will use the work of Kim Sterelney on human evolution to provide the sorts of parameters that this environment should contain. The second element of the strategy is how we will build the AI. The first generation of our AI protagonists will be built using an analytic functionalist theory of mind as a guide. We do this because arguably embodiment and in the case of biological embodiment in a multi modal system plays a vital role in human consciousness and we will not be able initially to embody the AI in anything like a complex enough way. So the core components of these AI will be beliefs, desires, and memory or their functional equivalents. We will provision these AI with a theory of mind and a basic theory of how the virtual ecology works and an array of preferences for manipulating the contents of this virtual environment. Our ultimate aim is to build an AI capable of cooperative behaviour and able to formulate causal stories about their environments and each other. Here we use the work of Judea Pearl on AI and the telling of why stories as inspiration. We will then run them and record the results. Practically we will break down both the environment build and the AI builds into simpler task oriented components. We will thus aim to build both up incrementally. This way we will break the task up into achievable subcomponents. This also provides the benefits of modularity, allowing for tests of different theories or implementations of cognitive abilities such as theory of mind. What we will be aiming to create is a research tool for testing evolutionary hypotheses about cognition in many of its forms. This tool will be open-source so that researchers from multiple disciplines can experiment with it as well as contribute their own ideas. We aim to find pathways to generalist solutions to what we will effectively make a multivariate survival problem. Not just a game of life but a social game of life.

Section: C 3**Status:** Concurrent**Name:** Giulio Ruffini**Email:** giulio.ruffini@starlab.es**Organization:** Starlab

Other Authors: Edmundo Lopez-Sola, Roser Sanchez-Todo

Primary Topic: [02.01].....Neural correlates of consciousness (general)**Abstract Title:** Towards an algorithmic information theory of consciousness (KT): current developments

Abstract: Although currently lacking a satisfactory framework to study consciousness in natural or artificial systems, research efforts spanning several fields – including neuroscience, physics, mathematics, and philosophy – are delivering converging intuitions. Algorithmic information theory (AIT) provides a natural framework to study and quantify consciousness from neurophysiological or neuroimaging data, given the assumption that the primary role of the brain is information processing. Our fundamental insight is that access to good models of the world is a fundamental asset for homeostasis (survival) and metahomeostasis (reproduction). In the Kolmogorov theory of consciousness (KT), we take as a premise that “there is consciousness” (in alignment with monistic theories of consciousness such as idealism or panpsychism) and focus on the requirements for structured experience in physical systems: we hypothesize that the existence and use of compressive models provides the structure to phenomenal experience. More precisely, KT holds that the successful comparison of data with encompassing but simple models run by organized systems (e.g., in biological recurrent neural networks) provides the phenomenal structure of experience. In AIT, a simple model is a short program which can be assigned a Kolmogorov complexity (K). Because of its abstract foundation, KT readily applies to all biological organisms and legitimates the possibility of awareness in artificial systems. A first consequence of the theory is that self-awareness is seen to arise naturally (as part of a better model) in cognitive systems interacting bidirectionally with the external world. Furthermore, by running such models to track data, systems can generate apparently complex data – entropic but hierarchically organized. By carefully defining what a model is as a mathematical concept, we can compare the theory to causal structure theories such as IIT and show the KT framework provides a way out of issues related to the unfolding argument. In particular, we associate qualitative aspects of structured experience of a system with the algorithmic features of the simplest program mimicking the input-output function instantiated by the physical system – irrespectively from implementation aspects. We discuss the types of systems that may sustain structure experience – KT agents – and the correspondence of their elements with neurobiology

and life. Finally, since our first main challenge is to provide evidence for the hypothesis that a human agent is aware (i.e., living stronger, more structured experiences) to the extent it has access to encompassing and compressive models to interact with the world, we discuss potential human experimental paradigms to explore this paradigm.

Section: C 3

Status: Concurrent

Name: Artem Besedin

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Organization: Lomonosov Moscow State University

Primary Topic: [01.12].....Free will and agency

Abstract Title: What brain-computer interfaces can tell us about the actions of artificial agents?

Abstract: Brain-computer interfaces (BCI) are being developed today mainly for practical purposes: they are used in neuroprosthetics to help people who lost a limb or have neurological problems with bodily movements. The cases of BCI mediated actions are of great importance for philosophy of action. Patients using BCI to control their cybernetic limbs learn how to do it from the beginning. And the mechanism usually presupposes some mental action as a trigger of the movement of a robotic limb. E.g., patient imagines the movement, the activity in her motor cortex is read off by the BCI, the movement is performed by the robotic limb. There is some temptation to claim that this Model-I (a mental action of imagining a desired movement causes the movement itself) is applicable to all human actions. BCI provides some evidence for ideomotor theory of action, but I don't make this strong claim. Rather, I claim that this Model-I can be used as a design for the actions of artificial agents (AA). By AA I mean certain type of AI that can directly interfere with the environment. An AI that only produces commands that need to be implemented by other agents is not an AA. At the first glance, it is hard to apply Model-I to AA because it presupposes imagining a desired outcome, and imagination, one can say, is difficult to be implemented on AI. But, for the present purposes, this mental action can be reduced to a particular distribution of attention. Then Model-I is transformed into Model-A: a mental action of distributing attention in such a way as to pay attention to the representation of the desired movement in the cognitive system causes the movement itself. By attention I mean, roughly, "a cognitive process that selects certain bits of information for further processing at the expense of the others" (a definition of M.A. Cohen and M.M. Chun). Attention in this sense can be implemented on AA. A possible objection to Model-A is this: it uses one type of actions — mental actions — to explain other types of actions, but

mental actions also need an explanation. It is true, but the positive claims of Model-A are that mental and overt actions are different in kind, that mental actions are fundamental, and that mental actions can be basically described as distribution of attention. Model-A implies some limitations for AA. To implement the process of attention on an AA, the resources of its cognitive system must be scarce relatively to its goals. If the resources are abundant there is no need to select certain processes for the cost of other. This scarcity can be achieved by expanding the goals of AA. It is only a necessary condition for AA to act in human-like way.

C 4 – Quantum State Reduction

Lloyd, Tagg, Brophy, Stroo, Thompson
Grand Ballroom C

Section: C 4

Status: Concurrent

Name: Peter Lloyd

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Primary Topic: [01.15].....Neutral monism and idealism

Co-Authors: Peter B. Lloyd

Abstract Title: Quantum measurement in mental monism: unitary consciousness and its ramifications

Abstract: The measurement problem has been a persistent philosophical thorn in the side of quantum physics since the beginning. Schrodinger's cat thought-experiment inadvertently brought the problem into sharp focus, but it was Wigner's friend thought-experiment that established that quantum physics is not consistent with mental realism. (By 'quantum physics' I mean the standard Copenhagen interpretation.) Proposals have been made (notably by Wigner and Stapp) that the collapse of the wave function that occurs in measurement is triggered by the action of a non-physical conscious mind. But these introduce consciousness as a deus ex machina, without a deep rationale. Moreover, dualist theories of this class do not address the inconsistency between quantum and mental realism. I have defended elsewhere (Lloyd 2006, 2019) the philosophical theory of mental monism, historically known as subjective idealism. This is the doctrine that all that ultimately exists are conscious minds, and the physical world is a virtual construct. What I shall present here is the argument that, if mental monism is true, then it entails an elegant solution to the measurement problem. This solution is along the same lines as envisaged by Stapp, but it arises naturally as a necessary part of a fundamental model, rather than as an arbitrary deus ex machina. Moreover, it provides consistency

between quantum physics and mental realism: Wigner's friend is no longer stuck in a paradox. This model may even be testable, in the manner described by Frauchiger and Renner in their celebrated 2018 paper, "Quantum theory cannot consistently describe the use of itself". A key step in the argument is one that is only hinted at in the later work of George Berkeley, who was the originator of mental monism in western philosophy in the Eighteenth Century. It was, however, explicitly recognized in the much earlier doctrine of Advaita Vedanta that was advanced by Adi Shankara in the Eighth Century. This key step is the argument that the subjects of all conscious minds are numerically identical. Or, to put it bluntly: despite appearances to the contrary, there is only a single consciousness in the universe. This is a position that is impossible to hold in any theory that requires the conscious mind to supervene on a material brain, but—as I have argued elsewhere (Lloyd 2019, 2020)—it falls out naturally as a consequence of mental monism. The second step is straightforward: given that there is a single universal consciousness, we can identify the observer of any quantum measurement with that unitary consciousness. Then, when any (conscious) quantum observer collapses the wave function, it is collapsed for all (conscious) quantum observers. When dealing with systems that contain no conscious observers, this theory obviously yields results identical to standard quantum theory. But, when dealing with a system that contains a quantum observer, the theory should have a testable impact. It is suggested that an experimental design along the lines of Frauchiger & Renner's thought-experiment implies an in-principle test of mental monism.

Section: C 4

Status: Concurrent

Name: James Tagg

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Organization: Valis Corporation

Co-Authors: William Reid

Primary Topic: [04.01].....Quantum physics, collapse and the measurement problem

Abstract Title: Report on an objective reduction experiment using macroscopic mirrors

Abstract: For nearly 100 years, the paradox of Schrödinger's Cat has remained unresolved. Why does the world we live in appear classical, despite being composed of quantum particles governed by the Schrödinger wave equation? Lajos Diósi and Roger Penrose proposed that the wave function collapses because it describes two incompatible space-times. The time taken to collapse is governed by Heisenberg's time-energy uncertainty principle. Subatomic

particles with low mass – and correspondingly low energy – collapse in years while cats collapse almost instantaneously. Experiments to witness the collapse of an intermediate-mass have many challenges. We report on an experiment to put small mirrors into superposition. The superposed mass of 0.2g is six orders of magnitude larger than the previous record. It is possible to run this experiment with relatively large objects due to an unobvious feature of the Diósi-Penrose equation. Large masses displaced by a small distance exhibit low self-energy, and correspondingly high collapse time.

Section: C 4

Status: Concurrent

Name: Thomas Brophy

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Organization: California Institute for Human Science

Primary Topic: [04.01].....Quantum physics, collapse and the measurement problem

Abstract Title: Quantum Collapse Property Dualism A-Theory as a path to Conscious Agency and the Hard Problem

Abstract: This presentation extends a project that has been advanced sequentially at The Science of Consciousness conferences (Brophy, TSC 2017, 2018, 2020) to develop a meta-theory that can sustain the existence of conscious agency, called Actual-Theory (A-Theory). Steps in the development of A-Theory have included: 1) include the non-causal-closure of the physical world established by modern quantum physics; 2) connect with the Born Rule statistical probabilities for the "collapse" process of the quantum wave function, non-specificity, non-algorithmic, to single events; 3) connect with descriptions of esoteric consciousness "unitive" stages as described by advanced meditators (for example Hiroshi Motoyama, Being and the Logic of Interactive Function). This current presentation situates property dualism as recently discussed by David Chalmers within the A-Theory paradigm. Introducing a fundamental property of the physical world that generates conscious experience and agency can address the "Hard Problem" of consciousness. This procedure is analogous historically to James Clerk Maxwell introducing the property of electric charge to explain the category of phenomena called electromagnetism. The new property could be called "noetic charge" and defined as an ontic property of matter that instantiates experience of being. This presentation explores the possibility of noetic charge and noetic field-based Property Dualism A-Theory, in the historical context of other new properties that have been successfully introduced to physics and fundamental theory of reality.

Section: C 4**Status:** Concurrent**Name:** Josella Stroo**Email:** j.l.stroo@uva.nl**Organization:** University of Amsterdam**Co-Authors:** Yair Pinto**Primary Topic:** [04.01].....Quantum physics, collapse and the measurement problem**Abstract Title:** Can quantum physics enable free will? Our brain experiments may find out.**Abstract:** Do people have free will, or are all our choices determined by factors beyond our control? In classical physics there is no room for free will, since every event is entirely determined by preceding events. However, quantum physics may provide a window of opportunity. We employ quantum experiments to investigate free will. Information about our approach can be found in this 4-minute video: https://www.youtube.com/watch?v=N_RSRkaVpKE - During this talk we will discuss the set-up and experimental results.**Section: C 4****Status:** Concurrent**Name:** Ian Thompson**Email:** ian@kernz.org**Organization:** Livermore Laboratory**Primary Topic:** [04.01].....Quantum physics, collapse and the measurement problem**Abstract Title:** Getting Quantum Measurements to do something Useful in Cognitive Psychology: Design of a Quantum-like Epistemic Engine with Predictive Processing for Fast Object Observations**Abstract:** For the invariant recognition of external objects, predictive processing is increasingly accepted as a plausible account of how an organism uses prior knowledge of the world to make hypotheses checked and corrected by incoming sensory information. Implementation in the brain, however, is difficult because of the need to store the large number of prior correlations as well as the probability distributions used by the preferred Bayesian methods (whether direct or Monte Carlo). It is also puzzling how these biological processes appear so fast, given typical neural activation rates. If a specialized kind of quantum system could function somehow adjoined to the neural cortex, much progress

can be made. There could then be a measurement-based analog quantum system which can represent credences naturally by wave-function magnitudes. Its initial states, time evolution and measurement (selection) events could be as follows. The very large number of stored correlations about objects in the world would be built into the initial quantum system, each correlation as an entangled set of object credences. The possible spatial translations, rotations (etc.) needed to generate sensory hypotheses would be implemented by Hamiltonian evolution of the system generating further representative superpositions. Finally, a particular measurement on the system would be determined by the sensory input itself. Objects would be observed according to the sensory data from the observation by the biological senses. Combining these features, the quantum system becomes one of Paul Churchland's 'epistemic engines', but with predictive processing capabilities. The function of the visual cortex is to collate the sensory inputs to generate a quantum measurement on the internal epistemic engine. That measurement would determine the existence (or otherwise) of the component of the epistemic engine's quantum state with sensory data and the objects causing that data. This quantum epistemic engine proposal works (at least in theory) because quantum states can store very many correlations, and because wave functions ideally represent the credences needed for Bayesian inference. The projection operators according to sensory content could follow Chalmers and McQueen (2021) whereby whatever describes sensory states in the brain is taken as super-position resistant and influencing the Lindblad evolution of the density matrix. We still have the speed issue, since the probability of a measurement on the epistemic engine matching the required sensory component would be extremely small, and thus needs to be repeated until successful. Because of the current lack of knowledge concerning how measurement selection events actually occur in physics, I speculate a little. I add to the Chalmers model a new physics kind of asymmetric joint operator to project simultaneously on the brain and on the epistemic engine, but with all its probabilities determined on the neural side – in a kind of epiphenomenalism. This would quickly transmit sensory information from one side to the other. The speed speculation is why I call the epistemic engine quantum-like. If the resulting predictions about object recognition were experimentally verified in nature, that would be evidence for new quantum systems and joint measurement events. Prepared by LLNL under Contract DE-AC52-07NA27344.

WEDNESDAY, APRIL 20**C 5 - Panpsychism**

Pugliaro, Beni (R) Stoica, Longinotti (R), Basios (R)
Grand Ballroom C

Section: C 5**Status:** Concurrent**Name:** Francesco Pugliaro**Email:** francesco.pugliaro@kuleuven.be**Organization:** KU Leuven, Belgium / FWO**Primary Topic:** [01.03].....Panpsychism and cosmopsychism**Abstract Title:** Outlining a Metaphysical Scheme of Consciousness for the Construction of a Plural Universe. The Case of Raymond Ruyer's Panpsychism

Abstract: Panpsychism is quickly asserting itself as one of the main stakes of contemporary analytic and continental debates (Skrbina 2009; Seager 2020). In 20th-century French philosophy, Raymond Ruyer is arguably the author who pushed furthest in the elaboration of a panpsychist metaphysics. His work enjoys today a resurgence of interest, and it appears at the center of new original projects (e.g., Barbaras 2022; Grosz 2018). The guiding principle of Ruyer's work is the idea that developments in the sciences of his time (notably in microphysics, embryology, ethology, and cybernetics) allow to provide a rigorous underpinning to the panpsychist position, which takes consciousness to be the primary reality of nature. My presentation aims to shed light on this thesis, by analyzing Ruyer's reconceptualization of consciousness as a self-structuring and non-local "mode of bonding" (Ruyer 2016) active within any unitary system, be it physical, organic, or mental. Much attention will be devoted to the cosmological implications of this idea. I will proceed in three steps. First, I will explore Ruyer's analysis of physical existence. 20th-century physics requires the rejection of materialistic presuppositions, according to which there is "an elementary level where components' matter can be described independently from anything else" (Rovelli 2021). Matter is not the ultimate support of reality, but the byproduct of certain modes of interaction between physical systems. This implies a relativization of the concept of material body, and a shift of focus toward the bonding activities at work on different scales of reality. This shift proves fruitful for philosophy, in that it points to an understanding of nature as the articulation of individualized fields of activity, cutting through the traditional distinctions between physical, organic, and mental domains. I will then turn to the analysis of experience. According to Ruyer, the visual field is a prime example of these bonding activities, in that it displays processes of self-

organization, delocalization, and the immediate unification of its parts. In fact, the analysis of experience provides a scheme to understand the unity of any system, mental or nonmental, insofar as it 'dominates' a region of spacetime by actively maintaining its own form. I will present this view as the result of a critique of the egological models of consciousness, which presuppose a subject distinct from the experiential field. Considered in itself, a visual form does not refer to any supplementary dimension, neither to a subject nor to an object of perception but is a pure "specimen of existence" (Ruyer 1957), whose mode of formation and internal connection is analogous to that of a water molecule, or an embryo. Finally, I will reflect on the relevance of Ruyer's contributions to the panpsychism debate. His analyses lead to a generalization of consciousness beyond the domain of human self-knowledge, forcing us to rework our modern conception of nature. Panpsychism could thus be construed as an effort of schematization, as a search for "cosmomorphic patterns" (Montebello 2015) providing an alternative to the materialistic and exceptionalistic schemes of modern thought.

Section: C 5**Status:** Concurrent**Name:** Majid D. Beni**Email:** mbeni@metu.edu.tr**Organization:** Middle East Technical University**Primary Topic:** [01.03].....Panpsychism and cosmopsychism**Abstract Title:** Dennetting Panpsychism

Abstract: The talk aims to solicit naturalist support for a version of panpsychism that is divorced from qualia realism. The support could be found in no less unlikely place than Dennett's illusionism. The present paper aims to Dennett panpsychism more or less in the same way that Dennett did Quine qualia. The project leads to dual goals. On the one hand, we will defend a more plausible (and less heterogenous) account of the relationship between competence and comprehension in the context of Dennett's thought. On the other hand, we end up with a more illuminated version of panpsychism because we argue that one's stance on panpsychism does not equivocate with one's commitment to qualia realism. Panpsychism is Dennetted precisely in this sense; the 'psyche' in panpsychism is not equivocated with intrinsically ineffable subjective experience. We will continue to argue that consciousness is a fundamental feature of the world (based on continuity between various self-organising systems), but without assuming that consciousness is intrinsically ineffable and subjective. Such a view on the nature of consciousness paves the way for soliciting naturalist support for panpsychism on the one hand and for

dealing with the issue of the gap between competence and comprehension in the context of Dennett's theory on the other. In this talk, we specify this gap in terms of the symbol grounding problem (Taddeo & Floridi, 2005) (Harnad, 2007)). Once we gave up on the intrinsically ineffable subjective character of consciousness, we can channel a part of the naturalistic force of Dennett's evolutionary/gradualist account of consciousness into panpsychism. This is the general insight of the talk: although Dennett strives to provide a naturalist theory of evolution of comprehension from competence, his theory leaves room for brutal emergence. More specifically the symbol grounding problem remains intractable in the context of Dennett's theory of the emergence of the meaning of language (as one of the milestones of the evolution of comprehension). In response to this call, we argue that panpsychism—when divorced from qualia realism—allows for a less brutally discontinuous account of the emergence of meanings out of the cognitive-linguistic competence. When stated in Dennettian terms, this means that the cases of panpsychism and pan-niftiness are not quite the same, because, unlike pan-niftiness, panpsychism can help with bridging the gap between competence and comprehension.

Section: C 5

Status: Concurrent

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Organization: National Institute for R&D in Physics and Nuclear Engineering - Horia Hulubei

Primary Topic: [01.04].....Ontology of consciousness

Abstract Title: Can mental states be local?

Abstract: I argue that, if mental states are reducible to brain physics, and if they are integrated experiences, then they are nonlocal, in the sense that they depend on matter states distributed at spacelike separated locations. This nonlocality implies that Classical Physics is not enough, in particular the computationalist thesis does not hold. I illustrate the argument with a thought experiment. The proof of nonlocality is straightforward and general, but the result is unexpected.

Section: C 5

Status: Concurrent

Name: David Longinotti

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Organization: Independent researcher (formerly U of MD)

Primary Topic: [02.20].....Neurobiological theories of consciousness

Abstract Title: The phenomenal imagery of consciousness is produced by arrays of qualia-generating neurons in the thalamus

Abstract: Theories that postulate experiential 'displays' in the brain are criticized for entailing a homunculus, but no homunculus is implied by such a mechanism if qualia are 'self-detecting'. Empirical evidence and laws of physics support the hypothesis that qualia are a biological form of energy generated in individual, specialized neurons. I posit that, by converting action potentials to feelings, these neurons avert an increase in their entropy. This thermodynamically necessitates that qualia are detected by their source, which explains their private nature and obviates a homunculus. From brain research and phenomenology, I infer that the thalamus contains topographic maps of qualia neurons that are time-shared for sensory and mental imagery. During the wakeful state, sensory images (e.g., visual 'pictures') are continuously produced by these arrays. Mental images are generated when synchronized, gamma band impulses gate cortical information (memories, associations, dreams, etc.) onto the qualia maps. The gamma impulses also suppress the psychological projection function during the brief intervals when cortical 'snapshots' are being experienced, thereby preventing hallucination. The elaborated model offers straightforward explanations for feature-binding, recursive thinking, the central location of the thalamus in the brain, the puzzling structure of the lateral geniculate nucleus, the phenomenological differences between sensory and mental imagery, the flicker-fusion frequency, synesthesia, blindsight, agnosias and other phenomena.

Section: C 5**Status:** Concurrent**Name:** Vasileios Basios**Email:** vbasios@gmail.com**Organization:** University of Brussels, Physics**Co-Authors:** Pier-Francesco Moretti (CNR), Wolfhardt Janu (MayLab Instruments)**Primary Topic:** [04.05].....Emergence, nonlinear dynamics and complexity**Abstract Title:** Non-local deviations from randomness occurring during organizational closure

Abstract: In this work, we study non-local deviations from randomness that occur during organizational closure. Organizational closure here is taken in the, by now, standard systems' theory sense; originally introduced by H.R. Maturana and F. Varela for autopoiesis and expanded by S. Kauffman to self-organization in complex systems. Our analysis of binary-trace signals that are generated along the process of organizational closure is based on Shannon block-entropy and quantum (von Neumann) entropy measures that quantify their Markovianity, or non-Markovianity. We discuss the baseline Markovian nature of our signals' data sets, as well as the deviations from Markovianity under the influence of external parameters and/or semantic constrains. The signals' inherent correlations that are observed, due to deviations from pure randomness in the presence of organizational closure, are examined under the light of Bell-type inequalities, namely the CHSH and Leggett-Garg inequalities. We also discuss the implications of these results for the non-local nature of anomalous influences during distinctly emerging consciousness states. The random events generators at hand produce pure random and uncorrelated binary outputs, as signals, that are basically of quantum mechanical nature based on their diodes' tunneling effect. They are safely shielded from external physical influences and all environmental disturbances that might interfere with 'pure randomness' except for the anomalous and non-local influences of consciousness, i.e. attention, intention, strong feelings, emotional coherence etc. Such a setting produces data that give a very strong support to the recent advances on the fundamental quantum-informational nature of consciousness states hypotheses, proposed by S. Kauffman and D. Radin, and by G.M. d'Ariano and F. Faggin. We shall also briefly discuss the epistemological and ontological implications of such predictions of this kind of non-local deviations from the normally expected values in data output. We will also draw attention to notable registered correlations with certain other, less commonly observed, incidences of organizational closure and propose possible theoretical and experimental frameworks for further investigations.

C 6 - Psychedelics 1

Denomme, Kargbo, Dourron, Cardone, Alnagger

*Grand Ballroom A***Section: C 6****Status:** Concurrent**Name:** Nicholas Denomme**Email:** ndenomme@umich.edu**Organization:** Department of Pharmacology, Center for Consciousness Science, Michigan Psychedelic Collaborative, University of Michigan**Primary Topic:** [02.19].....Psychedelics and psychopharmacology**Abstract Title:** The Tools of Perception: How Psychedelics Shaped Early Research on Monoamine Neurotransmission and the Biochemical Basis of Behavior

Abstract: Psychedelic drugs now serve as instrumental tools in modern neuroscience for understanding the neural correlates and causes of consciousness. Often underappreciated is the vital role that psychedelics played in shaping the fundamental discoveries of monoamine neurotransmission during the mid-twentieth century. The profound psychoactive effects of mescaline and LSD sparked a paradigm shift in thinking that ultimately led to an evolution in our understanding of the biochemical basis of behavior and etiology of mental illness. This talk will provide a historical exploration of the powerful influence that psychedelics had on prominent researchers such as John Gaddum, D. Wayne Woolley, Irvine Page, Julius Axelrod and more, whose work on monoamine neurotransmission revolutionized the way we think about the role of neurochemistry in behavior. In parallel, we will examine the often-interwoven influence that psychedelics had on psychiatric researchers such as Humphry Osmond, John Smythies, Abram Hoffer, Harold Himwich and more, whose search for a psychedelic-like endogenous psychotogen in mental disorders like schizophrenia refocused the field from psychoanalytic explanations to explosive advances in psychopharmacology.

Section: C 6**Status:** Concurrent**Name:** Robert Kargbo**Email:** robert.kargbo@usonainstitute.org**Organization:** Usona Institute**Co-Authors:** Anny Ortiz; Amanda R. Pratt; Tura Patterson**Primary Topic:** [02.19].....Psychedelics and psychopharmacology**Abstract Title:** Synthesis and Therapeutic Potential of 5-MeO-DMT

Abstract: In this presentation, we will provide an overview of transdisciplinary information related to the psychedelic compound 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT) in order to illustrate implications for consciousness studies and mental health therapeutic potential. Our poster will showcase therapeutic effects from naturalistic/observational studies, preclinical data on anti-addictive and anti-inflammatory properties, and possible neural correlates to the 5-MeO-DMT altered state of consciousness (ASC); a cultural-historical timeline displaying key ethical issues related to harvesting the compound in natural forms; and the recently published method of synthesizing 5-MeO-DMT based upon an open-science approach by Usona Institute. 5-MeO-DMT is a potent, short-acting psychedelic that produces an almost instantaneous ASC. The ASC engendered by 5-MeO-DMT is phenomenologically different from that afforded by other psychedelics, including its close relative DMT, which is highly visual, while the 5-MeO-DMT experience appears to be somehow visual-free. The transcendent ASC produced by 5-MeO-DMT is known to induce a profound expansion of consciousness that goes far beyond self-identity and ego. Based upon recently scientific published reports this profound experience may act as a therapeutic catalyst that can aid individuals struggling with highly refractory conditions such as substance use disorders, PTSD, and major depressive disorder, conditions for which best extant treatments are falling short. 5-MeO-DMT naturally occurs in several South American plant species that are in turn used by various indigenous tribes in the form of snuffs. 5-MeO-DMT is also found in large quantities in the defense secretions of the Sonoran Desert toad (*Incilius alvarius*, formerly *Bufo alvarius*). While there is no evidence of ceremonial indigenous use of 5-MeO-DMT sourced from these toads by any of the Sonoran Desert tribes, the natural compound has become quite popular in the last 10 years. However, since 5-MeO-DMT can also be synthetically produced, the toad species does not need to continue being harassed in pursuit of novel, efficacious psychiatric treatments for mental health ailments. While there are those that may believe synthetic 5-MeO-DMT is inferior when compared to the natural material sourced from the toad species, arguing that it lacks the “toad spirit”, or referencing the so-called “entourage effect”, there

is no scientific evidence to support such claims. The synthetic method we will present produces crystalline 5-MeO-DMT in >99% purity by HPLC and is suitable for clinical use. At present time, various research groups around the world are gearing up to commence rigorous clinical research with this unique molecule. Besides potentially functioning as a therapeutic catalyst for highly relapsing mental health conditions, might 5-MeO-DMT hold promise as a probe that can help unlock the mysteries of consciousness? With the possibility of future approval for medical use, the potential for diversifying the application of 5-MeO-DMT in consciousness research is immense. Some fascinating future research questions at the intersection of mental health research and consciousness research are for example: What are the neural correlates of the transcendent ASC afforded by 5-MeO-DMT, and how does that translate into the microphenomenology of the experience that makes it so therapeutic? What may this transcendent experience tell us about the nature of reality and consciousness itself?

Section: C 6**Status:** Concurrent**Name:** Haley Dourron**Email:** hdourron@uab.edu**Organization:** Drug Use & Behavior Lab, University of Alabama at Birmingham**Co-Authors:** Camilla Strauss; Peter Hendricks**Primary Topic:** [02.19].....Psychedelics and psychopharmacology**Abstract Title:** Towards a Broader Perspective of Psychedelics & Psychosis: Self-Entropic Broadening Theory

Abstract: The extremes of human experiences, such as those occasioned by classic psychedelics and psychosis, provide a rich contrast for understanding how components of these experiences impact well-being. In recent years, research has suggested that classic psychedelics display the potential to promote positive enduring psychological and behavioral changes in clinical and non-clinical populations. Paradoxically, classic psychedelics have been described as psychotomimetics. This talk will offer a putative solution to this paradox by providing a theory of how classic psychedelics often facilitate persistent increases in well-being, whereas psychosis leads down a “darker” path. This will be done by providing an overview of the overlap between the states (i.e., entropic processing) and their core differences (i.e., self-focus). We also describe potential points of overlap with less extreme experiences, such as creative thinking and positive emotion-induction. Overall, Self-Entropic Broadening Theory offers a heuristically valuable perspective on classic psychedelics and their lasting effects and relation to other states by

creating a novel synthesis of contemporary theories in psychology, providing a significant departure from the current psychoanalytically informed theories of psychedelics. We will also discuss the theory's implications for understanding the potential transdiagnostic efficacy of psychedelics. Findings will be situated within recent neuroimaging and immunological findings with both psychedelics and psychosis. In short, we hope this talk invigorates psychedelic science to provide more rigorous comparisons to other extreme experiences and further examinations of how classic psychedelics facilitate long-term change. As a more psychedelic future of psychiatry appears imminent, a move towards answering these long-standing questions is crucial.

Section: C 6

Status: Concurrent

Name: Paolo Cardone

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Organization: University of Liège

Co-Authors: Arthur Bonhomme; Vincent Bonhomme; Gregory Scott; Naji Alnagger; Nicolas Lejeune; Sebastien Van Goethem; Robin L. Carhart-Harris; Steven Laureys; Charlotte Martial*; Olivia Gosseries*

Primary Topic: [02.09].....Coma and vegetative states

Abstract Title: Psychedelics to treat disorders of consciousness: protocol for a randomized clinical trial with ketamine

Abstract: Prevailing theories of the neuroscience of consciousness suggest that consciousness is deeply linked to brain complexity. In fact, healthy participants show high complexity in conscious states (wakefulness and dreaming), and low complexity in unconscious states (deep sleep or general anesthesia). Similarly, patients with post-comatose disorders of consciousness (DoC) show pathologically low complexity. In theory, increasing brain complexity in these patients should increase conscious level. However, no study has previously attempted to manipulate complexity to restore consciousness. Promisingly, recent findings have shown that psychedelics, including ketamine, increase brain complexity in healthy participants. If this remains the case in patients with DoC, the use of ketamine could test the postulated link between consciousness and complexity and implicate ketamine as a promising new treatment for DoC. We will run a double-blind, randomized, placebo-controlled clinical trial (RCT) on 30 patients with DoC (stratified per diagnosis). The RCT will be organized in three phases: observational, experimental, and follow-up. In the observational phase, patients will undergo a multimodal clinical assessment (resting-state high-density EEG, resting-state fMRI, FDG-PET, behavioral assessments). In the experimental phase, each patient will have TMS-EEG while receiving either the

drug (ketamine) or placebo (saline solution), in two sessions five days apart. The order will be counterbalanced. We will use a targeted-controlled infusion system to infuse a sub-anesthetic dose of intravenous ketamine (maximal concentration: 0.75 mg/ml). Simultaneously, consciousness will be assessed behaviorally using the SECONDS scale every 30 minutes. In the follow-up phase (up to a year) patients' remote evaluations will also be carried out via phone to report possible memories of the experiment. Our primary outcome is the emergence of conscious behaviours after administration of ketamine (e.g., command-following, visual pursuit) that are not seen after placebo nor in the baseline. We expect higher brain complexity following ketamine administration only in those patients who show new signs of consciousness, or in those who do not, but subsequently report memories of the drug administration session. We will consider these patients as responders. Secondary outcomes include significant differences in baseline resting-state high-density EEG, resting-state fMRI, and FDG-PET between responders and non-responders, in brain regions relevant for consciousness (e.g., fronto-parietal network). Our project investigates (1) whether ketamine increases the level of consciousness in patients with DoC, (2) which baseline brain mechanisms predict responsiveness to ketamine, and (3) the relationship of the glutamatergic pathway to brain complexity and consciousness. Post-comatose DoC are devastating conditions with limited existing treatments. Ketamine, a drug widely used in clinical settings, could be repurposed for DoC. Ketamine, among other psychedelics, has been recently used for psychiatric disorders like depression, showing potential for other clinical uses. Besides demonstrating the translational potential, our project experimentally tests the assumption that consciousness and complexity are fundamentally linked. In other words, it may provide evidence that the manipulation of brain complexity leads to improvements in consciousness. This project can potentially invalidate consciousness theories, or strongly corroborate the link between complexity and consciousness.

Section: C 6

Status: Concurrent

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Co-Authors: Naji LN Alnagger; Rajanikant Panda; Vincent Bonhomme; Audrey Vanhauzenhuyse; Gorka Zamora-López; Daniele Marinazzo; Gustavo Deco; Olivia Gosseries; Steven Laureys; Jitka Annen

Primary Topic: [02.10].....Anesthesia

Abstract Title: Information Processing is Uniquely Disrupted During Sedation Induced via Propofol, Ketamine and Dexmedetomidine

Abstract: Through identifying similarities and differences in the characteristics of low conscious states induced via anaesthetics with dissimilar mechanisms of action, it may be possible to elucidate unitary mechanisms that underpin deep sedation and consciousness more generally. Here, we analyse the information flow, calculated from the resting state functional MRI data obtained during sedation induced by three anaesthetic agents: propofol, ketamine and dexmedetomidine. Reanalysing data presented in Bonhomme et al., 2016, structural T1-weighted MRI and resting state functional MRI data was obtained in healthy volunteers during wakefulness and deep sedation induced via propofol (n=16), ketamine (n=9) and dexmedetomidine (n=10). Brain extraction and AC-PC plane correction were performed using SPM. Pre-processing of fMRI data in FSL included motion correction, normalisation, temporal band-pass filtering, spatial smoothing and registration. Noise components and artefacts were subsequently regressed out for each condition and subject. The BOLD time series for the 214 brain areas (Finn et al., 2015) were extracted via parcellation using a functional atlas from Shen et al (2013). Leveraging a framework based on principles from information theory, we calculated the global and local active information storage (AIS) and transfer entropy (TE) (Lizier et al., 2012). AIS calculates the memory storage inherent to the time series data. TE is a measure of directional effective connectivity, through which the broadcasting and receiving properties can be calculated. The whole brain and regional group differences for baseline and sedation were assessed using pair-wise two sample t-test. Results were considered significant at $p < 0.025$ at the whole brain level, and at $p < 0.05$ (FDR corrected for 214 ROIs) at the regional level. In each of the three conditions: propofol ($p=0.003$), ketamine ($p=0.006$) and dexmedetomidine ($p=0.018$), global AIS was decreased during sedation compared with normal wakefulness. Propofol and dexmedetomidine had a more widespread effect on local AIS as compared to ketamine. Mean TE was decreased during sedation for each of the three conditions compared with normal wakefulness. Propofol sedation was characterised by the most widespread alterations of both broadcasting and receiving of information, whilst ketamine sedation displayed TE alterations in the superior temporal cortex and part of the dorsolateral prefrontal cortex, but not in the subcortical areas. During dexmedetomidine sedation reduced broadcasting potential was most pronounced in subcortical areas and the posterior cingulate. Our results show a decreased capacity of information storage across frontal, thalamic and sensory areas and common and distinct patterns of alterations in information flow between each of the three sedation conditions when compared to wakefulness. The widespread disruption of TE during propofol sedation likely underlies the deeper state of propofol sedation compared to the other two anaesthetics. The relative maintenance of AIS in the dorsolateral frontal cortex during ketamine sedation may indicate a preservation of higher order processes and the presence of disconnected consciousness. The preservation of AIS in the thalamus during dexmedetomidine sedation could be associated with the capacity of subjects to

rapidly recover responsiveness to external stimulation. Moving forward, we plan to calculate synergy to build a comprehensive picture of the network properties underlying these states.

C 7 - Studying and measuring consciousness

Blackmore, Hunt, LaBerge, Mccann (R), Voorhees, H. Mahn (R)
Grand Ballroom B

Section: 7

Status: Concurrent

Name: Susan Blackmore

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Co-Authors: Emily T. Troscianko, University of Oxford

Primary Topic: [06.10].....Education

Abstract Title: How and why to teach consciousness

Abstract: Consciousness poses three pedagogical challenges: helping students 1) understand that there's a problem at all; 2) grasp precisely what the problem is and is not; and 3) accept that, despite the many theories of consciousness, there is no agreed definition of consciousness, no solution to the problems yet, nor even a broadly accepted approach to generating one. We researchers, too, sometimes need help with all three. But these challenges are also opportunities. Responsible teaching about consciousness that takes them all seriously can further high-quality research, by forcing instructors to avoid both succumbing to "pet theory syndrome" and drowning in a sea of theories with no tools for critical appraisal. Teaching consciousness well involves encouraging students (and ourselves) to practice epistemic humility. In particular, it requires us to question our intuitions rather than take them for granted. Defamiliarizing intuitions is even more relevant in consciousness studies than in other fields, given the possibility that the entire problem is itself a function of false or misleading intuitions. Illusionism proposes that the hard problem be shifted from "how do we bridge the mind/matter gap?" to "how and why have we been fooled into thinking there is a mind/matter gap?". Effective teaching allows both students and instructors to test the potential of illusionism as one possible route to sidestepping the hard problem. There are many ways to make strange the apparently self-evident, and the simplest are often the most effective. Apparently trivial class demonstrations of tricky topics, involving simple props and volunteer students, can be highly effective intuition pumps and elicit clearer inquiry than reading and talking could. In this session we offer short interactive demos from our 2018 textbook, *Consciousness: An Introduction* (3rd ed.) such as the teletransporter,

philosopher's zombie, and sentience line. Throughout our teaching, and in the textbook, we encourage direct inquiry into subjectivity, for example by giving students questions to ask themselves during everyday life, like "Am I conscious now?" or "Was this decision conscious?". This helps students keep returning to the starting point (what actually is conscious experience?) and so equips them for well-grounded scientific inquiry. We also offer real-world examples of how changes like those created by psychoactive drugs or psychopathologies can alter the baseline for folk intuitions and thus the attractive force of specific theoretical frameworks like dualism or panpsychism. The workings of our own minds clearly exert strong influences on the way consciousness is studied and thought about. Other forces with potentially distorting effects can, likewise, be countered by structured interrogation. Two prime candidates are brain imaging and natural language use. Correlation-based imaging methods encourage researchers to unreflectively equate the neural correlates of cognitive processes (which clearly exist) with the neural correlates of consciousness (which are rife with ontological problems). Meanwhile, the structures of ordinary language push us over and over again into dualism—because the folk psychology that language coevolved with was arguably "born dualist". Both instructors and students can learn (in subject-specific and more personal ways) by questioning all forms of the apparently obvious.

Section: C 7

Status: Concurrent

Name: Tam Hunt

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Organization: UC Santa Barbara

Primary Topic: [01.01].....The concept of consciousness

Abstract Title: Where's my consciousness-ometer?

Abstract: Tools and tests for measuring the presence and complexity of consciousness are becoming available, but there is no established theoretical approach for what these tools are measuring. This paper examines several categories of tests for making reasonable inferences about the presence and complexity of consciousness (defined as the capacity for phenomenal consciousness) and also suggests ways in which different theories of consciousness may be empirically distinguished. We label the various ways to measure consciousness the "measurable correlates of consciousness" (MCC) and include three sub-categories of MCC in our taxonomy: 1) Neural correlates of consciousness (NCC); 2) Behavioral correlates of consciousness (BCC); 3) Creative correlates of consciousness (CCC). Last, we reflect on how broader philosophical views about the nature of consciousness, such as materialism and panpsychism, may also be informed by the scientific process

Section: C 7

Status: Concurrent

Name: Stephen LaBerge

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Organization: LUCIDITY

Primary Topic: [05.07].....Lucid dreaming

Abstract Title: Lucid Dreaming Allows Voluntary Perception During Rapid Eye Movement Sleep

Abstract: Following our earlier work showing signal verified lucid dreams (SVLDs) were typically initiated during PS epochs with elevated levels of phasic events (REMd, HR, RR, SPR) (LaBerge, Levitan & Dement 1986) and maximal suppression of motor output as shown by abolished H-reflex during SVLDs (Brylowski, LaBerge & Levitan 1992), and was therefore in a sense, an intensified, and perhaps a deepened form of PS, rather than a half-awake state, as some had supposed. Were SVLDs also more isolated from sensory input? We expected that they might be, which might provide a partial explanation for their metastability. So in 1999 we undertook a pilot study in our Stanford laboratory using the oddball P300 paradigm to quantify the degree of sensory disconnection. Throughout the night, a pseudo-random sequence of one of two tone pips were presented to the left ear every 1.5 sec. Our LDers were tasked to respond with quick LRc or UDC signals to target pips (the high-pitched 1 in 5 auditory stimuli) if any happened to be incorporated into their LDs with eye-movement signals. Remarkably and unexpectedly, when participants became lucid, they found that they were able to listen for attend to the auditory stream, and consciously perceive, discriminate, and correctly respond to the targets while otherwise continuing to dream, during unequivocal REM sleep. We similarly confirmed that LDers could attend to and perceive stimuli in other monosensory modes (flashes of light and electric shocks). The broad implication is that attention may be the primary determinant of whether or not we consciously perceive environmental events during REM dreaming.

Section: C 7**Status:** Concurrent**Name:** Kim Mccann**Email:** kmmcann@gmail.com**Organization:** Grand Canyon University**Co-Authors:** Mendi Davis**Primary Topic:** [03.09].....Unconscious/conscious processes**Abstract Title:** Ego-Dissolution and Nondual Awareness in Substance and Non-substance Induced Non-ordinary States

Abstract: The intent of this study is to investigate the range of ego-dissolution, as measured by the Ego-Dissolution Inventory (EDI; Nour, Evans, Nutt, & Carhart-Harris, 2016), in a population who claims to have undergone a mystical experience and/or experienced a non-ordinary state of consciousness. The participants provided self-reported responses to both the NADA-T and EDI scales. This study found a strong positive relationship between the EDI subscales and the NADA Bliss Dimension.

Section: C 7**Status:** Concurrent**Name:** Burton Voorhees**Email:** burt@athabasca.ca**Organization:** Athabasca University**Primary Topic:** [06.07].....Anthropology**Abstract Title:** Subjective Consciousness and Human Cooperation

Abstract: A major question in studies of cultural evolution is how humans developed the capacity for large scale cooperation among non-kin. Much of the current research on this question has focused on the importance of group selection acting to favor the evolution of a prosocial psychology that on the one hand leads individuals to be predisposed to cooperate with those recognized as cultural kin and, on the other, to cooperate in punishing defectors and free riders. This gives rise to the second order free rider problem. That is, participation in punishment may be costly so that even though there is a social agreement to punish defectors in the abstract, there is a chance that individual group members will not fulfil this commitment when the necessity arises. One proposed solution to this is that not only will defectors be punished, but also those who fail to participate in punishment. This paper presents an alternative, although complimentary view based on the sharp distinction between humans

and other animals made by human reflective self-consciousness. This gives rise to a cultural self, grounded in kinship relations, group membership, and social roles. This subjective consciousness provides a vehicle mediating between the behavioral expression of biological instincts and the need for cooperative interaction in a human society. The direct link of this subjective self to biological instinct satisfaction means that challenges to it will evoke emotional responses as if the challenge were to biological survival. This provides an automatic cognitive mechanism that (a) leads to the formation of “echo chambers,” that is the formation of groups of common beliefs within which agreements on social and cultural issues support members subjective identities; and, (b) generates automatic emotional impulses to exclude outsiders and punish defectors. I will explore some of the ways in which human subjective consciousness arises through cultural indoctrination based on interactions of children with peers and caregivers, saturation with exemplary cases of cultural norms and values, and unique personal experience.

Section: C 7**Status:** Concurrent**Name:** Mahn Holbrook**Email:** hmahn@unm.edu**Organization:** University of New Mexico**Primary Topic:** [01.01].....The concept of consciousness**Abstract Title:** Toward a Unifying Theory of Consciousness

Abstract: The goal of this presentation, “Toward a Unifying Theory of Consciousness,” for a “Concept of Consciousness” workshop, is to describe how we might collaboratively proceed in developing such a theory. My starting point in studying consciousness is acknowledging the significant advances made in in neuroscience, cognitive science, psychology, philosophy of mind, and other consciousness studies. Additionally, it examines how these approaches, which constitute conventional wisdom on the subject, have not unraveled the greatest mystery known to science because of three pitfalls that lead to dead ends. They include 1) applying concepts about human consciousness to other life forms, not differentiating human from animal consciousness; 2) separating the brain and mind, vitiating understanding them as a unity; and 3) focusing on developing definitions of consciousness by analyzing its manifestations, without studying and understanding consciousness as a process that comes into existence, develops, and evolves. A necessary starting point for a unifying theory of conscious is reaching a common understanding of how to approach the study of consciousness. Since consciousness is a process which cannot be observed and measured as such, if we seek to understand it in its essence – its Being

– we need to move beyond, while remaining grounded in, the empirical. This was the approach used by Lev S. Vygotsky, a Russian psychologist (1896-1934), whose life's work was developing a unifying theory of consciousness, using both ontological and epistemological approaches. He analyzed the unity of the brain and mind as an inseparable whole, since separation destroys the unity. Because the BrainMind Unity is beyond human observation, Vygotsky used an ontological approach to study this unity as a process, in its Being. He drew on current understandings gained from observation and measurement of both the brain and human behavior upon which to base his ontological approach. Much current research in neuroscience, cognitive science, psychology, philosophy of mind, and other consciousness studies suffers from a modern-day brain-mind dualism. In his analysis of the BrainMind Unity, Vygotsky differentiates human from animal consciousness and focuses on the qualitative transformation that occurs when humans used words as symbols to communicate meaning. The internalization of meaning creates a unification of the thinking processes and the languaging processes, which is key to the qualitative transformation from animal to human consciousness. Using Vygotsky's ontological approach, I start with the origin of our universe which brings Being into existence along with the forces that govern all the manifestations of matter and energy including life and consciousness. Empirical studies have enhanced our understandings of those manifestations, but do not unveil the mystery of consciousness. The crux of my argument is that life and consciousness come into Being jointly in life forms like one-celled bacteria, which sense, process, and act on the information encoded in the chemical, electrical, and thermal energy in their environment. Consciousness is fundamental to life, as life is fundamental to consciousness. Their mutual cause and effect reveal the mystery of how consciousness emerges from the physical world.

C 8 - Theories of consciousness

Hopkins, Arkhipov, DeLancey, Grasso, Nisbet, Awret, Blommestijn
Kiva Ballroom

Section: C 8

Status: Concurrent

Name: Amber Hopkins

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Organization: University of California, Los Angeles

Co-Authors: Kelvin McQueen

Primary Topic: [02.20].....Neurobiological theories of consciousness

Abstract Title: Filled/non-filled pairs: An empirical challenge to Integrated Information Theory

Abstract: Perceptual filling-in for vision is the insertion of visual properties (e.g., color, contour, luminance, or motion) into one's visual field, when those properties have no corresponding retinal input. We introduce and provide preliminary experimental support for filled/non-filled pairs, pairs of images that appear identical, yet differ by amount of filling-in. It is argued that these pairs are helpful in both the scientific study of consciousness and the experimental testing of theories of consciousness. Neurophysiological research on filling-in suggests that filling-in recruits brain activity with higher integrated information (Φ) than physically-based visual perceptions. We thus also present filled/non-filled pairs as an empirical challenge to the integrated information theory of consciousness, which predicts that phenomenologically identical experiences depend on brain processes with identical Φ .

Section: C 8

Status: Concurrent

Name: Anton Arkhipov

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Organization: Allen Institute

Primary Topic: [04.05].....Emergence, nonlinear dynamics and complexity

Abstract Title: Non-separability of Physical Systems as a Foundation of Consciousness

Abstract: We introduce the hypothesis that non-separability of degrees of freedom in physical systems is the fundamental property underlying the phenomenon of consciousness. The hypothesis states that non-separability is equivalent to consciousness in that the extent of non-separability and the number of degrees of freedom involved determine the amount of consciousness. We describe how, in this framework, non-interacting or weakly interacting systems, as well as feedforward systems, have zero or a very low amount of consciousness. Furthermore, most known strongly interacting/strongly correlated systems of particles, such as metals, liquids, superconductors, etc., likewise tend to degenerate to low non-separability and, therefore, low consciousness states. By contrast, brains exhibit high complexity and relatively weak but tightly coordinated interactions between their components, which appear to support high non-separability and, thus, high amounts of consciousness. We describe how vast majority of the degrees of freedom in the brain are likely separable and that the remaining non-separable degrees of freedom form "complexes" corresponding to conscious subjects, akin to the Integrated Information Theory (IIT). These non-separable degrees of freedom could be, for example, macroscopic collective variables like membrane voltage of neurons or population firing rates. However, our hypothesis does not preclude a critical role for microscopic degrees of freedom,

including those representing quantum processes. The more general concept of quantum entanglement includes two aspects: the purely quantum non-locality (knowledge of the state of one particle in an entangled pair immediately tells us the state of the other particle, even if it is far away) and non-separability (non-factorizability of the state vector, which can exist in classical systems). In our hypothesis, it is the latter that underlies consciousness. However, if quantum entanglement is realized in the brain, non-locality may tremendously enhance the richness of the non-separable states due to quantum computations. We highlight the formalism employing the Wigner function, which in the classical limit becomes the Liouville density function. This formalism seamlessly captures quantum and classical regimes and offers a fruitful framework for characterizing non-separability and, thus, the amount of consciousness. Interestingly, our hypothesis and this formalism do not contradict the Orch OR theory. The latter postulates consciousness to be the result of the reduction of quantum superposition. Our hypothesis simply equates the amount of consciousness with non-separability and does not restrict mechanisms that possibly select a specific state from the quantum superposition of states. Finally, we explore the possible computational benefits of non-separability. As a consequence, an evolutionary role can be associated with non-separability and consciousness. In summary, the hypothesis presented here offers a natural explanation for the physical properties underlying the amount of consciousness in any system. It appears to be consistent with both the IIT and Orch OR theories, and, thus, may reconcile these two leading theories of how consciousness emerges from the fundamental physical phenomena. The hypothesis points to methods of estimating the amount of non-separability as promising, if not necessarily computationally inexpensive, ways of characterizing the amount of consciousness in physical (including biological) systems.

Section: C 8

Status: Concurrent

Name: Craig DeLancey

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Organization: State University of New York at Oswego

Primary Topic: [01.02].....Materialism and dualism

Abstract Title: IIT entails the Complexity of Consciousness Hypothesis

Abstract: The complexity of consciousness hypothesis is the claim that paradigmatically mysterious phenomenal experiences would appear to be non-physical phenomena if they are extremely complex information events (for example, if they were representations with a great deal of irreducible information) (see DeLancey forthcoming). Here the measure of information used

is that given in descriptive complexity, also known as Kolmogorov Complexity; but the measure is closely related to Shannon's measure of entropy (1948). Using the complexity of consciousness claim, one can show that canonical anti-physicalist arguments—such as the Knowledge Argument, the Modal Argument, and the Zombie Argument—are either question-begging or likely unsound. Given the relative theoretical parsimony of this explanation, it suggests reason to believe physicalism about consciousness is still our most viable explanatory program. The Integrated Information Theory (or IIT) developed by Tononi and others, aims to explain consciousness as an integrated irreducibly complex information state. I argue that IIT entails the complexity of consciousness hypothesis, although the converse is not true. The Kullback-Leibler divergence is one measure that suggests a near equivalence in the concepts of complexity and maximal information (as understood in IIT). This entailment from IIT to the complexity of consciousness hypothesis is important because it means that the refutations of anti-physicalism that are available to the complexity of consciousness hypothesis are also available to IIT. SELECT REFERENCES Barbosa, Leonardo et al (2020) "A measure for intrinsic Information." Nature Scientific Reports, 10:18803. DeLancey, Craig (forthcoming) Consciousness as Complex Event: Towards a New Physicalism. Routledge press. Kullback, S. and R. A. Leibler (1951). "On information and sufficiency." Annals of Mathematical Statistics. 22 (1): 79–86. Oizumi, Masafumi, Larissa Albantakis, Guilio Tononi (2014) "From the Phenomenology to the Mechanisms of Consciousness: Integrated Information Theory 3.0." PLOS Computational Biology, 10 (5): e1003588. Shannon, C. E. (1948) "A Mathematical Theory of Communication." The Bell System Technical Journal, July: 379-423, October 623-656.

Section: C 8

Status: Concurrent

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Organization: University of Wisconsin-Madison

Co-Authors: Jonathan P. Lang

Primary Topic: [04.05].....Emergence, nonlinear dynamics and complexity

Abstract Title: Causal reductionism and why it should bug you

Abstract: Causal reductionism is often considered the gold standard in neuroscience: once we have accounted for all elementary mechanisms within a neural system there is nothing else to be explained, because there is nothing else that can cause. In this talk we argue that causal reductionism is based on an incoherent notion of causation that results in an incomplete account of 'what caused what', and we outline an explicit and operational approach that

captures the causal powers of a system in full: causal structure analysis (Grasso et al. 2021). This approach relies on the postulates of Integrated Information Theory (IIT) (Tononi 2004; Oizumi et al. 2014; Tononi et al. 2016; Haun & Tononi 2019) and, in line with IIT, requires assessing the irreducibility of mechanisms of any order: first-order mechanisms (constituted by single elements) as well as higher-order ones (constituted by two or more elements). By means of a simple example we illustrate how causal reductionism misses out on causes and effects that clearly are important both conceptually and biologically, because it assumes that only first-order mechanisms are causally irreducible, and it fails to recognize that higher-order mechanisms can have causes and effects that are just as irreducible. We show that this is due to the fact that reductionism conflates causation with prediction by assuming that since knowledge of first-order mechanisms is enough to predict everything about the dynamics of a system, then such knowledge can also exhaustively explain what caused what. We illustrate the limitations of causal reductionism by comparing three simulated systems termed “frogs” who live in a simulated environment. We show that causal reductionism fails to explain causes and effects at play within each organism because it relies only on first-order mechanisms, while causal structure analysis can explain causes and effects of the organisms’ behavior (and biological functions) by identifying that higher-order mechanisms fulfill the same causal requirement of irreducibility as first-order ones. Finally, we argue that recognizing the causal role of higher-order mechanisms is necessary to account for the structure of experience, and on this basis conclude that causal reductionism is also an inadequate starting assumption for the neuroscience of consciousness. References: Grasso, M., Albantakis, L., Lang, J. P., & Tononi, G. (2021). Causal reductionism and causal structures. *Nature neuroscience*, 24(10), 1348-1355. Haun, A., & Tononi, G. (2019). Why does space feel the way it does? Towards a principled account of spatial experience. *Entropy*, 21(12), 1160. Oizumi, M., Albantakis, L., & Tononi, G. (2014). From the phenomenology to the mechanisms of consciousness: integrated information theory 3.0. *PLoS computational biology*, 10(5), e1003588. Tononi, G. (2004). An information integration theory of consciousness. *BMC neuroscience*, 5(1), 1-22. Tononi, G., Boly, M., Massimini, M., & Koch, C. (2016). Integrated information theory: from consciousness to its physical substrate. *Nature Reviews Neuroscience*, 17(7), 450-461.

Section: C 8

Status: Concurrent

Name: Angus Nisbet

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Organization: University Hospitals Sussex NHS Foundation Trust

Primary Topic: [01.04].....Ontology of consciousness

Abstract Title: The machine is a ghost! - a new argument from physics for metaphysical idealism

Abstract: In his 1949 book, ‘Concept of Mind’, British philosopher, Gilbert Ryle criticized Cartesian dualism, describing it as a ‘category error’ i.e., the use of language pertaining to two categories of existence in the same argument, where these categories are different levels of description, incompatible with each other. Using Descartes’ own concept of the body as a machine, Ryle ridiculed the non-physical dualist concept of the mind by coining the phrase ‘the myth of the ghost in the machine’. The word ‘ghost’ from Germanic word ‘geist’, meaning breath, has a parallel etymology to the words spirit or soul (Greek ‘psyche’) which is translated as mind. 18th century philosopher, George Berkeley argued that physical properties, both primary qualities (solidity, size, shape, position, motion, rest, weight etc.) and secondary qualities (temperature, colour, taste and smell) are ideas in our minds based on how physical entities interact with our human bodies and their sense organs. Even today, for something to be said to exist, it has to have interacted with our sense organs, either directly or via scientific instruments such as telescopes, microscopes, Geiger counters, particle colliders etc. and then perceived by the mind. Current scientific concepts of the physical at the quantum level, such as particles, waves, fields etc. are metaphors based on how we experience entities at the classical level with our bodies and sense organs. Thus, what we call the physical, is only a set of concepts in our minds. Modern physics, suggests that the physical is something more like mind at both the quantum level and the relativistic level. Subatomic particles are not solid tiny ball bearings that you can roll between your fingers. Solidity, size, and mass, energy emerge from rules and mathematics at the quantum level and even space and time are, according to special and general relativity, expandable and collapsible. A number of physicists have postulated that information (Wheeler’s “it from bit”), computation (Deutsch, Wolfram), or mathematics (Tegmark), are more fundamental than matter. Rather than space and time being fundamental, into which matter, and energy exploded into at the big bang, instead, one can argue that matter and energy (and physical processes involving them), are fundamentally information interacting and flowing according to logical rules and mathematics. Thus, the physical, is more like thoughts (perhaps ‘conceived’, rather than ‘perceived’ as in Berkeleyan idealism). In the same way that Descartes (and others) have argued that thoughts need a thinker, and that matter needs space to exist in, if the universe is composed of thoughts, then implicit in this idea, is the notion that the universe is fundamentally a conscious mind. The complex, flexible and flowing connectivity for information provided by a living human brain and body allows a partly separate and complex conscious unity to exist within the greater consciousness of the universe. Thus, the universe can be considered as a great omniscient mind and an individual physical human brain and body together, a separate but subsumed mind. Thus, I argue that The Machine is a Ghost.

Section: C 8**Status:** Concurrent**Name:** Uzi Awret**Email:** awretu@gmail.com**Organization:** Inspire Institute**Primary Topic:** [02.12].....Quantum brain biology**Abstract Title:** The Strange Metal Theory of Consciousness.

Abstract: I will introduce a novel theory of consciousness inspired by unexpected recent connections established between condensed matter theory and quantum gravity, especially the AdS-CFT correspondence relating conformal quantum field theory to hyperbolic AdS spaces with an extra dimension. The theory is commensurate with Chalmers' 2018 "The Meta Problem of Consciousness" (can our reports about consciousness be given an explanation that is independent of consciousness?) demanding that theories of mind take a stand on the Meta Problem and show that their solution to the 'meta problem' coheres with their solution to the 'hard problem'. The Meta Problem allows for a more strategic approach in which well-chosen topic neutral explanations of some problem intuitions may help explain others. The question that motivates this whole discussion is whether physics is rich enough to solve the Meta Problem. In this 'Meta Problem first' approach the SMTC aims to provide a physical explanation to two central anti-physicalist intuitions that I term the Structural Mismatch Problem (SMP) intuition (why does it seem that the structure of our phenomenal states is not necessitated by the structure of the physical states generating them?) and the ~P problem intuition (why does it seem as if consciousness cannot be identical to physical brain processes?) I will follow Chalmers in concluding that QM (Chalmers) and QFT (Sean Carroll) seem to lack the resources to solve the Meta Problem, then argue that Quantum Gravity and the AdS-CMT (condensed matter theory) correspondence does possess such resources! SMTC is Meta-correlational on the Meta Problem (Chalmers) adopting a dual-aspect interpretation of Holographic duality in which the duals are necessarily connected (thus avoiding the extra metaphysical baggage associated with standard dual-aspect theories). Next I will introduce the AdS-CFT correspondence and especially the AdS-CMT correspondence, Strange Metals and Quantum Criticality and concentrate on a radical interpretation of entanglement in general and Holographic Duality in particular by Leonard Susskind that equates entanglement in a d-dimensional CFT to wormholes in a d+1- dimensional AdS space and describe Susskind's quantum computing spherical shell, his uploading scenarios and the claim that while physical through and through the 'inner' 3D AdS bulk space dual to the quantum computing shell is different than the Lorenzian laboratory space. I argue that were the Physical Correlates of Consciousness to display Strange-

Metal dynamics Susskind's Shell thought experiment would suggest that consciousness is constituted similarly to the way that the extra spatial dimension is constituted in the holographic Duality. Here I will present data purporting to show that the phenomenal spaces associated with perception are hyperbolic (akin to inhabiting Escher's Hyperbolic Plates). Also such PCC Strange-Metal dynamics would suggest that aspects of the SMP could be solved by a mathematical transform related to the AdS-CFT correspondence. Also AdS-CFT shows that a stably constituted AdS space is dual to a successful quantum error-correction code allowing for a new way of thinking about subsumption and the unity of consciousness. I will end with Yin-Yang cosmologies.

Section: 8**Status:** Concurrent**Name:** Gerard Blommestijn**Email:** gblomm@gmail.com**Primary Topic:** [04.14].....Quantum theories of consciousness**Abstract Title:** How the space-time metric tensor fields in microtubules can encode the qualia of conscious experience and choice

Abstract: The starting point in Penrose's thinking about consciousness is Gödel's incompleteness theorem. From this he shows that a human being must have something non-computable in his brain. This cannot be found in essentially computable classical physics. Something non-computable is needed. This can be found in quantum physics, in the reduction of the wave function. Where in the brain could these quantum reduction processes for consciousness be found? Penrose and Hameroff suggest the microtubules could be the right place; they are tubular structures with a diameter of ~25 nanometer (nm) in living cells, especially in neurons. These microtubules are cylindrically stacked arrays of the protein molecule tubulin. The tubulin molecule contains 32 'aromatic' amino acid benzene rings, most within a resonance transfer distance of 1 to 2 nm which is close enough to be able to influence each other's electron clouds by means of London-Van der Waals forces. In this way, large resonant networks of quantum wave functions on microtubules can build an 'orchestrated' representation of an observation, of an experience. Penrose-Hameroff's 'Orch OR' (Orchestrated Objective Reduction) theory states that any (Orchestrated) Objective Reduction event, which is a purely physical process, is itself a primitive kind of 'observation', a moment of 'proto-conscious experience'. This is the miracle that happens: something is consciously experienced! If I - as a conscious individual - am the subject of this reduction process, this 'proto-conscious experience', then it is I who is living the experiential side of the Objective Reduction event. But what is this I that perceives? The first and best explanation of the I in physics is by John Von Neumann in his landmark

book 'Mathematical Foundations of Quantum Mechanics', pp. 417-421 (Princeton University Press, 1955). Von Neumann: We must always divide the world into two parts, one is the observed system, the other the observer. The boundary between the two can be pushed arbitrarily deeply into the interior of the body of the actual observer, until it finds itself between his retina, nerve tracts and brain on the one hand and his abstract "ego" on the other hand. In this he defines the abstract "ego" as the perceiving power only, beyond the brain. This abstract "ego" perceives the totality of all perception modalities, such as seeing, hearing, feeling, thinking, dreams, memory etc. etc. The physical side is formed by the space-time geometry selected from the superposition of possible outcomes in an Orch OR process. This geometry is determined by the space-time metric tensor fields in the microtubules involved. In my presentation, I want to indicate how the qualia elements of conscious experience and choice can be accurately encoded by the metric tensor fields in the microtubules of the selected space-time geometry after the Reduction event. These tensor fields can be read as books with pages full of relevant primitives of space-time curvature ("letters, words") meaning one by one the Platonic ideas that make up all the qualia content of one's experience and choices at that moment (choices for physical and mental movement).

C 9 - Space, Time and Consciousness 1

Lahav, Rulin Xiu, Ahmadkhanlou, Zabriskie, D. Holbrook
Executive Board Room

Section: C 9

Status: Concurrent

Name: Nir Lahav

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Co-Authors: Zachariah A. Neemeh

Primary Topic: [04.16].....Miscellaneous

Abstract Title: The Relativistic Theory of Consciousness - can physics solve the hard problem?

Abstract: In recent decades, the scientific study of consciousness has increased our understanding of this elusive phenomenon. Yet, despite critical development in our understanding of the functional side of consciousness, we still lack a fundamental theory regarding its phenomenal aspect. There is an explanatory gap between our scientific knowledge of functional consciousness and its subjective, phenomenal aspects, referred to as the hard problem of consciousness. The phenomenal aspect of consciousness is the first-person

answer to the question of "what is it like", a private experience that so far proved resistant to direct scientific investigation. This raises a concern about whether any physicalist theory can solve the hard problem of consciousness. In our work we show that physicalism is broader than describing only structures and dynamics, and that by using the relativistic principle, physicalism can solve the hard problem. Prior work and theories tacitly assume consciousness to be an absolute property that doesn't depend on the observer. As a result, extreme approaches were developed like Naturalistic dualism and illusionism. In contrast, we developed a conceptual and a mathematical argument for a relativistic theory of consciousness in which a system either has or doesn't have phenomenal consciousness with respect to some observer. There is nothing above and beyond the observer and the measurements of the observer determine the observed properties. Phenomenal consciousness is neither private nor delusional, just relativistic. In the frame of reference of the cognitive system, it will be observable (first-person perspective) and in other frame of reference it will not (third-person perspective). These two cognitive frames of reference are both correct, just as in the case of an observer that claims to be at rest while another will claim that the observer has constant velocity. Given that consciousness is a relativistic phenomenon, neither observer position can be privileged, as they both describe the same underlying reality from different points of view. As we will demonstrate, phenomenal consciousness is not private, there is a transformation between one cognitive frame of reference to the other and between first- and third-person frames of reference. All we need to do to measure phenomenal properties is to change our perspective by moving to the appropriate frame of reference i.e., the frame wherein the representations have causal power, or the frame that measures the representations directly. In this lecture we will present the relativistic theory of consciousness and how the relativistic principle provides a new answer to the hard problem and bridges the explanatory gap.

Section: C 9

Status: Concurrent

Name: Rulin Xiu

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Organization: Hawaii Theoretical Physics Research Center

Primary Topic: [04.03].....Space, time and the nature of reality

Abstract Title: Holographic Principle, String Theory, and Grand Unification Theory

Abstract: Grand unification theory is to use one mathematic formula to derive all laws and phenomena. Currently, string theory is the prime candidate for the

grand unified theory. However, the principle and symmetry that lead to string theory remain unknown and predictions from string theory are limited. To find the grand unification theory, we need to know the fundamental constituent and the principle that creates all the observed phenomena. In this work, we propose that holographic principle is the fundamental principle that leads to the formulation of the grand unified theory. We suggest that elementary information, the pure, abstract, and universal information, is the essential element underlying and creating all physical phenomena. We show that 2-dimensional spacetime encodes the elementary information and is the hologram from which all phenomena and laws of physics emerge. We derive the minimum spacetime needed to encode one piece of elementary information. From this we obtain the holographic action which describes the maximum amount of information for a system ingrained on the hologram and is proportional to the area of the 2-dimensional elementary information spacetime. We find the holographic action is similar to the string action. This new derivation of string action gives a new way to understand, interpret, and apply string theory. We point out holographic action derived here is also a natural extension of the action appearing in quantum physics and general relativity. We demonstrate how to use the holographic action to calculate the black hole entropy and the cosmological constant from it. We find the cosmological constant calculated in this way is consistent with current experimental observation. It can solve the long-standing cosmological constant problem. We show how the observed physics phenomena, such as elementary particles, gravity, gauge interaction, dark matter and dark energy emerge from holographic action. We find that the observation of elementary particles is due to the Poincare symmetry. The existence of gravity and gauge interaction including electromagnetic, weak, and strong interaction, is due to the diffeomorphic symmetry. We point out how holographic action provides a possible solution of large hierarchy problem between Planck scale and electroweak scale. John Wheeler has proposed “It from Bit”, meaning all phenomena come from information. This work provides the basic principle and mathematic formulation of “It from Bit”. It is a grand unification theory that includes string theory, quantum mechanics, general relativity, and all physics laws in principle. It also has the power to make specific prediction and solve difficult problems in physics and philosophy. In the past work, we have shown that spirit and consciousness are related to the information existing in our body and vibrational field. This work reveals mathematically how our spirit and consciousness manifest all physical phenomena.

Section: C 9

Status: Concurrent

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Co-Authors: Mohammad Ali Taheri

Primary Topic: [04.04].....Cosmology and integrative models

Abstract Title: Consciousness Cosmology

Abstract: Consciousness Cosmology (CC) has a novel viewpoint that investigates the current cosmos paradoxes, which are too challenging to analyze. It first questions the classical cosmological approaches that result in the inverse manifestation of the cosmos and then provides novel hypotheses and theories on the cosmos formation from the beginning to the end. Based on CC, the main element of the cosmos is “Consciousness” which is neither matter nor energy, and all the information in the world is derived from it. “Consciousness” was first introduced by Mohammad Ali Taheri over 40 years ago. During the last four decades, many distinct branches have been developed by him under Consciousness, and one of them is CC. From the CC point of view, the cosmos is an automated self-sustained system that follows intelligent engineered principles. The universe is designed and operated by software that is based on consciousness. The main nature of the cosmos is “motion” and space is its primary medium. The motion generates a mechanism to compress and rebound the universe to create cyclic movements. Gravity is the factor that compresses space. After each compression and formation of the Cosmos Blackhole, analogous to a compressed spring, the space gets in the process of going back to its original unstressed condition with zero gravity, analogous to a rebounded spring. Time is considered as a counteracting vector that is acting against gravity and causing the compressed waves to get uncompressed. Consequently, time results in entropy. The cosmos has initiated from a Cosmos Blackhole consisting of a unique matter called Taheri Absolute Matter (TAM) that was formed by the crunch of Light-Dark Matter, Dark-Dark Matter, Rigid Heat Matter, and Rigid Gravitational Matter. According to a special CC mechanism based on matter, energy, and consciousness relations, a portion of dark energy was released from Dark-Dark Matter, and the explosion of a part of the Light-Dark Matter initiated the rebound of the universe 13.8 billion years ago. Then, the solid edge of the universe from the residual of TAM, which acts like a rocket with solid fuel, has moved the cosmos in all the directions at a very high speed towards its original unstressed condition where the space will release all its stress like a rebounded spring. The TAM will be fully used to rebound the cosmos to its original volume. After reaching the original unstressed condition, there will be no gravity. Consequently, the time will be zero, the wavelength

goes to infinity, the entropy goes to zero, the temperature reaches absolute zero, and there will be total darkness in the cosmos. The factor that causes the cosmos to compress from the unstressed condition back to another Cosmic Blackhole is the "motion" that governs the cosmos. At the edge of the universe and due to a mechanism based on the omnidirectional rotation of the cosmos, the uncompressed waves with infinite wavelength move back towards the center of the cosmos. Due to the collisions of these uncompressed waves, new compressed waves are formed, gravity is generated, and consequently, time re-initiates. The numerous gravitational centers attract one another, and finally, a new Cosmic Blackhole forms. This cycle of compressing and crunching to a Cosmic Blackhole and rebounding to the original unstressed condition repeats cyclically.

Section: C 9

Status: Concurrent

Name: Beverley Zabriskie

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Primary Topic: [01.01].....The concept of consciousness

Abstract Title: The Neuroscience of C.G. Jung/The Depth Psychology of Neuroscientists

Abstract: The focus, methods, language, and intent in the work of C.G. JUNG and many contemporary neuroscientists are dissimilar. Yet each enters the phenomenological, multi-layered specificity of the embodied, emergent mind, and the wave of psyche moving through archaic, and still operative, registers which compose awareness and provoke imagination. Depth psychologists and neuroscientists probe the realms from microbes to mind, from the earliest forms to the still evasive complexity of brain networks. They challenge the hierarchical evolutionary view of our species sources of knowledge, and so transcend Cartesian and Darwinian constructs, framing human experience -and dreams- in the context of existence shared with other living forms back and beyond the contemporary. For an analyst, their research and theses augment and support Jung's emphasis on diversity and specificity in dream interpretation, psychoid phenomena, the mind-matter continuum pertinent to Jung and Bohm, and the theories of synchronicity of dual-aspect monism. We become aware of the emergent nature of the Collective Unconscious as we are contextualized both in the species-wide reality of who we are, plus the macro-context of what we are, beyond time and space.

Section: C 9

Status: Concurrent

Name: Dwight Holbrook

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Organization: Adam Mickiewicz University

Primary Topic: [04.03].....Space, time and the nature of reality

Abstract Title: Beginnings: the Possibility of Something from Nothing

Abstract: The origin of the universe? The origin of free will? The origin of space? Or simply the appearance of something out of nothing, with no causal before, like a probability that transforms into a unpredictable particle actuality in quantum physics. In short, does better explanation for such questions await us? And are we hamstrung by our tendency for "cause-and-effect" explanations or "something vs. nothing" ways of forcing the options? This talk explores the notion of beginnings -- that is, the possibility of something from nothing. It begins by clarifying how the meaning of such terms is being intended, for example the question of whether the moon if no one sees it qualifies as a nothing, the question of an uncaused something or an effect minus an antecedent of any kind. In short, what does a something-from-nothing entail? And what is a something in the first place, as Heidegger asks in his essay, "What is a Thing?" Having sketched out the notions of "something" and "nothing", and in particular "something from nothing", the talk proceeds to the central question, namely the possibility of a something from nothing. Here possible examples are explored, and the extent to which they could serve in understanding a significant aspect in our lives. Admittedly, any assessment in this area depends to a degree on the ontology or belief system one adopts. Nevertheless, the sampling will seek to stand independently of value and belief systems. So what are some examples of a something-from-nothing phenomenon being raised in this talk? Three have already been cited. The first, that of the origin of the universe, raises the hypothesis of something from a literal nothing, where even a so-called precondition such as potentiality is ruled out, given the notion of time as having no beginning before the Big Bang. A second example takes up the notion of free will, a something from nothing so fundamental in our experience of living our lives and making difficult choices, contrary to much of the thinking today and challenging, as well, the assumption of robots gaining human capabilities, including the appearance of free will. In short, do we end up revising language and throwing out such words as "guilt", "heroism", "shame", "courage", "thanks", as implying a self-capable of being free from deterministic laws and behavior? A third example takes up the putative nothingness of space, given the perspective of particle entanglement and nonlocality, where in quantum physics particles across space can nonetheless be linked in ways that suggest there is no space at all. On the other hand, a something-from-nothing

phenomenon seems to arise in the case of our expanding universe. What is our expanding universe expanding into if not a nothing that becomes a something -- namely the space inside the expanding universe? What is something? What is nothing? It may be that we need new categories of understanding for a better answer. This talk suggests such a quest.

FRIDAY, APRIL 22, 2022

C 10 - Representation and Perception:

Robinson (R), Weger, Lecybyl (R), Langer (R), Schiffer (R)
Grand Ballroom C

Section: C 10

Status: Concurrent

Name: William Robinson

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Primary Topic: [01.09].....Philosophical theories of consciousness

Abstract Title: Russell, Tye and the Location Component of Bodily Sensations

Abstract: Bodily sensations such as pains and itches are normally felt as located in various parts of the body. In a 2015 paper, Michael Tye invokes this location component, along with the possibility of sensations in phantom limbs, in support of a representationalist view. The present paper explains Tye's argument and contrasts his account with an extension of a view advanced by Russell in 1912. It then argues that if Tye avoids the implausible view that phantom limb patients do not have pains, and hews to a representationalist view of color experience, he must treat pains and color experiences differently. A Russell-inspired view will then have an advantage, since it can embrace a unified treatment of the location component of bodily sensations and visual experiences.

Section: C 10

Status: Concurrent

Name: Daniel Weger

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Organization: Goethe University Frankfurt am Main

Primary Topic: [01.14].....Philosophy of perception

Abstract Title: Representationalism and the Predictive Mind

Abstract: Representationalism about perceptual experience claims that perceptual experience essentially involves being in a representational state and that the phenomenal character of a perceptual experience is determined by its representational content. Usually, proponents of representationalism defend externalism about the content of perceptual experiences because this allows for a response-independent construal of the properties that figure in the contents of perceptual experiences. This, in turn, delivers a quite natural and comprehensible account of experiential representation that easily accommodates the fact that perceptual experience is externally directed. Yet, externalist response-independent representationalism has problems explaining the internal dependence of perceptual experience and it does not fit well with empirical findings about perceptual experience. Internalist representationalism, in contrast, smoothly accommodates the internal dependence of perceptual experience and it matches with empirical findings. Since it can account for the fact that perceptual experience is externally directed, too, it might be considered as superior to the externalist alternative. However, it is generally agreed that it is unclear what a plausible account of experiential representation might look like assuming that internalist representationalism is true and, therefore, internalist representationalism has not been considered a serious contender. In this talk, I want to argue that the framework of Prediction Error Minimization (PEM) might provide internalist representationalism with an idea of how to give a plausible account of experiential representation on internalist grounds. PEM provides a theory of perception that rests on the Bayesian brain hypothesis which claims that the brain is a hypothesis testing machine in its essence. Thus, PEM conceives of perception as the task of inferring the hidden causes of the sensory input that the brain receives from its environment, and it claims that conscious perception is the outcome of unconscious inferential reasoning that approximates Bayes' rule. First, I will argue that PEM is both internalist and representationalist in spirit to show that it is in accordance with internalist representationalism. It is representationalist because it presupposes that perception involves the testing of hypotheses and it is internalist because the brain performs its task of inferring the hidden causes of the sensory input it receives and thereby constructing a model of the external world wholly from within the skull. Second, I will show that PEM is committed to a structuralist notion of representation that may be further spelled out in terms of inferential role semantics. My claim is that the hypotheses involved in perceptual inference acquire their content in virtue of the role they play in the perceptual hierarchy that lies at the core of PEM. Third, I will elaborate on how this might deliver an account of experiential representation that provides the basis for a plausible version of internalist representationalism that is informed by a well-founded neuroscientific approach to perception. Finally, I will present how the resulting version of internalist representationalism accommodates both the external directedness and the internal dependence of perceptual experience and

point out that it goes well together with empirical findings about perceptual experience.

Section: C 10

Status: Concurrent

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Primary Topic: [01.01].....The concept of consciousness

Abstract Title: An Optical Illusion Creates Acute Pain and Causes a Withdrawal Reflex.

Abstract: Introduction: Pain is a mystery. Understanding consciousness may help us to understand it. However, we would like to postulate that the reverse may also be true: Understanding pain might be a milestone for understanding consciousness. Ethical restrictions hinder research for a deep understanding of pain as most proposed experimental pain models require the activation of nociceptive neurons by producing tissue damage or by direct electrical stimulation. Aim: Produce acute pain without any tissue damage or any activation of the nociceptive pathway using optical illusion. M&M: We used a simple system of two parabolic mirrors called a mirascope to create a floating in the air, realistic, virtual, 3D, hologram-like projection/illusion of a metal pin. The system also contains a precise TOF distance sensor and uses microcontroller-based logic to control the position of the metal pin projection in space. The subject is requested to touch slowly the tip of the virtually projected pin. When the sensor detects the subject's finger approaching the metal pin's projection, the illusion unexpectedly moves up with a loud mechanical noise, creating a powerful impression of the pin penetrating the subject's finger. This illusion creates the sensation of acute pain and causes the withdrawal reflex. Discussion: Nociception is the physiological process of detecting damaging stimuli and is the simplest and the most primitive sensory process. Some response to damaging stimuli has been well documented in most live organisms, including plants. In contrast, pain is defined as unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage (IASP, 2020). Pain and nociception are closely related but different phenomena: in most cases, pain is a conscious, personal, sensory and emotional experience of nociceptive stimuli; however, in some rare cases, it is possible to evoke pain without requiring nociceptive stimuli. This project provides the new idea of evoking acute pain by optical illusion without activating nociception. There is no physical contact between the stimulator and the subject's finger. The pain is created purely by consciousness.

Section: C 10

Status: Concurrent

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Primary Topic: [03.03].....Other sensory modalities

Abstract Title: The Phenomenology and Prevalence of Trans Phantoms

Abstract: Trans phantoms are bodily sensations of gendered body parts that a person was not born with (i.e., phantom penis in someone assigned female at birth). Our research examines the prevalence of trans phantoms across the transgender, nonbinary and gender diverse people (TGD) as well as a phenomenological study of phantom penis. Based on the theory of the Bayesian brain, the predictive processing of the brain holds hyperprior predictions of certain gendered bodily experience which is not reciprocated by the material body. This theory follows the conceptualization of neuronal processing set forth by Friston with the Free Energy Principle and applied to TGD experience of gendered bodily dysphoria by Langer. There are gendered hyperpriors that are only resolved by active inference (external action as opposed to internal homeostatic responses), in this case, gender-affirming interventions such as hormone treatment and/or surgery. In the instance of trans phantom perceivers, the predictive processing extends to physical perception of the body part as opposed to non-perceivers who feel the need for that part but not the physical extension of it (i.e., there are transwomen who know their bodies will not be congruent until they have a vagina whereas there is a small subset who know that and feel the sensation of one). The first study on trans embodiment and tracks the prevalence of trans phantoms in a large (n=1398) online survey. Our questions were related to how and what subjects felt within their bodies. These included subjective experiences of interoceptive sensitivity such as hunger, need to use the bathroom, breath, temperature and pain. 700 subjects across TGD identities reported experiencing the sensation of a gender-affirming body part that they were not born with. These included phantoms across various body parts such as lips, breasts, vagina, hips, penis, testicles. The other study was phenomenological interviews with 26 transmasculine people on their experience with a phantom penis. Interviews focused on answering some of these questions: What are the perceptual, physical, phenomenological, and erotic dimensions of phantom penises, as personally experienced by (some) TGNB individuals? What are the individual characteristics of phantom experiences, e.g., their location, onset, frequency, intensity, and endurance? How do phantoms operate through time and across activities? How do

individuals understand or conceptualize their phantom phenomena? Preliminary findings indicate that although there are similarities, participants' experience of phantoms is individualized and unique. Through this work, we are building out the dimensions for understanding trans phantom sensorial experience.

Section: C 10

Status: Concurrent

Name: Fredric Schiffer

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Organization: McLean Hospital and The Harvard Medical School

Primary Topic: [04.13].....Brain stimulation techniques

Abstract Title: Dual-Brain Psychology: Profoundly Altering Personality with Hemispheric Stimulation, Findings and Hypotheses Related to Consciousness

Abstract: Dual-Brain Psychology comes out of clinical observations and a reconsideration of the split-brain studies. It posits that each hemisphere in most people can support different conscious personalities, one (left or right) that is more affected by past traumas and one that is healthier. These personalities can easily be aroused by stimulating either brain hemisphere with either lateral visual field stimulation or with unilateral transcranial photobiomodulation, near-infrared mode (UtPBM) using an 810 nm LED. For example, in a published NIH/NIDA study at McLean Hospital and MindLight, LLC, we were able to reduce cravings and use in patients with opioid use disorder, mostly from [Craigslist.com](https://www.craigslist.com). Using active UtPBM, N = 19, we found a 75% decrease in cravings that had a $p = 0.000$ with an effect size of 1.5 when compared with sham. N = 20, (which was the same device with foil over the LED). Participants had 4 twice-weekly 4-minute treatments with 3 weekly follow-ups. Schiffer has reported also that in clinical practice putting the LED on the forehead at F3 or F4 for 4-minutes in 55% of his patients, could induce profound changes in personality such that one was anxious, suspicious, and prone to behaving destructively while putting the LED over the other hemisphere induced a mature, healthy personality. Much study has gone into transcranial photobiomodulation and has led to a deep understanding of its positive metabolic effects, but that UtPBM could profoundly alter personality was somewhat unexpected and its mechanism is as yet unstudied. We hypothesize that consciousness relates to brain information, and we hypothesize that brain information is ultimately expressed as orchestrated biophotons that interact with a quantum field related to subjectivity to transform brain information into experience. We hypothesize that our LED excites a continuously changing biophoton field and facilitates its transformation into experience.

C 11 - Psychedelics and altered states 2:

Glynos, Joy, Safron, Morley, Sielaff

Grand Ballroom A

Section: C 11

Status: Concurrent

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Primary Topic: [02.19].....Psychedelics and psychopharmacology

Abstract Title: Indolethylamine N-Methyltransferase (INMT) is Not Essential for Endogenous Methylation of Tryptamine in Rats

Abstract: Indolethylamine N-methyltransferase (INMT) is a transmethylation enzyme and part of a large family of N-methyltransferases that utilize the methyl donor S-adenosyl-L-methionine (SAM) to transfer one or more methyl groups onto amino groups of endogenous small molecule acceptor compounds. INMT is distributed widely in various mammalian tissues and is best known for its role in the biosynthesis of N,N-Dimethyltryptamine (DMT), which is an endogenous trace amine found in the mammalian brain and other tissues. In mammals, the formation of DMT occurs via the methylation of tryptamine, where INMT catalyzes the transfer of two methyl groups to form the precursor molecule N-methyltryptamine, and finally N,N-dimethyltryptamine. Apart from tryptamine methylation, very little is known about the functional roles of INMT. Here we present a novel CRISPR/Cas9-developed INMT-knockout (KO) rat model, and an investigation of the role of INMT in tryptamine methylation. The primary finding is that protein extracts from INMT-KO rats show tryptamine methylating activity at equal levels relative to wild type rats. These results indicate that INMT is not necessary for the endogenous methylation of tryptamine, and that alternative methylation enzymes can perform this function. Because INMT was long thought to be the sole enzyme responsible for endogenous tryptamine methylation, this work opens the door for the discovery of novel pathways for endogenous DMT biosynthesis and paves the way for a more thorough investigation of the functions and mechanistic regulation of endogenous DMT.

Section: C 11**Status:** Concurrent**Name:** Michelle Joy**Email:** Michelle.t.joy@gmail.com**Organization:** University of Pennsylvania**Co-Authors:** Kenneth J. Weiss**Primary Topic:** [05.04].....Psychedelic and other altered states of consciousness**Abstract Title:** Touch in Psychedelic Medicine: Ethics of Consent

Abstract: As psychedelic medicine gains traction, aspects of care unique to this field need close examination. The ethics of psychedelics has particular contours that require study by practitioners and ethicists. Unlike traditional psychotherapy, psychedelic medicine considers aspects of therapeutic touch during a session. Given longstanding prohibitions against touching therapy patients, use of this technique – and consent for it – require scrutiny. The MAPS code of Ethics reads, “We obtain informed consent for any physical touch by describing the type of therapeutic touch. Physical touch is never sexual and we make agreements about how the participant can stop touch at any time.” However, hypothetical scenarios elicit a more complex picture. For instance, if a patient previously consents to only touch on the hand but asks for a hug during a medicine session should the request be honored or rejected? Should flexibility or on-the-fly decision making have been built into the consent, such that the “person” signing consent to no-touch also gives consent in advance of a state-dependent circumstance? If so, might the client later feel violated for breach of contract, claiming the clinician took advantage? Or should the client be held to the original decision, thus risking missing a potential breakthrough that might involve touching or nonsexual holding? While each psychedelic medicine elicits a unique state of mind, similarities exist in the ability – and goal – of the substances to change one’s consciousness. This session will look at the idea of state-dependent consent, a contract that may be influenced by the effect of the psychedelic medicine. We will look at the phenomenology of various psychedelic states and examine whether they might entail changes in desire for touch and whether those states affect a patient’s ability to consent. For example, if MDMA enhances one’s interest in touch, are the cognitive features of an enactogenic state maintained to allow for a change in decision making? We will examine the ineffability of psychedelic states, discussing whether one can truly make decisions about the value of touch before living the experience of the medicine. One may not appreciate the benefit from touch until entering the altered state of requesting it for therapeutic purposes. We will also look at the potential for change as inherent to the psychedelic-assisted therapy process and from that lens question whether the state of psychedelic consciousness

is an actualized desire to become a different version of the self. Can intent to change make consent negotiable? Can someone be in a state that more closely resembles a desired self and thus request touch more authentically than a past self without medicine? All these questions will be viewed from therapeutic and ethical lenses, while considering forensic implications for them with regard to liability for the clinician.

Section: C 11**Status:** Concurrent**Name:** Adam Safron**Email:** asafron1@jhmi.edu**Organization:** Center for Psychedelic and Consciousness Research; Johns Hopkins University School of Medicine**Primary Topic:** [02.19].....Psychedelics and psychopharmacology**Abstract Title:** On the Varieties of Conscious Experiences: Altered Beliefs Under Psychedelics (ALBUS)

Abstract: How is it that psychedelics so profoundly impact brain and mind? In this article we will describe a highly influential model of "RElaxed Beliefs Under pSychedelics" (REBUS), wherein 5-HT_{2a} agonism is thought to help people relax their prior expectations, so making room for new perspectives and patterns. This model is contextualized within the Free Energy Principle and Active Inference framework, as well as the associated neuronal processes theory of hierarchical predictive coding. More specifically, excessive excitation of deep pyramidal neurons is thought to cause a kind of paradoxical desynchronization, so "flattening" (Bayesian) "belief landscapes" by attenuating large-scale complexes of synchronous neural activity, particularly at alpha frequencies. Here, we provide an alternative and largely compatible perspective, in that while such effects may be both real and important, these alterations may primarily correspond to a rare (but potentially pivotal) regime of very high levels of serotonin 2a receptor (5-HT_{2aR}) agonism. We suggest an opposite effect may occur along much of the dose-response curve of 5-HT_{2aR} stimulation, in which synchronous neural activity becomes more powerful, with accompanying "StrEngthened Beliefs Under pSychedelics" (SEBUS) effects. We believe that REBUS effects are indeed crucially important aspects of psychedelic experiences but suggest these exist alongside SEBUS effects in various combinations. As such, we propose a larger integrative perspective for understanding "ALtered Beliefs Under pSychedelics" (ALBUS). The ALBUS framework provides a rich account of cognition based on predictive processing, which we believe is capable of subsuming REBUS and providing means of fruitfully integrating across other theories of psychedelic action. Towards this

end we demonstrate the utility of ALBUS by providing neurophenomenological models of psychedelics focusing on mechanisms of conscious perceptual synthesis, as well as hippocampally-orchestrated episodic memory and mental simulation. We further discuss cognitive diversity (including psychopathology) through the lens of these models. We consider the potential significances of modifications of the default mode network and alpha rhythms for creativity and various states of consciousness, including with respect to fundamental alterations in sense of self through ego dissolution. Finally, we survey a broad range of psychedelic phenomena and consider potential explanations, implications, and directions for future work.

Section: C 11

Status: Concurrent

Name: Richard Morley

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Organization: Texas State University

Co-Authors: Logan T. Trujillo

Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: Violence, Aggression, Mindfulness, and the Brain

Abstract: While research has yet to ascertain the role of conscious mental states in humans, there is a potential role that consciousness is involved in human behavior [Gray, J. (2004). *Creeping up on the hard problem*. Oxford: Oxford University Press]. This presentation will discuss mindfulness consciousness's impact on large-scale brain networks and behavior associated with violence and aggression. Aggression and acts of physical violence are commonly associated with exposure to violence and psychiatric disorders such as to conduct disorder and antisocial personality disorder. Research also suggests that network communication between large-scale networks predicts unconscious and conscious states (Lee et al., 2019). Brain imaging has been used to investigate the relationship among various brain networks in individuals convicted of violent crimes. Research findings suggest that three interrelated brain networks, specifically Executive Control Network (ECN), which is involved in self-regulation, Salience Network (SN), which detects motivationally relevant stimuli, and Default Mode Network (DMN), which is engaged in self-reflection and empathy, are involved in a variety of cognitive functions related to violence and are associated with psychiatric disorders. Research findings also indicate that the SN controls the oscillation among the three networks by deactivating the ECN and DMN when the brain perceives motivationally relevant stimuli. Brain imaging research has been used to explore the link between these three specific Brain Networks and predictors of violence such as antisocial personality disorder, lack

of empathy, exposure to violence, moral reasoning, impulsivity, and criminality. Evidence suggests that impaired connectivity between the ECN, SN, and DMN are linked to violence and predictors of violence. Mindfulness conscious states are characterized by bringing one's complete attention nonjudgmentally momentary internal and external environment. Trait mindfulness refers to the potential of an individual to experience state mindfulness. Evidence suggests that mindfulness mental states support improved well-being, self-regulation, self-awareness, and prosocial behavior. Research findings have also linked mindfulness interventions designed to help people maintain consciousness states. Previous studies also indicate that mindfulness-based interventions and trait mindfulness increased functional connectivity between the ECN, SN, and DMN brain networks associated with violence. Research findings also suggest that mindfulness-based interventions, trait mindfulness, and mindfulness conscious states reduce an individual's propensity to engage in violent and antisocial behavior. This presentation will discuss the implication of mindfulness conscious states to modifying brain network connectivity. This presentation will also describe the potential of mindfulness states to reduce antisocial behavior, reduce violence, and improve the minds of individuals exposed to violence. This presentation will also discuss the theoretical implications of this area of research to the study of consciousness. While research has yet to ascertain the role of conscious mental states in humans, there is a potential role that consciousness is involved in human behavior [Gray, J. (2004). *Creeping up on the hard problem*. Oxford: Oxford University Press]. This presentation will discuss mindfulness consciousness's impact on large-scale brain networks and behavior associated with violence and aggression. Aggression and acts of physical violence are commonly associated with exposure to violence and psychiatric disorders such as to conduct disorder and antisocial personality disorder. Research also suggests that network communication between large-scale networks predicts unconscious and conscious states (Lee et al., 2019). Brain imaging has been used to investigate the relationship among various brain networks in individuals convicted of violent crimes. Research findings suggest that three interrelated brain networks, specifically Executive Control Network (ECN), which is involved in self-regulation, Salience Network (SN), which detects motivationally relevant stimuli, and Default Mode Network (DMN), which is engaged in self-reflection and empathy, are involved in a variety of cognitive functions related to violence and are associated with psychiatric disorders. Research findings also indicate that the SN controls the oscillation among the three networks by deactivating the ECN and DMN when the brain perceives motivationally relevant stimuli. Brain imaging research has been used to explore the link between these three specific Brain Networks and predictors of violence such as antisocial personality disorder, lack of empathy, exposure to violence, moral reasoning, impulsivity, and criminality. Evidence suggests that impaired connectivity between the ECN, SN, and DMN are linked to violence and predictors of violence. Mindfulness conscious states are characterized by

bringing one's complete attention nonjudgmentally momentary internal and external environment. Trait mindfulness refers to the potential of an individual to experience state mindfulness. Evidence suggests that mindfulness mental states support improved well-being, self-regulation, self-awareness, and prosocial behavior. Research findings have also linked mindfulness interventions designed to help people maintain consciousness states. Previous studies also indicate that mindfulness-based interventions and trait mindfulness increased functional connectivity between the ECN, SN, and DMN brain networks associated with violence. Research findings also suggest that mindfulness-based interventions, trait mindfulness, and mindfulness consciousness states reduce an individual's propensity to engage in violent and antisocial behavior. This presentation will discuss the implication of mindfulness consciousness states to modifying brain network connectivity. This presentation will also describe the potential of mindfulness states to reduce antisocial behavior, reduce violence, and improve the minds of individuals exposed to violence. This presentation will also discuss the theoretical implications of this area of research to the study of consciousness.

Section: C 11

Status: Concurrent

Name: Alex Sielaff

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Organization: University of Arizona

Co-Authors: Jeff Greenberg

Primary Topic: [05.04].....Psychedelic and other altered states of consciousness

Abstract Title: Towards an Empirically and Theoretically-Rooted Explanation of Mystical-Type and Related Experiences in the Psychedelic Therapeutic Process: A Terror Management Perspective

Abstract: The present work highlights a novel theoretical extension to Terror Management Theory (TMT) regarding mystical-type experiences (MTEs) as they occur in the psychedelic therapeutic context. These experiences and others like them fall under a broader umbrella which Robert J. Lifton calls the experiential mode of transcendence; which is just one of five modes of transcending, specifically, the anxiety associated with one's awareness of their own inevitable death. TMT asserts that the uniquely human awareness of mortality elicits potentially debilitating terror that is managed by believing in, and living up to, a personalized cultural worldview. One's (1)worldview offers a framework through which one can earn (2)self-esteem, and together – with the added reciprocal reinforcement offered by (3)close relationships – this three-

part anxiety buffering system constitutes an ever-present means to manage the ever-present potential terror of death. When one's anxiety buffer does not adequately manage the terror, other more maladaptive terror management methods may be employed which can manifest as certain psychiatric symptoms. The hypothesis being put forth here is that the therapeutic function of MTEs lies in their ability to elicit an intrinsic shift in the way clients relate to their worldview beliefs which brings their anxiety buffer into a more functional and adaptive state; this then reduces the client's need for the maladaptive clinical symptoms, allowing them to fall away of their own weight. This is hypothesized to occur over a longitudinal process that encompasses the MTE itself along with the preparation and integration periods before and after the psychedelic dosing session. This perspective suggests that transcendent experiences like MTEs – combined with a therapeutic environment – are treating the problem closer to its source rather than simply managing the symptoms that result from the deeper problem - which this model would say is essentially an inadequate anxiety buffer. TMT's three core hypotheses have already been cross-culturally validated across 1,000+ empirical studies and 35+ years, meaning that this theoretical perspective has the benefit of connecting psychedelic therapy to a body of empirical literature that is more than a nascent ad-hoc explanation. Preliminary evidence consistent with the model shows that university students who reported having experienced an MTE, compared to those who did not, were higher in intrinsic spirituality, trait absorption, belief in an everlasting soul, desire for personal growth, and were also more oriented toward their religion/spirituality as a means of asking questions rather than seeking answers. The theoretical model is discussed herein along with some applications and implications.

C 12 - Subcellular correlates of consciousness

Mihelic, Alachkar, Ruggiero, Davis, Grinde, Egoan
Grand Ballroom B

Section: C 12

Status: Concurrent

Name: F. Matthew Mihelic

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Organization: University of Tennessee Graduate School of Medicine

Primary Topic: [02.12].....Quantum brain biology

Abstract Title: Quantum DNA: Modeling, Evidence, and Implications

Abstract: The DNA molecule can be modeled as a quantum logic processor in which electron spin states are coherently conducted along the pi-stacking

interactions of the aromatic nucleotide bases while being spin filtered by the interaction of electron spin with the helicity of the DNA molecule. [1] Coherent electron spin states are held in a logically and thermodynamically reversible enantiomeric triple state of pseudorotation conformations (C2-endo / O1-endo / C3-endo) of the deoxyribose moiety in each nucleotide. The deoxyribose moieties can thereby function as quantum gates that enable quantum-to-classical transition to occur across the energy barrier that separates the C2-endo and C3-endo conformations, and that energy barrier is appropriate to the Landauer limit for a deterministic bit of information ($kT \cdot \ln 2$). [2] By Planck's equation ($E=hf$) this theoretical quantum gate in the deoxyribose moiety "vibrates" between the C2-endo and C3-endo enantiomers at a frequency of 4.3 terahertz, which can provide an intrinsic source of biological terahertz quantum activity. The quantum DNA model has been validated in pilot research that demonstrated non-local correlations between the depolarization patterns of neuronal cells in separated cell cultures that were modulated by laser pulsations and by isoflurane general anesthetic gas. [3] The results of this pilot research support modeling cellular DNA as the source of quantum biological calculation and of non-local quantum coherence between the cells in separated cell cultures, and the results of this pilot research also support modeling microtubules as locally coherent quantum wires that can have their local quantum coherence disrupted by isoflurane general anesthetic. Further research into the quantum DNA model is imperative because of the tremendous implications that it has with regard to genetics, biological systems, quantum computing, artificial intelligence, social sciences, and consciousness studies. References: [1] <https://www.mdpi.com/2075-1729/3/3/474> [2] https://dc.uthsc.edu/cgi/viewcontent.cgi?article=1001&context=gsmk_facpubs [3] https://dc.uthsc.edu/cgi/viewcontent.cgi?article=1002&context=gsmk_facpubs

Section: C 12

Status: Concurrent

Name: Amal Alachkar

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Organization: University of California Irvine

Co-Authors: Wedad Alhassen

Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: Cilia: from vestigial organelles to vital players in high order cognitive functions

Abstract: Cilia, evolutionarily conserved organelles that are composed of microtubules, protrude from almost all cell types and act as cell antennas. Cilia's distinct designs, which served swimming purposes in ancient Cambrian

unicellular organisms, were repurposed by evolution to drive functions completely different from their earliest ones. However, two features of both motile and primary cilia have been preserved throughout millennia across all cell types: their high dynamic physical structures and their capability to detect environmental signals and transduce them into biochemical responses. While almost all neurons contain cilia, their significance in the brain has not received attention yet, and for long, brain cilia were considered vestigial organelles. The fact that most ciliopathies are also associated with neurological disorders, including cognitive deficits, raises the questions of the role of cilia in relation to cognition and probably consciousness. Our lab work revealed a high degree of circadian rhythmicity of cilia gene expression across primate brain areas and a dynamic nature of cilia length and morphology in response to external manipulations. We also showed dysregulations of almost all genes associated with the structural and functional components of primary cilia in mental and consciousness disorders such as schizophrenia. Further, we demonstrated the dysregulation of time perception and spatial memory (space perception) as a result of cilia removal from specific regions of the brain. Our research findings provide evidence for brain primary cilia as a site of higher-order functions of the brain, particularly cognition.

Section: C 12

Status: Concurrent

Name: Marco Ruggiero

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Organization: National Coalition of Independent Scholars

Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: The brain microbiota as it relates to the Orch OR theory of consciousness

Abstract: A common denominator of the various evolutions and revisions of the Orch OR theory is the concept that consciousness arises inside brain neurons as a result of quantum computing occurring in the context of microtubules. If quantum computing in cytoskeletal structures is the key, then there is no theoretical impediment at hypothesizing that cytoskeletal structures of microbes residing in the human brain could give rise to forms of consciousness. Far from being sterile, the human brain has a rich and diverse microbiome and ultrastructural studies demonstrated abundance of microbial cells in brain areas associated with reward-seeking, learning, memory and consciousness. The microbes of the human brain are the same that are found in soil and water and they reach the brain carried by cells of the immune system as well as travelling along the axons of peripheral nerves. Just as it would be unrealistic

today to discuss the function of the gut, or that of the immune system, without considering the essential role of the microbiome, here I propose that also the discussion on Orch OR should take into account the role of the brain microbiome. Microbial consciousness arising from the cytoskeleton was described in 2017 and further elaborated in 2019 postulating that subjective awareness emerged as an intrinsic feature of the first unicellular forms of life through the working of oscillating cytoskeletal structures and structurally flexible proteins, that is, in a manner closely reminiscent to the concepts at the basis of Orch OR. If phenomena of quantum entanglement occur between the microtubules of adjacent neurons, they will also occur between the cytoskeletal structures of human neurons and those of the brain microbes as well as between the cytoskeletal structures of the different microbes. Wireless and quantum entanglement-based communication between microtubules of individual neurons supports the hypothesis that the process of orchestration can take place on a large scale, in theory involving all neurons across the wholeness of the brain. According to what I propose here, these phenomena of communication are not restricted to human neurons but are extended to the brain microbiome. This is all the more conceivable when considering that wireless communication based on the resonance of vibrations inside microtubules does not require neurotransmitters or synapses and, therefore, can occur between neurons and microbial cells even though they are not anatomically connected by synapses. If the concept of the brain microbiome and the ensuing concept of the rhizome could be integrated in Orch OR, its explanatory and predictive powers would be vastly increased. For example, the issue of permanence of consciousness independently of neurons would be further supported by the consideration that the microbiome survives the human body; if the Orch OR phenomena occurring inside the microtubules of human neurons are entangled and shared with those of the microbiome, an organ that has 10 times more cells and 100 times more DNA-based information than its human counterparts in our bodies, then survival of consciousness would be a topic pertaining to microbiology as much as to philosophy. References: <https://loop.frontiersin.org/people/84141/overview> - https://scholar.google.com/citations?hl=en&user=9RfGtN8AAAAJ&view_op=list_works&sortBy=pubdate

Section: C 12

Status: Concurrent

Name: Mac Davis

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Organization: Minicircle

Primary Topic: [02.21].....Pharmacology and psychopharmacology

Abstract Title: Toxoplasmosis, endemic pathogenic virons, and the

Abstract: *Toxoplasma gondii* is an obligate intracellular single-celled protozoan capable of infecting virtually every warm-blooded animal on the planet. And indeed, it is has — over 50% of people have been estimated to be infected with this parasite. *T. gondii* resides in the brain, often times on the outer edge of the hippocampus. From there, *T. gondii* epigenetically remodels genes in the medial amygdala, such that predator aversion is greatly decreased, induces widespread histone-lysine acetylation in cortical astrocytes, and secretes testosterone and neurotransmitters like dopamine into surrounding brain tissue. Although the mainstream view of Toxo is that it is "latent" in people and "doesn't matter," research in the last few decades has shown a causative role in schizophrenia, and strong correlations with impulsive behavior, motorcyclists, and car accident victims. Links to bipolarism and attraction to management, businesses and entrepreneurial roles have been found. Murray (2013) and Bromham (2018) have shown that parasitic load correlates to cultural and political views on traditionalism, religiosity, and authoritarianism, with greater parasitic load correlated with greater desire for authoritarianism on political compass scores. Elon Musk, when asked about toxoplasmosis is quoted as saying "Toxoplasmosis runs the world." These parasites have an enormous unacknowledged impact on humanity. Jaroslav Flegr, world expert on toxoplasmosis estimated 23% of the global disease burden is explained by toxoplasmosis infection via simple inflammatory response dysregulation resulting in faster progression of cardiovascular disease, metabolic syndrome, and immune failure. Viruses like Epstein-Barr, Cytomegalovirus, polyomavirus, herpes, and HPV are generally believed to be "not a big deal." The presence of these viruses is known to significantly increases the risk of neurodegenerative disease and some cancers. New research by Bjornevik (2022) on Epstein Barr Virus strongly suggests a profound causative role in multiple sclerosis. These pathogens not only directly alter mood, and behavior but also cause persistent health problems via constantly fluctuating inflammatory and energetic load on the human body mind and they have proven long-tail effects which are not frequently addressed, and typically ignored. The COVID-19 pandemic drew attention to both what is possible in drug development when there is a cultural and political urgency to develop a vaccine, and the radical long-term effects that simple transmissible viruses can have on human health and culture. Strategies to research and help mitigate these toxic loads, and even turn them into positives will be supplied in the talk.

Section: C 12**Status:** Concurrent**Name:** Bjørn Grinde**Email:** bjgr@fhi.no**Organization:** National Institute of Public Health**Primary Topic:** [04.11].....Consciousness and evolution**Abstract Title:** Did consciousness first evolve in the amniotes?

Abstract: I present evidence that the initiating event in the evolution of consciousness occurred in connection with the adaptation of vertebrates to a life on land; that is, some 300 million years ago in the early amniotes (reptiles, birds, and mammals). The main evolutionary advantage was a more sophisticated strategy for making decisions, brought on by an increased need for behavioral flexibility and adaptability in the terrestrial environment. The processing units of neural systems evolved to direct animals either toward what is beneficial for the genes, or away from what is detrimental. The amniote strategy depended on the use of respectively positive and negative feelings as a common currency to evaluate these two options. Feelings require the capacity to feel, which suggests a form of awareness. This may have been the key to the initiation of consciousness. It seems unlikely that a similar strategy is present in other phyla, as these diverged from vertebrates at a stage without advanced neural systems. I present behavioral, physiological, and neurobiological evidence in support of the hypothesis, as well as a strategy for testing it. Grinde B. The evolutionary rationale for consciousness. *Biological Theory*, 7 (2013) 227-236; Grinde B. The Evolution of Consciousness – Implications for Mental Health and Quality of Life. Springer, Switzerland, The Netherlands, 250 pages (2016); Grinde B. Did consciousness first evolve in the amniotes? *Psychology of Consciousness*, 5 (2018) 239-257.

Section: C 12**Status:** Concurrent**Name:** Alexander Egoyan**Email:** alex21cen@yahoo.com**Organization:** Georgian State University of Physical Education and Sport**Primary Topic:** [02.01].....Neural correlates of consciousness (general)**Abstract Title:** Concepts of Elastic Membrane and Elastic Quasi-Membrane as Complementary Tools for Understanding Consciousness and Brain Function

Abstract: The concepts of elastic membrane (EM) and elastic quasi-membrane (EQM) were introduced recently by the author with the purpose to explain the

holistic processes in the human brain related to perception (TSC 2011, 2015, 2020). EMs are holistic, indivisible macro objects which have many interesting features: 1.) they may be used for constructing multidimensional geometry and physics, 2.) 2-dimensional EMs with closed topology may be interpreted as perceiving entities embedded into human brain (only one EM will correspond to the selected organism). This model requires the preferred reference frame, where 2-dimensional EMs are embedded into the 3-dimensional EM of the Universe. In other reference frames EMs become quasi-membranes – EQMs, which are not real objects and may be associated with Platonic values embedded into the space-time geometry. Due to their elasticity each EM (EQM) will contain motionless (only vibrating) and moving parts. In the case of EMs, the accent is made on the motionless parts, while in the case of EQMs – on the moving parts. This means, that when observed in the preferred reference frame, each EM may be considered being in rest just instantaneously changing stationary positions from time to time, while each EQM is moving all the time changing its moving parts. These two concepts give rise to two complementary theories: the first one is phenomenological suitable for qualitative explanation of perception, while the second one is physical capable of explaining real physical phenomena in the brain. According to the first theory the EM squeezes around thalamic nucleus from where it propagates through the neural network to the regions of the cortex responsible for perception and tries to occupy most stable positions around the brain microtubules. It is supposed that our perceptions are encoded into the vibrations of the EM: only squeezed regions of the membrane produce perceptions because the membrane should be dense enough to generate perceptions. Squeezing of a region of the membrane happens at the expense of stretching of the surrounding regions. From the squeezed regions perceptions are projected on the stretched regions. This model explains how vibrations of different neurons of sensory-perceptual cortex give rise to qualia. According to the second theory EQM points to the border between classical and quantum worlds in the brain. Quantum computer seems to be the best tool for processing holistic signals coming from the EQM – it allows simultaneous processing of the signals from different neurons. The two theories will help us to reconcile IIT and ORch OR: the EM stretches and squeezes through neurons with a sufficiently high level of information integration, while the EQM acts as an interface for a quantum computer. According to the first theory we are 2-dimensional EMs, while according to the second theory we are quantum computers based on the quantum computations in the brain microtubules. EQMs are supposed to be useful for understanding the relation between space-time curvature of brain microtubules and qualia. The two theories are complementary and may be combined to find connections between phenomenological and physical models of brain processes.

C 13 - Space, Time and Consciousness 2**Section: C 13****Status:** Concurrent**Name:** Julia Mossbridge**Email:** jmossbridge@sandiego.edu**Organization:** University of San Diego; TILT: The Institute for Love and Time**Primary Topic:** [04.03].....Space, time and the nature of reality**Abstract Title:** A Retrocausal Effect in Photons that Mimics Predictive Anticipatory Activity in Humans

Abstract: Predictive anticipatory activity (PAA; also called presentiment) describes a physiological phenomenon in which randomly-selected and seemingly unpredictable events that arise in the future are strongly correlated with physiological “pre-sponses” that arise prior to the selection of the future events. This phenomenon has been scientifically examined in humans and a few other species since 1978; two meta-analyses and multiple mainstream studies have confirmed the effect since then. The mechanisms underlying PAA are unknown and appear to involve retrocausality. In this talk, Dr. Mossbridge will describe similar results arising from “time-traveling photon” experiments that rely only on a simple student-grade single-slit optical system. In these experiments, 11-second cumulative photon counts are recorded prior to a random decision, based on both a quantum and pseudorandom number generator, determining which of four different durations will be selected for the remainder of the experiment. The results of three such experiments reveal a 5-to-6 sigma retrocausal correlation effect based on a bootstrap analysis. Specifically, the number of photons counted prior to the decision is significantly correlated with the number of photons counted after the decision; crucially, the number of photons counted after the decision differs across experimental durations. Dr. Mossbridge will discuss how this effect can inform our understanding of retrocausality in human consciousness, and our understanding of how time is consciously perceived versus the physical reality of time.

Section: C 13**Status:** Concurrent**Name:** Ronald Gruber**Email:** rgruber@stanford.edu**Organization:** Stanford University**Co-Authors:** Carlos Montemayor; Richard A. Block**Primary Topic:** [03.17].....Temporal consciousness**Abstract Title:** An information gathering and utilizing system (IGUS) robot to solve the ‘two times problem’

Abstract: The two times problem is that of resolving the age-old debate between the physics conception of time and the psychology conception of time. Recent models of human temporal experiences utilize an information gathering and utilizing system (IGUS) to reconcile a specific aspect of that conflict, namely the phenomenon of the past/present/future. As a result, a resolution was obtained for the phenomenon of the ‘now.’ That was the first step towards reconciliation. Further recent changes to the IGUS ‘robot’ have included a modification (‘gadget’) that allows for the emergence of more temporal consciousness, such as the ‘flow’ of time. Here, we expand the usefulness of the IGUS model (‘robot’) into a unique theory of time intended to resolve all the conflicts for the many temporal experiences of manifest time (which includes flow/passage). That view involves two systems (a ‘dual mind’) of temporal experiences: 1) a veridical system that mainstream physics demands, e.g., temporal order, and 2) an illusory system that psychology demands e.g. motion. The key to making this possible was the discovery that the physical parameters of time perception demanded by mainstream spacetime cosmological theories can be found within the brain. They include such a dynamic temporal experiences as completed movement and completed change. They also include the potential for an ephemeral self. The most important ‘gadget’ to the IGUS is that for the illusory, enduring self which begets mental time travel and auto-noetic consciousness. The theory suggests that the veridical system reflects accepted spacetime cosmologies. However, as a result of natural selection an illusory system of temporal experiences developed for purposes of behavioral adaptation. The human fares better with an enduring self, free will and mental time travel. Those are illusory experiences emanating from time illusions that make us human. The intellectual result of the dual system IGUS approach is that the conflict between physical time and psychological time can be resolved. So doing would be in keeping with Richard Feynman’s 1963 anticipation that there must be “a correlation between events in two regions of space – the one inside the cranium and the other elsewhere ‘on the spacetime diagram.’”

Section: C 13**Status:** Concurrent**Name:** Behrouz Raadnasab**Email:** b.radnassab@gmail.com**Organization:** CosmoIntel Inc.**Co-Authors:** Mohammad Ali Taheri; Firouz Payervand; Reza Yazdanparast; Farzad Ahmadkhanlou; Sara Torabi; Farid Semsarha**Primary Topic:** [04.16].....Miscellaneous**Abstract Title:** Introducing the “Mental Body” in Matter based on Experimental Evidence

Abstract: The mind is a concept that has always fascinated and perplexed human beings. Due to the inner and perceptual nature of the mind, its existence is self-evident to humans. However, there are questions that remain empirically unanswered such as why and how it comes into being and what its nature is. Based on most theories of the mind in philosophy, only human beings are considered to have minds. In other theories, the existence of the mind in animals has been proposed. In some of them, the mind has been considered as a universal property of matter. Recent theories have no empirical basis, and scientists have so far found no way to test them other than by turning to philosophy. According to one of the theories presented by Taheri, not only the Mind, as one of the numerous existential bodies of a human being, is not a part of the brain, but the function of the brain is governed and managed by the Mind. The Mind is the software administrator of all the existential dimensions of a human being; it manages all the softwares of the various constituents/divisions of human existence in their entirety, including cellular function and management of the memory, learning, and recall faculties. It will be shown here that Sciencefact is a new window to the empirical proof of the matter mind. Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. The aim of the present study is to investigate the mechanism of the effects of TCFs on the properties and behaviors of materials based on the obtained results in some previous physics experimental designs. In our studies using the Vibrating-

Sample Magnetometer (VSM), the magnetic properties of nickel and alumina samples under influence of TCFs were evaluated. Moreover, in a tensile test, the behavior of ST-37 steel specimens was investigated with and without the effects of TCFs. The results revealed the magnetization behavior of nickel and alumina in room temperature, even three and seven days after termination of the TCF treatment, was equivalent to their behavior in a temperature of about -133°C and 500°C, respectively. While, no low or high temperature effects were observed in the structure of the materials. In addition, the behavior of ST-37 steel specimens under tensile test, even four days after termination of the TCF treatment, was equivalent to the behavior in a temperature range of 600-800°C. Similarly, no high temperature effects were observed in the specimens. According to the results, change in magnetic and mechanical properties of the samples took place without the need to give or take energy or change the microstructure or arrangement of the matter. Based on the existing evidence from these laboratory test results, a novel theory on the TCFs arises: The emergence of different properties and behavior of materials in the presence of the TCFs suggests that matter, in addition to the physical body (its constituent matter and energy), necessarily needs a “mental body”. According to this theory, the mental body of matter comprises the information of each component of the system, the process of formation and all its equilibrium and unbalanced states, and the mental states constructed during the process of formation of matter and its balanced state. The function of the mental body of matter is to maintain the information, to interact with the CFs, to accept new mental states, and also to exhibit behavior appropriate to the new complex mental state. According to this theory, which is completely based on reproducible experimental laboratory results, the effect of the TCFs can be viewed from two distinct aspects: TCFs and Matter. In the former aspect, it is equivalent to the application of one of the mental states in the coordinates of the mind of matter. In the latter aspect, this is equivalent to the occurrence of a behavior corresponding to the nature of matter experienced through evolution.

Section: C 13**Status:** Concurrent**Name:** Akihiro Nishiyama**Email:** anishiyama@people.kobe-u.ac.jp**Organization:** Kobe University**Co-Authors:** Shigenori Tanaka; Jack A. Tuszynski**Primary Topic:** [04.02].....Quantum field approaches**Abstract Title:** Quantum Brain Dynamics and Holography**Abstract:** We aim to describe non-equilibrium hologram memory formations

in Quantum Brain Dynamics (QBD), Quantum Field Theory of the brain. The QBD originated with the monumental work by Ricciardi and Umezawa in 1967 is one of the hypotheses expected to describe the physical mechanism of memory. The concrete physical degrees of freedom in QBD are water electric dipole fields and photon fields. Memory in QBD is ordered patterns of aligned dipoles in the same direction due to the breakdown of rotational symmetry. In addition, holography, a technique to record and reconstruct 3-dimensional images, adopted by Pribram is also a hypothesis to describe brain dynamics. Here, we propose the integration of the QBD and the holographic brain theory. We adopt the Schrodinger-like equations for coherent dipole fields and the Klein--Gordon equations for coherent electric fields in non-equilibrium QBD in 3+1 dimensions. We consider water dipoles and photons around microtubules in the brain as a candidate of the physiological system of memory. We show how ordered patterns of aligned dipoles for holographic memory evolve in time course. We find that ordered patterns of aligned dipoles in memory are amplified from their initial patterns by quantum fluctuations in time scales of tens of ps. We find properties in open systems are significant in memory printing and storage. Holography and QBD will provide a prospective approach for memory formations.

Section: C 13

Status: Concurrent

Name: Margaret Schick

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Organization: Soulful Wellness

Primary Topic: [05.03].....Hypnosis

Abstract Title: Regression Hypnosis as a Tool for Exploration of Chiron (The Wounded Healer) In the Natal Chart

Abstract: Discovered in 1977, Chiron is an icy, small celestial body orbiting the Sun between Saturn and Uranus. Once thought to be an asteroid, Chiron was the first-identified member of a new class of astronomical objects now called centaurs; they typically exhibit the characteristics of both asteroids and comets. They are named after the mythological centaurs that were a mixture of horse and human. In Greek mythology, Chiron (also Cheiron or Kheiron) was held to be the wisest and most just of all the centaurs. In astrology, Chiron in the Natal Chart represents the archetype of The Wounded Healer. It indicates where a person may have healing gifts to offer others as the result of a deep spiritual and/or psychological wound which first must be recognized and healed within the individual. This wound is understood by astrologers to have been passed down to an individual through their ancestral lineage as well as through

unconscious memory from a past life or lives. As the Chiron wound begins to heal within one person, the process of healing is advanced in the collective unconscious. Individuals wishing to explore this unconscious memory may be able to access it through a transition in consciousness catalyzed through regression hypnosis, a healing modality. I regressed 150 clients between November 2020 and December 2021. Exploration of the Chiron wound as represented in the Natal Chart was most often the primary regression experience that I observed in clients, whether or not this was the client's stated intention for their regression experience.

Section: C 13

Status: Concurrent

Name: Donald Mender

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Organization: Yale University

Primary Topic: [04.14].....Quantum theories of consciousness

Abstract Title: The Qualitative Thermofield

Abstract: Emergentism likens the brain's sentience to a thermodynamic macro-observable supervening upon coherent physical micro-states. Yet the emergent macro-properties of statistical physics are all physical, whereas qualia cannot be assumed to be physical without begging questions posed by the Hard Problem and by the causal completeness of physics. One can directly confront such tensions by reinterpreting consciousness not as a physically emergent macro-"thing" but instead as a quantized vacuum, i. e. as both a) the symmetry-broken ground state of merely virtual foam conditioning coherently ordered structure associated with neurophysics and b) Sartrean consciousness as "no [real] thing." The causal completeness of physics requires that qualia have no physically measurable effects, including a) above. Thus, thought-experimental transformations among (e. g. inversions of) one's own first person qualia must leave dynamical laws completely invariant. These and allied unbroken symmetries may configure the semantically holistic origin of phenomenally intrinsic intentionality from pertinent subsets of the permuted totality constituted by all potential relationships among qualia. The symmetries can be made local through generalization of restrictively systematic inter-qualitative transformations, driven by the globally uniform rules of human linguistics, to also subsume transformations among qualia across a panpsychist array of postulated non-human entities (bats, rocks, etc.), untethered to our linguistic species but hypothetically sentient. Resulting local symmetry will generate a phenomenal gauge field with its own intentionally causal structure distinct from and not interacting with physical forces. The following idealization formalizes tension

between 1) the broken symmetry of the brain's ordered structure conditioned by consciousness as a quantized vacuum and 2) the unbroken symmetry of causally complete physics in inter-qualitative relation to consciousness: Let ideal consciousness as "no real thing" be the epistemologically maximal quantum vacuum state ordering brain algorithms able to comprehend the general physical gauge field characterizing all physics in some hoped-for future ontologically maximal TOE. The algebraic group associated with that epistemologically maximal vacuum must be the ontologically minimum subgroup - the minimum quantum vacuum subgroup - of the TOE's ontologically maximum gauge group, whose transformations leave unified dynamical laws unchanged. Then dynamical laws are not invariant but rather vary maximally under inter-qualitative transformations governed by the ontologically minimum, epistemologically maximum quantum vacuum's subgroup. Resolution of the above formal tension between group and subgroup will restore fully unbroken symmetry globally through a linguistic Nambu-Goldstone-like boson and locally through a psychophysical Higgs-like boson. These new symmetry-restoring bosons should differ from those proposed in previous thermofield constructs, which have modeled excitations of the brain's quantum vacuum states as merely mechanistic substrates of quantitative memory transduction without any fundamental incorporation of qualia. Symmetry-restoring bosons as excitations surmounting the explanatory barrier constituted by metaphysically symmetry-breaking fields will restore the quantized Sartrean vacuum state of explicitly qualitative consciousness to full physical symmetry. The new Higgs-like boson in particular should balance energetic books regarding dissipation of coherent symmetry-broken psychophysical order into a symmetrically entropic distribution of qualia across the domain of physics via dishabituation and habituation, which respectively scramble and efface coherent physical correlates of wakefulness.

C 14 Healing and altered states:

Section: C 14

Status: Concurrent

Name: Marjorie Woollacott

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Organization: University of Oregon

Co-Authors: A. Shumway-Cook

Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: Neural correlates of mystical experience during meditation, psilocybin and NDE, and associated shifts in narrative framework

Abstract: Despite their different etiologies, research suggests that three types of spiritually transformative experiences (STEs), near-death experiences

(NDE), psilocybin experiences, and meditative experiences of expanded awareness appear to have attributes in-common with a broad range of mystical experiences, and often result in a profound and lasting transformation in the lives of experiencers. Research from our own lab and that of others suggests that all three types of STEs appear to share some common neural correlates, including a reduction in neural activity in the major centers of the brain, specifically the Default Mode Network (DMN). The DMN is considered the foundation of the egoic stories and narrative framework that underlie the meaning one associates with oneself and the world in which one lives.^{1,2,3,5} In addition, research has shown that among meditators there is a concomitant increase in activity of the Executive Attentional System (e.g., anterior cingulate cortex), hypothesized to be associated with maintaining reduction in the DMN activity.⁴ This presentation discusses the evidence supporting the commonalities in the three types of STE's including: 1) first-person data from individual case studies, 2) data from controlled clinical research studies on their transformative effects, as well as in 3) neurophysiological data correlated with the occurrence of the STEs themselves. We propose that during these STEs, neural activity in areas of the brain that normally acts to filter awareness is reduced, thus opening the capacity to an experience of expanded awareness and altered states of consciousness. In addition, when DMN activity is diminished, it creates the possibility for a transformation in the underlying framework (worldview) used to interpret, or give meaning to, anomalous experiences. Finally, we suggest that the extent to which transformation in worldview occurs, is partly dependent on the rigidity of the narrative framework previously constructed within the egoic default system. If the experiencer's framework is grounded in rigidly held beliefs, transformation may not occur, or alternatively, may only occur gradually as other experiences continue to erode the previous narrative's hold on the individual's worldview. References 1. Barrett, F. S., & Griffiths, R.R. (2018). Classic hallucinogens and mystical experiences: Phenomenology and neural correlates. *Current Topics Behavioral Neuroscience*, 36, 393–430. 2. Brewer, J. A., Worhunsky, P. D., Gray, J. R., Tang, Y. Y., Weber, J., & Kober, H. (2011). Meditation experience is associated with differences in default mode network activity and connectivity. *Proceedings of the National Academy of Sciences USA*, 108(50), 20254–20259. 3. Greyson, B. (2014). Congruence between near-death and mystical experience. *International Journal for the Psychology of Religion*, 24, 298–310. 4. Schoenberg, P. L. A., Ruf, A., Churchill, J., Brown, D. P., & Brewer, J. A. (2018). Mapping complex mind states: EEG neural substrates of meditative unified compassionate awareness. *Conscious and Cognition*, 57, 41-53. 5. Woollacott, M., & Shumway-Cook, A. (2020). The mystical experience and its neural correlates. *Journal of Near-death Studies*, 38, 3-25.

Section: C 14**Status:** Concurrent**Name:** Helane Wahbeh**Email:** hwahbeh@noetic.org**Organization:** Institute of Noetic Sciences**Co-Authors:** Paolo Speirn; Garret Yount**Primary Topic:** [05.09].....Parapsychology**Abstract Title:** Extended Perception Corroboration: A Pilot Study with Energy Medicine Practitioners

Abstract: This study aims to evaluate extended perception by observing energy medicine sessions. Six expert Reiki Masters were the energy medicine practitioners and gave 30-minute sessions to 40 participants. Participants had one or more of the following conditions: acute physical injury (such as broken bone), mental impairment (memory issues), and psychological symptoms (anxiety and/or depression). Six people vetted for extended visual perception made observations before, during, and after each session using quantitative and qualitative measurement tools. Participants and Reiki Masters also recorded their session observations. Data were analyzed for similarities: 1) within-perceivers for the same sessions, 2) between the Reiki Master and perceivers, 3) between the participant and Reiki Master, and 4) between the participant and perceivers. Participants' well-being outcomes and potential predictors were also evaluated. The participants' well-being improved from the sessions, maintaining gains one week later ($F(3,159) = 12.3, p < 0.00005$; Baseline - 55.7 ± 18.8 , Before - 58.9 ± 18.1 , After - 73.2 ± 16.2 , One-week later - 64.3 ± 20.3 ; effect size is 0.61, 95% confidence interval [0.39 to 0.59]). Post-hoc analyses revealed significant differences from baseline to post-session and baseline to after-session. The perceivers generally perceived similar information as noted in free-form drawings and free text. Perceivers' perceptions about the participants' health were highly corroborated and matched participants' self-report. No predictors revealed themselves, supporting the tradition that Reiki applies to anyone regardless of health condition. Furthermore, the symbols perceivers noted were meaningful to the participants, but perceivers did not see the same symbols nor ascribe the same meaning to them that the participants did. Future studies are needed to refine the methods developed here to continue the exploration of extended perception, its validity, and practical application in healthcare.

Section: C 14**Status:** Concurrent**Name:** Eric Garland**Email:** eric.garland@socwk.utah.edu**Organization:** University of Utah**Co-Authors:** Adam Hanley; Justin Hudak**Primary Topic:** [05.02].....Meditation and mindfulness**Abstract Title:** Mindfulness elicits self-transcendence and endogenous theta stimulation to reduce opioid misuse: Results from a Randomized Controlled Trial

Abstract: Background: Some of the most pressing "diseases of despair" afflicting modern society, including chronic pain and addiction, result in maladaptive self-referential processing in the brain and disrupt the capacity to experience pleasure and meaning from natural rewards in the socio-environment. The current opioid crisis is a case in point: prolonged opioid use in the context of chronic pain and distress can blunt positive emotions, distort the sense of self, and thereby compel opioid misuse as a means of preserving a dwindling sense of well-being. Mindfulness meditation-based therapies may address this malady by inducing self-transcendent states of consciousness imbued with the qualia of affective bliss. Here test this hypothesis by examining relations between EEG responses, ratings of self-transcendence, and opioid misuse outcomes in patients participating in a full-scale, NIH-funded randomized clinical trial (RCT). Methods: Opioid misusing chronic pain patients (N=250) were randomized (1:1) to 8 weeks of Mindfulness-Oriented Recovery Enhancement (MORE) or a supportive group (SG) psychotherapy control delivered in a primary care setting. Pre- and post-intervention, patients completed a mindfulness meditation task in the laboratory while EEG was recorded. Self-transcendence and bliss were measured with the Nondual Awareness Dimensional Assessment (Hanley, Garland, & Nakamura, 2018). Opioid misuse was assessed through 9-month follow-up. Results: Patients randomized to MORE evidenced significantly less opioid misuse ($F=4.89, p=.028$) and significantly greater self-transcendence ($F=.10.84, p=.001$) than the SG. Patients in MORE also evidenced significantly greater increases in frontal midline theta power ($F=8.56, p=.004$) and coherence ($F=4.60, p=.035$) during meditation than patients in the SG. Increases in frontal midline theta coherence were associated with greater self-transcendence ($r = .24, p = .02$) and bliss ($r = .28, p=.009$), and mediated the effect of MORE on decreased opioid misuse ($B = -.92, SE = .50, 95\% CI = -1.96, -.02$). Discussion: Although frontal midline theta is well-established as a biomarker of cognitive control, frontal midline theta also increases during states of flow, in which self-referential processing is suspended and transcended during deep cognitive absorption with ongoing experience. Hypothetically, meditative self-transcendence might produce a potent experience of natural

reward and stimulus-independent happiness, driven by endogenous theta stimulation of the prefrontal cortex, which may in turn facilitate restructuring of reward processing in addiction.

Section: C 14

Status: Concurrent

Name: Corina Greven

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Organization: Radboud University Medical Centre

Co-Authors: Nienke M. Siebelink, Susan M. Bögels, Anne E. M. Speckens, Jan K. Buitelaar

Primary Topic: [05.02].....Meditation and mindfulness

Abstract Title: Mindfulness-based intervention for children with ADHD and their parents

Abstract: Background: Attention deficit hyperactivity disorder (ADHD) is characterised by developmentally-inappropriate inattention and hyperactivity-impulsivity shown across multiple settings. Next to coming with positive traits such as creativity, ADHD symptoms can come with serious consequences and impairment. A relatively novel approach in health care is mindfulness, the trainable ability to focus attention on experiences in the present moment, without judgment. Mindfulness shows promise in ADHD because it focuses on training aspects of self-control such as focusing attention, controlling impulses and regulating emotional responses - skills that children with ADHD often struggle with. What is more, mindfulness training can be given to children and parents simultaneously, as parents of children with ADHD often have elevated psychological problems themselves and parent-child relationships are impacted. Family mindfulness-based intervention (MBI) for child ADHD targets child self-control, parenting and parental mental health. However, its effectiveness remains unclear. Methods: Here results are shown from MindChamp, a pre-registered randomised controlled trial comparing an 8-week family MBI as an add-on to care-as-usual (CAU) (n = 55) with CAU-only (n = 48). The focus is on a group of children with ADHD aged 8–16 years with remaining symptoms after receiving CAU, and who enrolled together with a parent. Primary outcome were parent-rated child self-control deficits post-treatment. Secondary outcomes in the children included ADHD symptoms, other psychological symptoms, well-being and mindfulness, rated by self, parent or teacher. Secondary outcomes in the parents included self-ratings of ADHD and other psychological symptoms, well-being, self-compassion and mindful parenting. Assessments took place at post-treatment, 2- and 6-month follow-up. Results: ANCOAS showed that there were no statistically significant differences between the MBI+CAU and CAU-only

groups on the primary outcome ($d = 0.27$, $p = .18$). However, post-hoc analyses at individual level revealed that significantly more children in the mindfulness group improved reliably on self-control deficits post-treatment relative to the control group (32% vs. 11%, $p < .05$, Number-Needed-to-Treat = 4.7). Child ADHD symptoms were significantly reduced post-treatment, but only some of these effects remained at follow-ups. Post-treatment group differences on the other secondary outcomes in children were consistently in favor of MBI+CAU but were mostly non-significant; there were no significant differences at follow-ups. In the parents, significant post-treatment improvements were revealed with respect to their own ADHD symptoms, well-being and mindful parenting. At follow-ups, some significant effects remained (ADHD symptoms, mindful parenting), some additional significant effects emerged (self-compassion, other psychological symptoms) and others disappeared or stayed non-significant. Conclusions: To summarise, no group-level differences were found for family MBI+CAU compared to CAU-only on the primary outcome of child self-control problems post-treatment. However, when looking at an individual level, more children in the MBI+CAU group reliably improved on self-control. For parents, effects were larger and more durable. Results are interpreted in the light of qualitative research interviewing the families participating in the MBI that revealed acceptance of child behaviours, parental non-reactivity and improvement of parent-child relationships as central to treatment effectiveness. When CAU is insufficient for ADHD, a family MBI may be a valuable addition.

Section: C 14

Status: Concurrent

Name: Adam Hanley

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Organization: University of Utah

Co-Authors: Eric L. Garland

Primary Topic: [05.02].....Meditation and mindfulness

Abstract Title: Self-transcendence predicts better pre- and postoperative outcomes in two randomized clinical trials of brief mindfulness-based interventions

Abstract: Objectives: Self-transcendent experiences have been infrequently examined by modern psychological science, despite their purported healing potential. The two studies reported here were designed to test whether surgical patients could achieve self-transcendent states during a brief mindfulness training and whether the realization of self-transcendent states during mindfulness training predicted better clinical outcomes. Methods: Two, single-site, parallel group, randomized clinical trials (RCTs) involving

knee and hip replacement patients were conducted. In Study 1 (N=196; trial registry: NCT03665727), patients were randomized to a preoperative, 15-minute, mindfulness of breath or cognitive-behavioral pain psychoeducation intervention. In Study 2 (N=118; trial registry: NCT04520958), patients were randomized to a preoperative, 20-minute, mindfulness of breath, mindfulness of pain, or cognitive-behavioral pain psychoeducation intervention. Self-transcendent state and acute clinical symptomology was assessed immediately before and after the preoperative interventions. Postoperative outcomes were also assessed. In study 1, patients' physical function was assessed at their 6-week, postoperative visit. In study 2, pain intensity, pain unpleasantness, and opioid use in the first month after surgery was tracked. Results: A brief MBI was able to induce self-transcendent states in a general sample of knee and hip replacement patients (Study 1: $F= 36.79$, $p<.001$; Study 2: $F= 7.25$, $p=.001$). MBI-induced self-transcendent states were associated with immediate decreases in pain intensity (Study 1: $\beta=-.26$, $p=.001$; Study 2: $\beta=-.30$, $p=.004$), pain unpleasantness ($\beta=-.21$, $p=.008$), and anxiety ($\beta=-.36$, $p<.001$) immediately after the preoperative intervention. The depth of self-transcendent states achieved during meditation before surgery predicted better postoperative physical function ($\beta=.21$, $p=.033$) in Study 1 and less postoperative pain intensity ($\beta=-.35$, $p=.016$) and pain unpleasantness ($\beta=-.32$, $p=.019$) in Study 2. Conclusions: These two studies suggest self-transcendence is a therapeutic mechanism that is accessible to a general sample of surgical patients. These two studies also indicate that self-transcendent states can arise during a single, brief, mindfulness training session, and the emergence of a self-transcendent state likely signals reductions in immediate clinical symptomology and, possibly, longer-term health benefits.

Section: C 14

Status: Concurrent

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Co-Authors: Upadhyay, Preeti; Narayanan, Shilpa; Khera, Tanvi; Kelly, Lauren; Balachundhar, Pavitra; Mathur, Pooja; Shanker, Akshay; Novack, Lena; Sadasivam, Senthil; Subramaniam, Balachundhar

Primary Topic: [05.02].....Meditation and mindfulness

Abstract Title: Impact of Routine Isha Yoga Practice on Stress and Well-being during the Covid-19 pandemic in the United States

Abstract: Introduction: With nearly 195 million cases and 4.2 million deaths reported by the World Health Organization as of July 27, 2021, the COVID-19

pandemic has been a significant stressor worldwide. Measures taken to restrict disease transmission have led to reports of increased psychological distress and decreased overall well-being. Benefits of yoga practices include improved sleep quality and reduced stress. We hypothesized that regular yoga practice during the COVID-19 pandemic will reduce stress and improve mental and physical well-being. Methods: In this randomized controlled trial, the effects of yoga practices were compared between an observational arm of seasoned yoga practitioners and two controls (non-yoga practitioners) of the same age, gender, and neighborhood. Following randomization, one control group (active comparators) was taught a 3-minute yoga practice to perform twice a day and the other control group (placebo comparators) read or remained idle for 15 minutes a day during the 12-week study period. Participants responded to 8 validated neuropsychological scales assessing stress (Perceived Stress Scale, PSS), anxiety and depression (PHQ-4), joy predisposition (DPES-Joy Subscale), mindfulness awareness (MAAS), resilience (BRS), mental well-being (WEMWBS), and post-traumatic growth (PTGI) at 3-time points. PSS was defined as the primary outcome and P values ≤ 0.05 were considered statistically significant. Results: Of the 6,892 participants included in the study, there were 1,177 active comparators, 1,161 placebo comparators, and 4,554 yoga practitioners. Among the yoga practitioners, 57% were employed full time and 20% part-time compared to 64% and 14%, respectively, for both control groups. At baseline, the median PSS score for active and placebo comparators was 16 (IQR 12, 21) compared to 11 (IQR 7,15) for yoga practitioners ($p<.001$). At 6 weeks, these scores were 12 (IQR 8,17), 14 (IQR 9,18) and 9 (IQR 5,13), respectively, ($p<.001$). At 12 weeks, these scores were 11.5 (IQR 8,16), 13 (IQR 8, 17) and 9 (IQR 5,13), respectively, ($p<.001$). At all time-points, yoga practitioners had lower PSS scores than both control groups.

Section: C 14

Name: Hidehiko Saegusa

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Abstract Title: Transmission of consciousness through visual gaze

Abstract: Transmission of consciousness, awakening and enlightenment through visual gaze between the eyes of a 'Master teacher' and spiritual student has been described in ancient Vedic, Buddhist and Japanese texts. The transmission technique has been kept secret and handed down from Masters only to 'deeply awakened' disciples. In my 33 years of spiritual practice , I learned the transmission technique.I'm going to show scientific evidence of transmission of consciousness. Here are 'testimonials' from people who received my transmission:

" I only felt gratitude and was deeply touched. Tears were unstoppable, and

deep healing happened.” “...when Hide came close to me... he transmitted intense energy from top of the head to my toes. I was really stunned.” “I felt I was surrounded by blissful energy, and Joy and Love were overflowing from inside of me and I was really moved.” “ I saw a very bright light and felt overwhelming blissful energy.” Some people have ecstatic experience, sometimes for many days. Many years of practicing the techniques has allowed me to “see” the future (read other people’s mind), and make decisions accordingly, enabling me to be very successful in business.

POSTERS - EXHIBITORS - ART - TECH HEALTH - DEMOS

Wednesday, April 20 - 5:00 – 7:00 PM MST

Friday, April 22 - 5:00 – 7:00 PM MST

R = Remote

POSTERS BY SECTION, LAST NAME

1.0 PHILOSOPHY

T. Roberts, A. Aris, J. Sugar, L. Vucolova, J. Strozier, Szabo, RC Schriener, (R) J. Naskov, J. James, D. Trussell, J. Beck, M. Jawer, A. Rangarajan, K. Perkins, M. Baranowski, J. Olson, C. Acosta, G. Hodes, P. Hurren, M. Sundaram, N. Swami, M. Chakraborty, S.S. Pokharna (R,) K. Noble. P. Soni, T. Kovacs, J. Camacho, F. Oyarzun

Section: 1.0

Status: Poster

Name: Tim Roberts

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Organization: (retired, ex-CQU)

Primary Topic: [01.01].....The concept of consciousness

Abstract Title: The Even Harder Problem of Consciousness

Abstract: The problem of subjective experience remains a major topic of debate amongst researchers in both the philosophy of mind and the foundations of artificial intelligence. David Chalmers has referred to this as The Hard Problem of Consciousness, since subjective experience appears to resist most attempts at a functional description. Theories involving 60Hz oscillations in the cerebral cortex, Bose condensates, and quantum collapse in microtubules have all been proffered as offering potential solutions to The Hard Problem, while some other researchers seem eager to retain an essentially dualistic world-view. This paper proposes an even more fundamental problem, potentially disturbing to both sides of the materialist / dualist divide: given that conscious organisms exist in the world, how can it be that one of those organisms happens to be you?

Section: 1.0

Status: Poster

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Organization: International Association of Process Oriented Psychology

Primary Topic: [01.01].....The concept of consciousness

Abstract Title: Process Consciousness, Mind, Matter, and The Living Cosmos

Abstract: The word 'consciousness' in the English language is a noun, connoting an object. Immediately we are caught in a grammar and logic of objecthood. Conceiving of consciousness in objectual terms, however, is a fundamental error. By asking not “What is consciousness?” but “What does it mean to be conscious?” we de-nounify consciousness and recognize that it is the process of being conscious, rather than an object called 'consciousness' that we seek to understand. There is in actuality no such thing (at least in the objectual sense of 'thing') as 'consciousness', there is only 'being conscious'. From this perspective, there are no actual 'objects' or 'states' of consciousness, only 'conscious beings'. Moreover, there are in actuality no such 'things' as 'mind', 'matter', 'space' and 'time', only mental, material, spatial and temporal processes. Going further, what we may think of as independent mental, material, spatial and temporal processes are simply different aspects of unified conscious process. By analogy, interpreted processually, by combining space and time into spacetime, special relativity unifies spatial and temporal processes into expressions of a unitary phenomenon of spatio-temporal flux. Similarly, in general relativity the morphing of spacetime due to mass (the principle of gravitation) unifies spatio-temporal and material processes. Only in the abstract does it make sense to talk of 'space', 'time' and 'matter' as separate 'entities'. In actuality there are only unified physical processes with interdependent spatial, temporal and material aspects. Space is not static and matter is not objectual, the spatial and the material are, in essence, co-arising aspects of dynamic temporal processes. My presentation extends this perspective to posit that, just as all physical processes are simultaneously spatial, temporal and material, all conscious processes are simultaneously physical and mental. Matter is unthinkable without mind, just as space is unthinkable without time. Conversely, mind does not matter or materialize independent of physical processes. The mental and the physical are interdependent parts of unified conscious experience, and the concepts of 'mind' and 'matter', rightly understood, are theoretic elaborations on the nature of our mental and physical experience, not reductive explanations thereof. By carefully deconstructing 'consciousness' in terms of what it means to be conscious, I will present a cosmology in which 'all being is conscious being'. In this conceiving, 'to be is to be conscious' and we inhabit a living cosmos as conscious beings participating in creating all

conscious being, just as all of conscious being participates in creating every interacting being.

Section: 1.0

Status: Poster

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Organization: University of Southern California and Cal State University, Long Beach

Primary Topic: [01.01].....The concept of consciousness

Abstract Title: Interpersonal Consciousness, Buddhist Cosmology, and Information Theory

Abstract: Trying to solve the Hard Problem from inside the brain is, I believe, an impossibility. If we look deep inside the brain, we find areas that demonstrate effects of consciousness or structures that are necessary for consciousness to flow, but magnify as we may, we will never “see” consciousness as an entity. The last few decades have seen several attempts to develop an "interpersonal theory" of human psychology. This had already been done by Sociologist George Herbert Mead, articulated in his posthumous volume *Mind, Self and Society* in 1934. Societies develop first, then notions of "Mind" and "Self" emerge. We learn the language of self-talk from parents and playmates, and language, in all its nuance, is embedded in culture. The Self exists part of an “Individual Mind,” so it too, depends on Society. But where does consciousness come from, and what does it do? Certainly, human consciousness acts through the mechanisms of the body, but is not identical with the body. The only solution to nested paradoxes is that consciousness is fundamental and not limited to the body. This is the Buddhist perspective. If we closely examine any “separate object,” including ourselves, we see that it is in constant flux with other objects and the environment. The object qua object in Buddhism is a useful and persistent illusion. What we sense is not, however, “objective reality.” No existing “thing” arrives in (or leaves) this world completely independently. This is not a trick of language, but a set of precepts developed over two thousand years of practice, dialogue, and intimate instruction. (Or ten thousand, if we include Tibetan traditions that predate Buddhism by some tens of thousands of years.) Because human consciousness animates a physical body, consciousness must, therefore, have fundamental existence. Otherwise, it could not interact with the physical world--beginning with the neurochemicals that drive brain functioning). The mathematical model that best describes the way we'd like consciousness to behave, is Information Theory. One clear definition of Information Content is “The degree to which new information is Surprising. Thus, redundant information adds no content, while unusual, highly unlikely information adds much. Also, one consciousness can affect many without loss of fidelity, in

the same way that information can be replicated, only affected by signal transmission—in the same way that consciousness must “travel” via signals. Therefore, it is reasonable that such laws as Consciousness may obey, should be related to processing information. Recently, physicists have suggested that the most fundamental construct in the universe is information. If this is true, then consciousness should have a few fundamental principles, like Newton’s Laws or Quantum Mechanics, but also incorporating Thermodynamics, especially the Second Law, Entropy increases. Increasing entropy implies an expanding universe, and more germane here, indeterminacy—unlike both Newton’s Laws and Quantum Theory. Boltzmann’s word “Entropy” comes from the German for “Evolution,” and certainly the expressions of consciousness appear to evolve.

Section: 1.0

Status: Poster

Name: Ludmila Vucolova

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Primary Topic: [01.01].....The concept of consciousness

Abstract Title: How a strictly physical universe gave rise to consciousness.

Abstract: By integrating a chain of theoretical assumptions with particular intrinsic links among them, we speculate that consciousness, or a state of awareness, is an inner, subjective, self-generated phenomenon that emerges from three-phased energy-driven interaction of the organism with its environment via the exercise of sensorimotor agencies. The three phases of interactions of the organism’s sensory (S) and motor (M) agencies with its environment – the entities of sensory stimulation X and Y (the things of objective measure) – give rise to a realization (a mental state) of sameness between X* and Y* (the things of subjective measure), where Y* is a self-produced entity generated by an agent’s motor repertory M. This realization constitutes a conscious experience and manifests as a state of awareness, a thought. X is an entity in the outside world which has properties of matter, for example, shape, length, position, motion, time, mass, and charge. Y is an entity that has properties of matter, specifically that of motion – movement of the speech articulators. Consequently, two physical entities – the things of subjective measure X* and Y*, previously unassociated, became a mental pair, and the physical properties of phenomenal distinction (e.g. color, shape, motion) of X* are prescribed to Y* (a sound/ word). This event gives rise to a new form of existence for X* as Y* in a subjective mind of an agent, and Y* can substitute for X*. It enables the translation of physical stimulus X* into symbolic representation Y*. This experience sets the stage for commonality, a mutual understanding of the event; each participant owns the content of experience and has a first person’s perspective. This theoretical account introduces key elements of

the construct involved in the dynamic interactions that generate a conscious experience and suggests how they interact and are materialized in the structure of the brain. It demonstrates the different neural mechanisms within each phase of experience, and the different manifestations of the event, such as awareness, a thought, perception, comprehension, and a mental image. It provides vital insights into the various intrinsic aspects of phenomena: embodiment, third/ first-person accounts, mind reading, phenomenal and access consciousness. This theory postulates that the proposed principle of interaction of an organism with its environment is fundamental and extends to the all systems of communication, those with and without sensory-motor deficiencies. It reveals the basic principles that underlie the design and diversity of structural models developed across diverse modalities of sensory-motor systems and the hidden unity underneath the systems. It explains how the principle of diversification within the sensory system modalities, submodalities, and sub- submodalities can account for a multitude of properties of various phenomenological distinctions, numbered in the millions. Regardless of the type of motor articulators (the tongue, lips, jaw, fingers and hands) involved in generating of arbitrary signs (words, visual signs, and tactile signs and written), their motions have a common feature – a change in the physical position in three-dimensional space and we can extend Plato’s thought, that consciousness and language are written in the characters of geometry. We can conclude that consciousness arises from the complex processes of interaction of an organism with its environment and a strictly physical universe gives rise to consciousness.

Section: 1.0

Status: Poster

Name: John Strozier

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Organization: SUNY Empire State College --- Professor emeritus

Primary Topic: [01.01].....The concept of consciousness

Abstract Title: Subjective Perspectivity, Intentionality, and Qualitative Character. John Strozier (Professor emeritus; Science, Mathematics, & Technology; SUNY Empire State College, Saratoga Springs, NY.)

Abstract: Consciousness is: looking outward (1. Subjective Perspectivity) at something else (2. Intentionality) with subjective feeling (3. Qualitative Character, Qualia). The first two are strongly suggested by the Reflection Principle (Strozier, (201)). As yet, Qualitative Character cannot be explained, but we present some ideas. First, a brief description of the Reflection Principle: a) Inputs from the senses as neural spikes feed forward into the brain that builds various neural representations/memory of the sensory world over time, reflecting the different

aspects of those inputs. b) These neural representations are the objects of neural cognitive functions that generate efferent signals to the muscles and organs to do something. c) Neural projection operators generate outgoing (recurrent) neural signals that interact with those neural representations. These outgoing signals move back towards their sensory source generating the sensation of "what it is like" (Nagel (1974)) by scanning, interacting, reaching out in a subjective, first-person mode. The sensory sources thus are the objects of subjective consciousness. d) The outgoing projected neural signals also interact with the incoming sensory neural signals to generate differences that are either negative feedback to correct, or positive feedback to emphasis, those neural representations. By generating outgoing neural signals from the incoming neural signals, the Reflection Principle point of view is egocentric and outward, which is exactly the subjective point of view for both subjective perspectivity and intentionality. What remains is Qualitative Character (qualia); the phenomenal feeling or sensations of an experience, but not the explicit content. Feelings would include touch, pain, pleasure, etc. generated as a reaction to stimuli, current and historical. We suggest that subjective feelings are due to chemical/ physical unbalances as off-sets in the body from normal set-points. The origin of set-points comes from both biological evolution and learned experiences. How feelings, as off-sets, are expressed phenomenology to conscious organisms through neural action in the brain remains a mystery whose possible solution awaits greater knowledge of both learning and detailed phylogeny of one-celled animals to present-day conscious organisms. The centrality of subjective experience by a conscious organism A notes that all A knows (except for innate actions) is through external or internal subjective experiences. If the experience of B by A can be reported, then B can be described objectively in third person by the sum over many experiences analyzed as in Science (Eq.1). We argue that, except for qualitative character, which can only be reported indexically and/or by comparison (the color, blue; pain, dull; etc.), all conscious experience of B is reportable if attended to (subjective consciousness focused and sweeps over B), and thus can be objectively analyzed. Perhaps it is all semantics: objective described objects experienced by an individual is recorded by that individual as subjective experience. My experience is subjective, for others after report and analysis, objective. Eq. 1: $3rd(B) \sim G \sum_i (R1st.i) B$: where \sum_i denotes the sum over i of $(R1st.i)$, reportable first-person subjective experience of B; and G is the operator that analyzes the reported experiences.

Section: 1.0

Status: Poster

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Primary Topic: [01.01].....The concept of consciousness

Abstract Title: The philosophical approach to and the basic conditions of consciousness based on The Theoretics by Balázs Török-Szabó

Abstract: The term conscious and consciousness is widely used and interpreted in many different ways. Numerous disciplines study and research it, including philosophy among others. It also appears in everyday situations, having different interpretations, so there is reason to believe that it is something that preoccupies people and may have significance. Defining consciousness can bring us closer to understanding our relationship with reality and can therefore provide a basis for further scientific research, methods and tools, but can also provide a whole new basis for attitudes towards everyday life in the ordinary sense. In researching the process of development, we have come to the point where development has been defined as a conscious change. To make this process understandable and clear, Balázs Török-Szabó have set up a comprehensive model of the functioning of the human intellect — this model can be called the anatomy of conscience in some respects. In this model one will find a description of conscience, man's relationship to reality and conscience, from experience through thinking to will and action. Based on our research results, we have come to the conclusion that consciousness means a relationship with the conscience, that is, when attention is directed to the conscience. It is a process, a constantly changing movement. The extent to which one is conscious means, on the basis of these, the extent to which one's attention extends to one's own conscience. If it is fully extended, then the individual, through himself, himself actually experiences reality and its possibilities. Independence and orderliness are the two basic conditions for awareness. The coexistence of the two factors is also necessary - in most cases both are present to some extent in practice - but the most important thing is for the two to be in balance. Consciousness therefore is a balance of independence and order. From the individual's point of view, development can begin if this balance exists.

Section: 1.0

Status: Poster

Name: Roger Christan Schriener

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Primary Topic: [01.01].....The concept of consciousness

Abstract Title: Consciousness Conceived: In the Armchair, in the Wild, and in the Child

Abstract: How do the concepts of consciousness that are discussed by scholars compare with those of non-philosophers, including children? And what about animals? Do they have rudimentary notions about topics such as consciousness, experience, selfhood, and mentality? I will contend that some philosophical conceptions of experiential phenomena are closely related to the unsophisticated concepts of animals, and in fact are built upon an animal platform. Most would agree that higher animals such as dogs and primates have sensory experiences. I will argue that in such creatures, sensory experiences are accompanied by certain kinds of cognitions, including concepts of the identity and nature of perceived objects. These cognitions may well be conscious, and certainly influence the creature's conscious states. In developing this theme, I will discuss issues such as the following. (1) Externalism and internalism: Many say that folk philosophy is naturally externalist, taking perceptual experiences to be the external objects we perceive. It may also seem that animals treat perceptions of objects as items in the external world. That is true in some respects, but I will argue that this externalist construal is provisional and intermittent. In animals, children, and academicians as well, there is a complex interplay between taking experiences to be outside of the experienter and taking them to be internal (or rather, to be "non-external.") (2) Self-intimation: Some say that experiences are self-disclosing. In some deep sense they are known simply by occurring, without being accessed by next-order epistemic states. If this is so, are animal experiences also self-disclosing? Does this mean that on some level animals know their own experiences in the same way as philosophers of mind? (3) David Chalmers' "hard problem" of consciousness: Suppose we had a completed scientific understanding of animal minds. Would that fully explain their consciousness? Or would scientific information about them leave their consciousness mysterious, so that the full story of their inner life must be more than physical? Are zombie zebras conceivable, in principle? The paper will conclude by inviting questions and comments about the relationship between sophisticated philosophical concepts and the untutored cognitions of beasts and schoolchildren.

Section: 1.0

Status: Poster

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Primary Topic: [01.01].....The concept of consciousness

Abstract Title: Consciousness, Self-Consciousness, Mind-Clear Difference

Abstract: There is a difference between Non-Manifested Consciousness, Manifested Consciousness, and Individualized Consciousness. The Non-Manifested Consciousness is inconceivable by the Mind. Manifested Consciousness is what everyone thinks about when they talk about consciousness, and it is not the same as the Individualized Consciousness. We posit that Individual Consciousness outlives the brain and body after physical death. The concept of INDIVIDUAL is an important one. The word "individual" means one and indivisible (Latin: individuo). An individual cannot be divided into constituent parts, nor is it a part of something else. It is an individual who has consciousness. It is not the mind, it is not the brain, and it is not the body. We also call it 'Self Consciousness' (hereinafter referred to as SC). While we are alive the mind is under the influence of the brain and SC. After we die, the mind is under the influence of SC only. Also, as what is being created in the mind influences the brain, so the body influences the mind. Mental conceptions have their physical basis in the body and brain while we are alive. After we die the mind separates from the brain and attaches only to SC. It is the consciousness that some call the soul. A positive feature of the mind is that it provides us with a good indirect way of connecting with others. The mind serves us a multitude of information as a result of interaction with the environment. The brain is very complex, but it is not the place where consciousness arises, also, it is not the place where the mind arises. A very important fact is that Consciousness and SC are not the minds. To put this challenge in perspective, it is important to point out that the only thing any one of us truly knows is to exist in our own consciousness. What we call "the external world" is a model constructed in our minds. While we live within our bodies, the brain, mind, and consciousness are inextricably connected through SC. Different states of mind affect the brain and the body, and these states (which take place through mental activities, five-sensory cognitions, feelings, moods,) return "information" to the brain. When the brain has damaged the manifestation of consciousness through that brain is difficult or impossible. Consciousness is not the one being damaged, but the physical manifestation of consciousness in the form of physical communication and contact with the environment. The mind and body are connected to the brain through mental activities during life. It is most clearly seen through

psychosomatic diseases, which are clear evidence of the influence of the mind on the body. We also have some evidence that the brain changes during meditation. Examples are states of consciousness such as enlightenment, the experiences of mystics, the deep spiritual experiences, etc. The research has proven that consciousness, through its deep activity, causes changes in the brain that can be detected by devices such as fMRI, etc. That is a situation where consciousness affects the brain.

Section: 1.0

Status: Poster

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Primary Topic: [01.01].....The concept of consciousness

Abstract Title: The Grand Operating Design Theory, The Brain Battery and the Hard problem of Consciousness

Abstract: After 70 years of intense research, the scientific community has developed a massive amount of knowledge, but very little understanding of some of the most basic questions of Life. Based on currently available theory, there is no explanation of how the brain really works! What is consciousness? what makes a thought? •Why do we need sleep? •What is a dream? •How does stress make us sick? •How do hormones work? •What makes us age? •What makes Life “Go”? These questions have been unanswerable using prevailing medical theories that are based primarily on the “synapse” and the reuptake of neurotransmitters. The answers to these questions become clear however, by following the laws of physics and the logical flow of energy from the highest energy found in the neurotransmitters to lower energy levels down the cascade The Grand Operating Design is a new look about the chemistry and energy flow in the brain The Grand Design also describes a new way to look at the structure and function of the brain as a whole. To explain the physiology of Consciousness, we must have a better understanding of the energy required to provide this critical function. The Theory recognizes that acetylcholine(+) is created in the sensory organelle and provides the energy for sensory input This energy is transmitted to the brain, the received and stored by the reticular activating system. Part one: If we keep the laws of thermodynamics and conservation of energy in mind, the energy of acetylcholine will be delivered in a steady flow and used to create all the neurotransmitters at "production nuclei" and send them up into the Brain. This portion of the Chemo-electric Engine is composed of four different enzymes that act as energy pumps that concentrate energy onto the negative neurotransmitter molecules (NE, DA & SER). The

“Chemo-Electric engine” of the reticular system converts Acetylcholine to Acetic Acid (with Choline removed) and then in a series of steps recharges Biopterin, which, in turn, pushes creation of the negative neurotransmitters directly and an equal amount of Acetylcholine indirectly. <https://grandoperatingdesign.com/chapter-5-theory-or-the-chemoelectric-engine/> The Hard Problem of consciousness: <https://grandoperatingdesign.com/chapter-9-concepts-of-consciousness-and-brain-function/> Acetylcholine represents knowledge and is positively charged and the negative neurotransmitters dopamine and norepinephrine and serotonin are attracted to it. By anatomy, acetylcholine meets the other negative neurotransmitters at the central medial nucleus of the thalamus (The 3rd Eye). The neurons in the central medial nucleus have the uncanny ability to fire at 1000 beats per second in bursts of 10 to 12 beats, then rest... then fire again another at 10-12 beats at the clock speed of the brain which varies from 40 to 450 times per second. This could allow sustained output at over 1000 cps. This system, allows the three negative neurotransmitters dopamine(-), norepinephrine(-) and serotonin(-) to form a three way switch between 3 variables (i.e. attraction and repulsion and reservation) This energy output represents Consciousness and “Thought” and is a wave function at 1000 cps with a 3-way switch allows all the hues of color and emotion. See diagrams

Section: 1.0

Status: Poster

Name: Dianne Trussell

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Organization: University of New England (informal to date)

Primary Topic: [01.01].....The concept of consciousness

Abstract Title: A New Concept of Consciousness and Foundation for All Scientific Research

Abstract: This is a proposal for a concept of consciousness based on evidence, experience, intuition and some unexpected effects arising within an ongoing experimental study. Given the primacy, ubiquity, entanglement and non-locality displayed by consciousness, and its energy-like effects, no branch of scientific research can be conceived, conducted or interpreted outside the medium of consciousness. Hypotheses and Tenets: The observed features of consciousness are in accord with the tenets of the Ageless Wisdom teachings, which encompass all of science and indeed all of existence. This ancient tradition is an ongoing scientific process that can be re-integrated into modern scientific research to shed light on many currently intractable problems like the hard problem and explanatory gaps, not just in consciousness research but throughout the psychological, biological and physical sciences also.

Consciousness is present on many co-existent levels, which may correspond with Bohm's many levels of the Implicate Order. Consciousness does not originate within the organic body but comes from 'outside', from the quantum field (first level of implicate order?) into the microtubules. Via microtubules and the ordered water within them, consciousness is distributed to all tissues, not just the brain. Thus the physical human mind is the whole body. There are just two basic forms of consciousness informed by two major 'energies' (not the familiar physical energies), being: 1. The form in which a person is in a state of harmony, oneness, stillness, boundlessness, detachment, and no-self that the contemplative traditions aspire to attain for 'a more evolved/higher/divine' state of being. In this state one is aligned/attuned to the one source, 'God', characteristic of the soul. This form is traditionally known as divine fire, mind of God, etc. It corresponds with adherence to the baseline 'randomness' of the REG. 2. The form in which a person is in states of disharmony or disequilibrium, individualism and separation, any type of stimulation or depression, emotion (positive or negative), attachment, mental/intellectual dominance, illusion, desire, competition, recognition, etc., that the contemplative traditions aspire to let go of. In this state one blocks one's access to the oneness and remains in an unstable state characteristic of the 'human spirit'. This form is traditionally known as prana, chi, astral, etc. It corresponds with deviations away from the baseline 'randomness' of the REG. Indications of this dichotomy arose during a pilot study of physiological and psychological differences between normal and meditative states. A portable random event generator (REG) was running the whole time. The energies of consciousness can be re-emitted by the vibrating/resonant physical body and can therefore influence other physical bodies. A recent example from neuroscience is the phenomenon of hyper scanning: synchronisation of more than one person's EEGs and ECGs in the absence of any sensory connection. Experimental results of myself and others will be discussed within this framework. Future work will be conducted to focus in on this dichotomy of consciousness in a broader framework than meditation alone.

Section: 1.0

Status: Poster

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Primary Topic: [01.03].....Panpsychism and cosmopsychism

Abstract Title: Using category and constructor theories to build a solution to the hard problem

Philosophers often take for granted that fundamental physics is a story of initial

conditions and dynamics on a set of particles and fields. The past 100 years of development in theoretical physics has belied that notion. In response, constructor theory begins from the ground up and casts physical systems as enacting constraints on sets of possibilities. This foundational move therefore allows for further restrictions on possibility spaces by mid-level beings such as us and is therefore highly relevant to the hard problem of consciousness. Despite this, we have not seen theories of consciousness embrace constructor theory. Similarly, category theory has emerged as a story of mappings (or functors) between foundational categories (whatever they may be) and derived categories (such as particles etc.). As in the case of constructor theory, we have not seen consciousness studies embrace category theory as a way to formalize relations between mental and physical categories. In this work, we attempt to utilize both approaches to build a solution to the hard problem. We argue that a promising strategy is to draw upon the work of Strawson and Zahavi and cast the set of thin or minimal subjects of experience, henceforth referred to as selfons, as categories which are related to (unknown at present) physical categories. (Thin subjects are momentary excitations in nature, are always accompanied by experience and dissipate or decay after coming into being.) If this program can be successfully carried out, it would lend tools to sharpen a hypothetical debate between neutral monism and holistic physicalism. Neutral monism can be seen as a story wherein the categories corresponding to selfons and matter are derived from a more fundamental (or neutral) category. In contrast, holistic physicalism is a picture of selfons arising from foundational physical categories and dissipating into material categories. Experiences are properties of selfons, and the use of constructor theory can make explicit, restrictions on sets of possibilities carried out by selfons. Armed with these two powerful frameworks, we further argue that panpsychism and emergence are therefore not the only viable solutions to the hard problem. In fact, both panpsychism and emergence exhibit tacit commitments to dynamical systems approaches in physics and therefore do not seem to appreciate the contributions of constructor theory. Furthermore, panpsychism and emergence do not attempt to use the ignorance of the true physical (following Stoljar) and set up relations or functors using category theory to thin or minimal selfon subjects. To summarize, we follow Strawson and Zahavi and assert that experience is always accompanied by a (thin or minimal) subject of experience or selfon. These selfons form a category which is related to foundational (unknown) physical categories. The selfon category enacts constraints on the set of possibilities as spelled out by constructor theory. In this way, holistic physicalism offers a solution to the hard problem setting up a contrast with neutral monism. With theoretical physics in crisis, we think the time is right to consider category and constructor theories as twin fundamental frameworks of consciousness studies.

Section: 1.0

Status: Poster

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Primary Topic: [01.02].....Materialism and dualism

Abstract Title: Paradox As Fundamental: Redefining the Meta-Paradigm

Abstract: Every discussion ever held regarding the nature of consciousness and its place in relation to our scientific exploration of the world has taken place in an over-arching conceptual container, a meta-paradigm, an implicit container of possible words, spaces and conceptual mappings of the reality we are exploring and interpreting. The meta-level here typically falls at the boundary imposed by religion and culture. It must necessarily extend into the unknown and the unknowable, beyond the limits of language into the unspeakable, beyond the limits of the decidable and computable. Many discussions center around mind-body dualism and conflicting maps of reality depending upon which side you assume to be fundamental, or if you allow for both. At this point it seems like it would be more productive to focus on the pivot points, the paradoxes that arise between seemingly mutually exclusive truths, how we are evolved to process them, and what they say about the fundamental nature of our reality. A Taoist perspective and the Christian Trinity can be explored as existing examples of attempts to integrate paradox culturally.

Section: 1.0

Status: Poster

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Primary Topic: [01.03].....Panpsychism and cosmopsychism

Abstract Title: An Emotional Universe? Sentience as the Precursor of Consciousness and Key to Panpsychism

Abstract: In her book *Conscious* (2019), Annaka Harris suggests a variation on panpsychism: that consciousness may be fundamental in the same way as spacetime: as a continuous, pervasive field. Such a field would give rise to a range of conscious possibilities as it interacts with matter. The universe, she speculates, could be teeming with types and degrees of consciousness – “flickering in and out, overlapping, combining, separating...in ways we can’t quite imagine, rules by physical laws we don’t yet understand.” The approach Harris advocates is termed cosmopsychism. I propose an original critique of

this evolving point of view, in 2 parts. First, I will argue for a de-emphasis of consciousness and a greater emphasis on sentience. Since a good deal of human functioning takes place beneath conscious awareness and without individual volition (e.g., proprioception, the circulatory system, the enteric nervous system, the immune system, the sympathetic and parasympathetic nervous systems, placebo effects, dreaming), functions such as these that underlie consciousness must be understood as prerequisites for self-awareness. Organisms’ unconscious capacity, therefore, ought to be recognized as a fundamental aspect of whatever field is being postulated by cosmopsychism. Second, if the capacity for sentience is intrinsic to matter or if (as in Harris’ view) this capacity acts upon matter as a field, it is conceivable that that the universe is hospitable to feelings. As Antonio Damasio has said, the “feeling of what happens” is fundamental to consciousness. It might even be that intense, unconscious feelings can become accessible to others via the field that Harris postulates. This would serve to explain the synchronicities and teleomatic perceptions that some people experience, which seem to revolve around significant felt meaning. Such meaningful coincidences are, on inspection, meaningful because they tend to illuminate – either directly or through symbolism – some deep feeling, intuition, or connection with another person. Indeed, such experiences could demonstrate the validity of cosmopsychism. I shall argue that it is far from coincidental that instances of intense or volatile feelings are a common feature of apparitions, poltergeists, telepathic dreams (e.g. certain striking dreams recorded in connection with the 9-11 attacks), and the like. Our common sentience attests to the strong possibility that we live in a fundamentally emotional universe.

Section: 1.0

Status: Poster

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Organization: InfinitiEd

Primary Topic: [01.03].....Panpsychism and cosmopsychism

Abstract Title: The Psychosocial and Therapeutic Benefits of Astronomy as a Consciousness Transformative Methodology

Abstract: “When we are all Cosmically conscious, there will be peace on the Earth.” Classical Hindu Aphorism Cosmological awareness has the capacity for expanding the consciousness beyond specific racial, cultural, and socio-religious paradigms while fostering respect and reverence for the diversity, totality and integrity of all life. It facilitates comprehension of the radical interdependence of ecosystems across scales from quantum through biological and socio-cultural to

cosmological. Astronomy, cosmology and astrobiology play roles in facilitating understanding of ecological diversity, appreciating with clarity the vital role of each aspect of life. Astronomy is one of the primary levers of socio-cultural transformation. Why has cosmos “human-ed”? Without a profound investigation into the fundamental nature of reality from multiple diverse perspectives, with an open, well-trained inquisitive and creative mind, nurtured by the intuition, we risk missing the integral comprehension of why the universe has arrived at this stage of evolutionary speciation we call ourselves, -humans, within the diverse eco-systemic dynamic in which we are imbedded, and how we are to cooperate and co-create in the greater scheme of cosmos, itself. As an example of astronomy as a stress reduction methodology, it was stated by an astronomer, that “a night observing on the mountain is like a two week vacation”. Literally the mind and consciousness are moving outward into participation in the vaster time-space scale beyond the Earthly confines and normative stress factors. Deep silence of such spatial focus has been experienced as remedial for the nervous system. Astronomical immersion, beyond human authoritarian constraints, facilitates a sense of participation in and connectedness to far greater reality. It facilitates that which is at the core of the leading edge of remedial stress reduction techniques in our modern anthropogenic society and culture as one becomes ontologically integral to and with universal cosmic intent. From the cosmological and astronomical encounter the universality of life moving through, within and as everything may be both deduced as well as experienced. Fundamentally healing at the ontological scale, meaning is experienced as inseparable from being. There is the sense of human beings as witness, co-creators and inseparable participants in cosmos. The sense of meaning and belonging - as one of the primary healthy human psychosocial intentions is encountered with the unbound expanse of space-time – relatively innumerable stars and clusters of galaxies strewn across potentially limitless space, including the observer and all planetary life.

Section: 1.0

Status: Poster

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Primary Topic: [01.03].....Panpsychism and cosmopsychism

Abstract Title: Contours of Consciousness: A Graphical Approach to Modeling the Operational Domain of Subjective Experience

Abstract: On panpsychism, subjective experience is a fundamental and ubiquitous feature of reality (Goff, Seager & Allen-Hermanson, 2017). By likening

the ubiquity of subjective experience to the substratum of a coordinate space and representing a conscious system as a point set of its measurable attributes within the coordinate space, I propose a methodology for graphically modeling the operational domain of subjective experience for conscious systems. Renderings for the common vampire bat *Desmodus rotundus*, the scalloped hammerhead shark *Sphyrna lewini*, and modern anatomical human *Homo sapiens* will be presented with discussion on the selection and standardization of morphological, sensory system, psychometric, and ecological data deployed as measurable attributes in the modeling. Further discussion will consider the viability of conceptualizing the borders of the renderings as the set of all known solutions to an expanded definition of the "easy" problems of consciousness differentiated by David J. Chalmers (1995).

Section: 1.0

Status: Poster

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Primary Topic: [01.04].....Ontology of consciousness

Abstract Title: A Genetic Basis for Sixteen Variations in Consciousness

Abstract: The brain informs consciousness of interior and exterior events, and in so doing conveys to the holder of consciousness a sense of self and of being surrounded by a dynamic environment. That sense of being, it is argued, derives from within one or more of four genetically-determined, default-initiated, brain-operating systems. Considering the work of Roger Sperry and others it is commonly accepted that the hemispheres are operated by autonomous systems that complement one another. This suggests a dualistic model of consciousness wherein the holder of consciousness is informed by two distinctly different systems. In view of the broad involvement of genetic dominance in human design, in some individuals we might reasonably expect the brain's two dualistic processing systems to genetically integrate in one of two ways and thus result in two additional systems, holistic-acting brain-operating systems that reflect nondual-based system characteristics. Three types of genetic dominance produce four brain-operating systems: When genetic complete dominance determines the brain's operation, one hemisphere is dominant and the other is recessive, so consciousness is informed by either a dominant left hemisphere and a recessive right hemisphere or a dominant right hemisphere and a recessive left hemisphere. When genetic incomplete dominance determines the system feeding consciousness the two brain-operating systems integrate to form a single hybrid system of operation. When genetic codominance determines the brain's processing behavior the two hemispheric systems form a team operation to inform consciousness. Where

that consciousness is concerned, it is argued, often one hemispheric system will default to process perception, the incoming data that informs consciousness, whereas the complementary system will default to process a response, the outgoing data that reflects the reaction of the holder of consciousness to incoming data. For example, most right-handed women default to process perception in their right hemisphere and response in their left hemisphere. This combination causes most right-handed women to be both right-brain dominant and left-brain dominant. Four brain-operating systems capable of defaulting to process perception, sequenced with four brain-operating systems capable of defaulting to process a response, suggests the possibility of 16 different brain-operating-system-combination types, each with a unique approach to processing perception and response, thus producing 16 variations in consciousness.

Section: 1.0

Status: Poster

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Primary Topic: [01.08].....The "hard problem" and the explanatory gap

Abstract Title: Mind, Matter, and Phenomenal Experience

Abstract: Phenomenal qualities are embodied spacio-temporal abstractions subjectively perceived by a conscious observer. Specific examples, i.e., qualia, include the color purple, the taste of chocolate, and the fragrance of a rose. The question of whether phenomenal awareness can be empirically understood forms one important facet of the “Hard Problem of Consciousness” (Chalmers, 1995, pp. 200–219). It is the position of this study that we can only explain why we experience sensory qualities in the manner we do if we first comprehend how they may have evolved in the very distant past. This examination explores the evolutionary development of phenomenal experience. In so doing, it proposes that behind the mechanisms through which external stimuli interface with our sensory apparatus, there lies a long evolutionary process of standardization, approximation, and synchronization that has ultimately forged the close links between the two. The consistent and efficient associations that the resultant evolutionary links give rise to cumulatively generate conscious experience. There is a tight correspondence between our sensations and incoming stimuli, and this synchronous covariance is meaningful and functional; however, it does not result from a strict cause-and-effect relationship between the physical properties of external objects and our internal neuro-physiology. As such, this analysis endorses Hoffman’s (1998, 2003, 2008, 2009 and 2019)

view that the external world is largely hidden from direct sensory evaluation. The following investigation extends Jung’s (1952) thesis to further explore the concept of complementary phenomena that was originally envisioned by Wolfgang Pauli. (Meier, 2001) This modified thesis, as it applies to a causality and synchronicity with respect to the development of color perception, is then employed to more deeply explore the evolutionary ties that ultimately engender all sensory modalities. Without invoking the Quantum-Mind hypothesis, this paper supports the idea that our five senses are not direct, or true, or even approximate abstract representations of any underlying material qualities of incoming stimuli; instead, they efficiently provide useful meta-data pertaining to the macro properties of spacetime, matter, and motion, as well as the causal-objective of all life. The overall analysis concludes that it is the structural categorization, hierarchical organization, and abstract re-normalization of this indirect higher-order information that has engendered meaningful sensory awareness, and all conscious thought over evolutionary time.

Section: 1.0

Status: Poster

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Primary Topic: [01.08].....The "hard problem" and the explanatory gap

Abstract Title: The Causes of the Hard Problem: A Note1 Greg P. Hodes

Abstract: The Causes of the Hard Problem: A Note1 Greg P. Hodes (ghodes@juno.com) ABSTRACT This note calls attention to the fact that efficient causes – the sort of cause that changes something or makes something happen – can play no constitutive role in the immediate, cognitively conscious relation between cognitive subject and a cognitive object. It notes that: (1) it is a necessary condition for an efficient causal relation that it alter its relata; and (2) it is a necessary condition for a conscious cognitive relation that it does not alter its relata. This has important implication for the theories of knowledge and consciousness, the “Hard Problem,” and related puzzles.

Section: 1.0

Status: Poster

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Primary Topic: [01.08].....The "hard problem" and the explanatory gap

Abstract Title: Bridging mental and physical domains through Form

Abstract: Consciousness can be defined as one's subjective moment to moment experience including the perception of an "I" (the self). From a physicalist standpoint, how could something seemingly non-physical (mental, subjective experience) arise from a physical process of some sort? A starting point for this paper is consciousness is a process, not a thing. And to bridge the mental-physical divide and truly understand consciousness in scientific terms more than just a new mechanism will be required - one or more new physical principles will be needed too. The paper introduces a (potentially) new way to look at the world in the context of consciousness studies, as an abstract continuum of 'form' spanning physical and mental domains. It seeks to set out some possible pointers to a solution to the hard problem, within the bounds of physics and albeit with some metaphysics thrown in. The mental world seems abstract, and is a world which is filled with objects, or more specifically the forms of those objects (whether real or imagined). Form is defined here as the set of attributes of an object which are capable of being perceived. It could be said that the mental world is a world of form. Moving to the physical world, physical objects have form, which although material in nature is also abstract, for example a tennis ball has a surface spectral reflectance (physical) which generally maps to the colour 'green' (mental) and has a spherical shape, but a green sphere can also be an abstract object. There might be an intimate connection between mental and physical, through form. It is proposed we can put mental and physical into a common framework through including form as a fundamental dimension along with mass, length, time and electric charge. (The concept of form as fundamental is not new, it of course goes back to Aristotle). Consciousness is unlikely to be a brain-only process. It is more likely to arise through the interaction of the brain/body with its environment. In that interaction, subjective 'now' (the present) is not instantaneous, rather it is a rolling time window of the order of (say) 0.5s which provides continuity to the conscious being's experience of the world. That rolling time window, together with form as a bridge between mental and physical, might be important inputs for a theory of consciousness. The paper illustrates how the concept of form as a dimension can be applied, taking visual perception by way of example. After a brief review of some scientific/philosophical perspectives on where objects as perceived are located, the paper considers the interaction between a conscious being and a physical object in the context of mental (perceived) form being mappable to physical form. With this framework/approach, the object as consciously perceived is (in broad terms) the physical object out there in the world, while the perspective or 'view' the brain/body has of the object, including the feeling of being an 'observer' of the object, is a creation of the brain.

Section: 1.0

Status: Poster

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Primary Topic: [01.08].....The "hard problem" and the explanatory gap

Abstract Title: Mind body interaction in ancient Indian philosophy

Abstract: RS Mind body problem which comes in many forms such as famous explanatory gap and hard prob of consciousness, is still an unsolved problem. We argue that it is , because of our lack of knowledge about subtler realities of mind matter and consciousness . Although, quantum physics has told lot about matter however it has not been able to provide a complete theory of matter. What to say of mind and consciousness which are much more subtler realities. Hence , we decided to look in to ancient Indian philosophy especially Samkaya philosophy as recently many scientists such as Schrodinger suggested . The reason is, that it not only contains , a lot of information about the subtler realities , but , also, being a systems philosophy , it is a holistic view of creation which consists of three grand realms of mind matter and consciousness on both individual and cosmic level . As such it sees all the different realms as not only interconnected but also in constant mutual interaction. It provides theories and concepts that explains how creation evolved and how different regions or realms are interconnected and in interaction. Its concept of mind as subtle matter, bridges the gap between mind and matter. Furthermore , mind is composed of five types of subtle particles or vibrations called five tanmatras i.e. ,(sound sight taste touch and smell). Tanmatras , the subtle particles (or vibrations) of the field of consciousness are potentials or essence. They are subtle elements as well as subtle senses . As such they are not only the basis of physical reality but also means of its experience. They are the units of experience as well. Thus , these concepts provided us with a frame to develop our hypothesis , that states that interaction between mind and object or the gross matter, is possible as there exists a subtle aspect of the process of perception also known as functional integrity between mind and object . As such the object in its subtle aspect communicates with the tanmatras within us and thus information of object is received by manna and then send to buddhi where purusa experiences the object as a vritti . what the subtle aspect (also known as functional integrity between mind and object) is , will be explained here. we conclude and suggest , that in future development of science of mind and solving problem of mind body interaction, we need to look at the concept off five tanmatras of Indian philosophy. Again ,they provide an alternative to quantum theories which are unable to solve mind body problem as being based on quantas they can't explain mind which is conscious. The quanta are not sufficient to explain the quantum reality of mind.

Section: 1.0

Status: Poster

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Primary Topic: [01.09].....Philosophical theories of consciousness

Abstract Title: Consciousness in Advaita Vedanta: A Key to Peaceful Co-existence in a Pluralist Society

Abstract: Advaita Vedanta, an Indian philosophical system based on the Vedas, has a quite comprehensive perspective on consciousness. It presents consciousness as the basis for everything else and thus puts consciousness ahead of all other concepts. At the experience level, Advaita Vedanta posits a misreading of this fundamental consciousness and calls this ignorance and envisages a practice of thought that would correct this misreading. Then the person following Advaita Vedanta philosophy would be able to perceive the fundamental consciousness which is the common denominator of all that is perceived by us in this universe. Because of its all-inclusive philosophy, Advaita has the potential to become a great solution to bring peace in this increasingly polarized world. Advaita perspective also helps one to better manage one's emotions and insecurities. It is a philosophy that is best suited to tackle the stressful environment of the present-day world. This paper delineates the aspects of Advaita perspective on consciousness that enable us to overcome the limitations posed by the physical world. This paper argues that the Advaita perspective on consciousness comes closest to reconciling the problem of consciousness posed by Artificial Intelligence.

Section: 1.0

Status: Poster

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Primary Topic: [01.09].....Philosophical theories of consciousness

Abstract Title: The Neurophysiological No-Gap Argument and Popper's New Hypothesis of Mind-As-A-Force-Field

Abstract: The present paper argues that the neurophysiological no-gap argument is not a compelling one against Popper's 1993 hypothesis of mind-as-a-force-field based on the premise of strong emergence. Strong emergence is characterised by the claims that emergent phenomena are distinct from their

underlying, basal phenomena and that emergent phenomena are causally relevant in the physical domain. Those who take mental phenomena as strongly emergent entities bestow irreducible causal powers on them. Popper's 1993 hypothesis— containing a mind-force analogy and a new idea of consciousness-brain interaction— states that (i) consciousness emerges from non-extended but localizable physical forces when these forces obtain a certain autonomy from the biochemical substances they are related to, and (ii) consciousness, which has many properties in common with physical forces, interacts with the brains through their complicated electro-magnetic force-fields. Those who challenge the possibility of consciousness-brain interaction owing to the causal-closure principle often present the neurophysiological no-gap argument. The argument assumes that neurophysiology never needed to appeal to sui generis mental causes to provide the complete and immediate cause of any neural event in the causal chains of neural events generating bodily movements. The implication is clear: current neurophysiology will not appeal to sui generis mental causes to fill gaps in the causal chains of neural events. The said argument clearly entails the causal-closure principle that every physical event that has a cause has an immediate and complete physical cause. Despite having different formulations, the causal-closure principle is one essential premise of the neurophysiological no-gap argument— arguably the key argument against consciousness-brain interaction. Naturally, the said argument seems to pose a serious threat to Popper's 1993 hypothesis. The present paper, divided into two main sections, attempts to provide some reasons why it does not. The first section questions the causal-closure principle, which arguably draws its main force from the conservation laws of physics, by (a) contrasting the conventional formulations of the said laws with the formulations presented in a mechanics textbook, viz, Herbert Goldstein's Classical Mechanics, and (b) by emphasizing the difference between the 'principle of ubiquity' and the 'principle of the universality of physical law' (Hendry 2010). The second section consists of a close scrutiny of current scientific accounts (e.g., Ellis 2020) of strong emergence in both biological and physical systems and of the rising neurophysiological evidence (e.g., Jones 2017) of minds being neural electromagnetic fields acting on brains. The key insights drawn from the analysis of those scientific and neurophysiological accounts together with the questionable status of the causal-closure principle indicate why the neurophysiological no-gap argument is no serious threat to Popper's hypothesis of mind-as-a-force-field. Literature cited: 1. Ellis, G.F.R. 2020. The Causal Closure of Physics in Real World Contexts, Foundations of Physics, 50, 1057-1097. 2. Hendry, R.F. 2010. Ontological Reduction and Molecular Structure, Studies in History and Philosophy of Modern Physics, 41, 183-191. 3. Jones, M. W. 2017. Mounting Evidence that Minds are Neural EM Fields Interacting with Brains, Journal of Consciousness Studies, 24 (1-2): 159-183. 4. Popper, K.R., et. al. (1993). A Discussion of the Mind-Brain Problem, Theoretical Medicine, 14, 167-180.

Section: 1.0

Status: Poster

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Primary Topic: [01.09].....Philosophical theories of consciousness

Abstract Title: Forty seven powers of Aatma described in Jainism indicates its holographic structure

Abstract: Jainism is well known for its similarity with the modern science in many respects. The concept of aatma is foundation of Jain philosophy and extensive literature is available in Jain scriptures. As per Jainism, aatma has infinite powers (shakties) but there are forty-seven major powers (shakties) which are described in Pravchan Navneet written on the basis of sermons given by great sant Kanji Swamy. These sermons are actually based on the original work of great Acharya Kundakunda Swamy about 2000 years ago in prakrat language, written in most respected scripture known as “Samaysar” and its Sanskrit commentary by Acharya Amrut Chandji (around 905-955 AD). It indicates that although aatma and matter are different from each other, but both have oscillations through utpad (origination), vyaya (disappearance) and dhruva (conservation) attributes. They describe waves like structure of these shakties. One wavelength of utpad and vyaya is known as a paryaya. Infinite waves are discussed through akrabadhh (not in sequence) paryayas, but each has kramabadha (in sequence) paryayas. An infinitely small part of aatma is practically known as aatma pradesha (discrete unit), which can store huge amount of knowledge. Their definition of interconnectivity in two different ways at three different levels indicates some similarity with quantum entanglement. Five types of infinities are defined in practical context, which are very interesting and may provide new avenues of thought. An extensive analysis of these shakties indicate interesting similarities with the concept of quantum hologram. The similarity of Jainism with nilpotent quantum mechanics (NQM) is so remarkable that both formalisms use the same term “Mirror” in similar context and with almost similar meaning. The concept of NQM is based on universal rewriting system. Here a fermion and its corresponding vacuum state are described by two vector spaces such that one is dual of the other. The information present in both the vector spaces are exactly same but in different form. One is physical whereas other is nonphysical and hence not observable. The information is of two types viz. local and non-local. The mixture of local and non-local information may partly explain telepathy and clairvoyance. In Jainism, Universe (aakashstikaya) is assumed to be consisting of two parts such that one is empty with infinite extent and other consists of six substances, viz. space (aakastikaya),

time (kala), medium of motion (dharmastikaya), medium of rest (adharmastikaya), matter (pudgal) and Jivastikaya (living beings), contained in finite part. Out of these six substances, five of them viz. aakasatikaya, pudgalastikaya, dharmastikaya, adharmastikaya and time can be treated as forming one vector space whereas non-physical aatma with infinite knowledge can be considered as the dual vector space (mirror image) of this. Through this formalism, it appears that one can also explain the hundred years old claims of Mrs. Annie Besant and colleagues that atoms and their parts were directly seen through clairvoyance using anima siddhi.

Section: 1.0

Status: Poster

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Organization: Maharishi International University and the Holmes Institute

Primary Topic: [01.09].....Philosophical theories of consciousness

Abstract Title: The Transmission Model of the Brain

Abstract: In recent times, scientists have verified that there is a correlation between neural events and mental events (meaning thoughts, emotions, and perceptions). Indeed, when a particular region of the brain is active, then the individual has experiences associated with that region. Based on these correlations, many have concluded that the brain produces consciousness. However, given the mainstream scientific paradigm of physicalism, it is extremely difficult to explain how this could occur. How can a material structure such as the brain give rise to subjectivity? No one knows, as illustrated by the following quotation by philosopher Alva Noe: “After decades of concerted effort on the part of neuroscientists, psychologists, and philosophers, only one proposition about how the brain makes us conscious—how it gives rise to sensation, feeling, subjectivity—has emerged unchallenged: we don’t have a clue.” This issue is related to the hard problem of consciousness, which may be stated as follows: Even if we successfully explain the neurophysiological processes that accompany all brain functioning, we still will not have explained the origin of subjective experience. For instance, we can describe the neural impulses that occur when we touch a hot stove; however, this does not address the awful pain of searing our skin. The “hard problem” is so challenging that it calls into question whether the brain produces consciousness. Indeed, it has prompted various philosophers and scientists to seek alternative explanations of the relationship between matter and mind. One potentially useful alternative is the transmission model of philosopher and psychologist William James (1842–1910). According to this model, the brain “transmits” consciousness, much as a radio

tower transmits radio waves. Philosopher and physicist David Scharf elaborates on this concept: "Rather than producing consciousness and mind, the brain acts as an interface. It receives and filters some of the mental signals while amplifying others. The brain transmits, limits, and focuses consciousness as needed for the survival of the organism." In James's view, the ultimate source of our awareness is a vast "mother-sea" of consciousness. The transmission model has many strengths. First, it successfully accounts for the mind-brain correlations mentioned earlier. Naturally, changes to a transmitter affect the quality of the transmission. In the same way, changes to our neural state affect our mental state. To arrive at this commonsense conclusion, it is not necessary to postulate that the brain is the ultimate source of consciousness; the same logical result is achieved if this organ simply acts as an interface. In addition, the transmission model has the following advantages. It does justice to the apparently irreducible nature of consciousness. It is also consistent with scientific evidence regarding 1) the functionality of conscious processes, 2) nonlinear results of brain damage, 3) brain deactivation in association with psychedelic states, 4) near-death experiences, 5) nonlocal effects of meditation, and 6) (for those who are willing to consider this topic) psi phenomena. This paper will explore the transmission model and the other subjects mentioned above.

Section: 1.0

Status: Poster

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Primary Topic: [01.11].....Personal identity and the self

Abstract Title: A New Theory of Consciousness expounds the emergent (upon merger) nature of language acquisition shown to underlie the various phenomenal and mental states of an experiencing agency

Abstract: The work herewith presented in the form of a new theory, predominantly tries to unify the divergent views about Self-hood (or experience in general), seen evidently in epistemological as well as phenomenological exploration techniques. Self is the self-referential aspect of phenomenal and mental experience, such that the former leads to the emergence of the latter. The mind-body problem is attempted to be solved by expounding on the emergence of a mind, from merely bodily interactions. The meta-problem of Consciousness put forward by Philosopher David Chalmers is attempted to be solved, by expounding on the emergent nature of cognitive faculties which underlie the functioning of each level of self. The brain is regarded as a prediction machine, where the quality of making predictions about the

future state of events in the physical world is considered as a self-referential quality of a specific level of Self, namely level 6 (one among 8 levels of Self). Consciousness is regarded as the process of merger of dual facets of a particular kind of experience (namely positive and negative experiences) leading to the emergence of new kind of experiences (such as reflex action, emotion, locomotion, abstract thinking, pointing, predictive processing, self-observation, met-cognition and so on) and thus leading to a new level of Self. Each level of self, underlies an emergence of a new part of speech. The central idea of the theory is that experiences of reflex action, emotion, locomotion, abstract thinking, predictive processing, self-awareness and theory of mind faculties form part of an emergent chain where each level of emergence leads to the formation of a new part of speech and interrogative words in the internal framework for syntax in the mind of a person, starting from pronoun (I), adjective, noun, preposition, what, when and why questions respectively. Consciousness is regarded as the process of merger of dual facets of a particular kind of experience leading to emergence of a new kind of experience and thus leading to a new level of Self. Everything that 'is' is a Self of a certain kind of form or essence that it strives to preserve. Self-reference is the indication of the process of preservation of the essence of being-ness of some entity. Every entity through persist interaction undergoes self-reference and the absence of self-reference is the indication of escape or negative kind of experience. Such interactions are persist and escape interactions respectively. Everything 'is' because it interacts with the surrounding. The framework of syntax and cognitive capacities underlies experience. Bodily experiences emerge from one another to lead to purely mental experiences. The ethical implication of the theory lies in the idea that good and bad exist because the former is meant to enhance the essence of a thing and the latter is meant to safeguard such essence. Evil exists, not to cause harm, but to safeguard one's own essence through escaping action.

Section: 1.0

Status: Poster

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Primary Topic: [01.14].....Philosophy of perception

Abstract Title: Sensation and perception - Different ways of processing information

Abstract: Many different things are built on the concept of information in our world. Information has a different meaning in informatics, education, literature, physics. The book *The Theoretics* contains comprehensive and general, all-encompassing meanings of information that can form the basis for harmonizing knowledge across disciplines. The processing of information takes place through the senses, and the information processing system of the mind plays a key role in the process. Stimuli from the outside world are captured by our senses and transmitted to the brain. The nervous system transmits the transformed stimuli to the brain. The human brain picks up and stores different types of stimuli in different ways. Based on these, the incoming stimuli can be divided into three distinct parts. There are stimuli related to movement and physical characteristics (of which the mind creates so-called physical notions), there are data- and context-related (mental notions) and there are mood-type stimulus and memory packages (emotional notions). These are all treated very differently by the brain. Everyone's brains can handle and use all three types, but they come in different proportions. Some people focus primarily on moving things, some who work more with data and correlations, and some who focus on moods. Considering different attitudes can be key to understanding human relationships. Furthermore, the existence of attitudes shows that we do not necessarily see the world in its entirety, but some see only one type of stimulus, others a different one, and still others a third one. It also follows that extending our attention to other types of notions will broaden our view of the world and allow us to connect with a larger part of reality.

Section: 1.0

Status: Poster

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Primary Topic: [01.14].....Philosophy of perception

Abstract Title: A Philosophical Account of Concussions

Abstract: Discussion of theories of consciousness and acquired traumatic brain injuries (TBI) are plentiful. Talk of the relationship between consciousness and TBI ranges from the following: Paul Churchland's argument from brain injuries to criticize dualism and defend materialism in the mind-body problem, Helen Bibby's infamous study of TBI patients being too impaired to perform theory of mind tasks, Megan Craig's first-person account of a TBI and personal identity changes, and Berit Brogaard's multisensory research lab on the superhuman mind, notably, Jason Padgett's acquired savant syndrome following his TBI.

TBIs or concussions have been used to defend philosophical claims, empirically question different theories of the mind, cause changes to personal identity, and even create mathematical superpowers. Despite scholars relying on the concept of concussions, little analysis has explained the nature of concussions. The purpose of this paper is to fill this missing gap, an analysis of the concept of a concussion. The central problem of concussions is explaining how a concussion causes widespread symptoms ranging from Bibby's TBI patients, Craig's identity problem, and Padgett's savant syndrome. This paper is divided into three parts. Part I introduces the concept of concussions by distinguishing between three types of concussions, vestibular, cognitive, and emotional. These distinctions highlight a group of symptoms associated with each concussion—dizziness and brain fog for vestibular, memory and executive function for cognitive, and hormonal abnormalities for emotional. These distinctions also help to understand why different methodological tests are required to identify each concussion, Videonystagmography for vestibular, Brain Scope for Cognitive, and fMRI scan of the pituitary gland for emotional. Then, I will argue that vestibular concussions and dizziness can solve the philosophical problem of bodily perception, specifically awareness of your body and locating oneself in space, which is the starting point intuition of the mind-body problem. Understanding dizziness and the inability to locate oneself in space can reveal insights into bodily perceptual awareness and show why the mind-body problem is a mind-ear problem. Part II proposes that a distinctive feature of concussions is the interconnectedness of information between different systems transmitting information to themed brain through neural correlates. A concussion is the disruption of neural connections between different systems of information and not damage to a specific system. The sheer forces of bone to flesh created a diffuse axonal injury that shreds the transmission of communication that causes a widespread of brain symptoms. This neural interconnectedness account of concussions points toward a hybrid theory of consciousness, the neural correlates theory and the integrated information theory of consciousness. Part III applies the types of concussions to the experiences of Bibby's TBI patients, Craig's account of personal identity, and Padgett's savant syndrome. Bibby's TBI patients' inability to perform theory of mind tasks suggests only a cognitive concussion, Craig's account suggests cognitive and emotional concussions, and Padgett's savant syndrome suggests a combination of all three. Concussions are a uniquely temporal injury because different concussion symptoms can arise at different times. My account can capture the differences in concussions and their temporal nature.

Section: 1.0

Status: Poster

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Organization: Universidad de Chile

Primary Topic: [01.16].....Miscellaneous

Abstract Title: Questions and Comments that We Rarely see

Abstract: Are qualia biological inventions, or are all possible types of qualia pre-defined, as are all possible fundamental particles? Do mechanisms for generating qualia also generate the witness that experiences the generated qualia? Does consciousness in vertebrates originate and manifest itself in the brainstem? By observing behavior, can we conclude that some invertebrates (e.g. octopi; bees) exhibit 3D modeling and understanding, hence awareness sensu Penrose?

Section: 2.0

Status: Poster

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Primary Topic: [02.01].....Neural correlates of consciousness (general)

Abstract Title: The Science of Consciousness and the Foundations of Phenomenology

Abstract: Developing the science of consciousness requires understanding the composition and structure of consciousness as well as the composition and structure of the brain. While progress is being made in understanding the composition and structure of the brain, comparable progress is not being made in understanding the composition and structure of consciousness. The field of inquiry that aims to understand the composition and structure of consciousness is phenomenology. But foundational phenomenological debates have persisted through a century with little indication of consensus-building. This talk proposes that the most promising response to the deadlock is to examine the foundations of phenomenology itself. That field of inquiry I call 'metaphenomenology.' Making progress in the science of consciousness requires making progress in metaphenomenology. Central questions of metaphenomenology include: what fixes the reference of 'phenomenal character' for purposes of phenomenological investigation? What is the nature of phenomenological awareness? What is the epistemic payload of phenomenological awareness? What is the logic of phenomenological reasoning? Does our cognitive endowment impose limits on our phenomenological knowledge? What are the causes and the epistemic consequences of phenomenological disagreement? Toward a science of consciousness, this talk proposes a research program organized around these questions and suggests a set of answers that paints an integrated, mutually-reinforcing portrait of phenomenology.

Section: 2.0

Status: Poster

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Co-Authors: Mohammad Ali Taheri; Sara Torabi; Noushin Nabavi; Fatemeh Modarresi-Asem; Majid Abbasi Sisara; Ali Rezaei; Parisa Maftoun; Monireh-Sadat Mousavi; Saeid Amjadian; Gholamhossein Riazi; Farid Semsarha

Primary Topic: [02.02].....Methodologies (fMRI, EEG etc.)

Abstract Title: Investigating the Behavior of Human Brain and Heart Rate Variability Parameters under the Influence of Faradarmani Taheri Consciousness Field

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. This study aimed to investigate the influence of Faradarmani, as a type of TCFs, on the brain and on the autonomic nervous system (ANS) of humans. The first part of this study investigated group analysis and functional connectivity analysis in the brain of Faradarmangars population while under the influence of the Faradarmani TCF using task-fMRI (Functional magnetic resonance imaging). Faradarmangar is an individual who establishes the Faradarmani TCF. The results revealed activation of frontal lobe (BA6/BA10/BA11), decreased connectivity within activated clusters and posterior Cingulate Gyrus (BA31) and an increased functional connectivity within deactivated clusters and frontal lobe (BA11/BA47) during the Faradarmani connection. In a separate study, the functional and effective connectivity, and the corresponding brain graphs of electroencephalographic (EEG) from the brain of Faradarmangars were compared with that of non-Faradarmangar groups during the same connection. non-Faradarmangar is the subject of study, an individual under the influence of Faradarmani TCF through a Faradarmangar. According to the results, the brains of the Faradarmangars indicated significant decreased activities in delta, beta2, and beta3 frequency bands mainly in frontal lobe and in parietal and temporal lobes, dominant multiple decreased connectivity mainly in the

case of beta3 frequency band in all parts of the frontal network, an increase in the activity of six node areas, significant decrease in the characteristic path length and increases in global efficiency, clustering coefficient and transitivity compared with the non-Faradarmangars' brains. Therefore, compared the brains of the Faradarmangars while mediating the Faradarmani TCF to the brains of non-Faradarmangars, it seems that the unique higher graph function efficiency and the reduction in their brain activity while mediating the Faradarmani TCF, represents a passive and detector-like function. In the second part of the study, heart rate variability (HRV) and skin conductance (SC) indices were measured as reliable indicators of the ANS changes under the influence of the Faradarmani TCF among 50 random volunteers. Both increasing and decreasing variations were observed where the significant alterations were related to the HRV parameters rather than on the SC, compared to the baseline. Therefore, not only does the Faradarmani TCF have a significant effect on ANS function, but also this effect is unique on each individual. The study of the effect of sympathetic activity on the EEG and fMRI signals and further studies on the influence of TCFs on the brain activities, are on the authors' agenda .

Section: 2.0

Status: Poster

Name: Scott Koshland

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Primary Topic: [02.06].....Memory and learning

Abstract Title: Examining the underlying processes occurring in sleep reveal mechanisms for memories to become associatively linked to assist in defining meaning and organizing into hierarchical levels

Abstract: The underlying processes of memory imprinting and functional assignment of associative relevance (meaning) in sleep is examined. Research on the sleeping brain reveals activity related to the imprinting of memories and formation of relational associations that define meaning in the subconscious and conscious mind. Information is the unit of consciousness . Consciousness can be defined in terms of the realization (awareness and interpretation) of processed information. Memory is stable retained ordered information that can be realized. The retained ordered information of memory is a fundamental requirement for processing information in the causal experience of the conscious state. Memory serves as the basis for the translation and interpretation of information. The information processing of consciousness can be considered as a movie recording, where the memory of the information of the of the previous frame is processed from one frame to the next subsequent frame. Brain activity during Non-Rapid Eye Movement (NREM) and Rapid Eye Movement (REM) sleep reveals processes that imprint memories and then

assign associative relevance to memories that define their meaning. Activity during NREM sleep has been shown to be related to the imprinting of explicit or declarative memories while activity during REM sleep is thought to be related to implicit and procedural memory imprinting. Electroencephalogram (EEG) and certain brain structures activity are correlated with these sleep states and the imprinting of memories. REM sleep EEG hippocampal theta waves that are seen in animal waking search behavior represent an open source learning state allowing for data input from various cognitive, emotional and sensory inputs. In the waking search state Hippocampal theta EEG wave activity along with the Prefrontal Cortex and Locus Coeruleus are active allowing focused attention. There is Hippocampal theta wave activity during REM sleep but both the Prefrontal Cortex and part of the Locus Coeruleus activity is significantly reduced resulting in loss of focused attention (unfocused state) and allowing free flow of input from different emotional, cognitive and sensory centers that can then become associatively linked or disassociated. The architecture of sleep cycling between NREM and REM sleep cycles during night allows the imprinting of memories in NREM sleep and then generating relational associations or disassociations in the REM sleep stage. Normally sleep starts with periods of deeper NREM sleep states ending with REM sleep and then cycling back again, with longer deeper NREM states earlier in night and ending with longer REM sleep periods in the later night's cycles. The assignment of associative linkages in REM sleep helps organize and also order the NREM imprinted memory information into hierarchical levels. This associative process that occurs during REM sleep helps integrate hierarchical levels of cognitive functions allowing their coherent alignment and imprinting these levels of cognition into the memory of the sub and conscious domains. In summary, examining the underlying processes occurring in sleep reveal mechanisms for memories to become associatively linked with various inputs to assist in defining meaning and organizing into hierarchical levels of sub and conscious states.

Section: 2.0

Status: Poster

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Co-Authors: Mohammad Ali Taheri; Sara Torabi; Noushin Nabavi; Farid Semsarha

Primary Topic: [02.06].....Memory and learning

Abstract Title: In vitro and in vivo studies of the effects of Faradarmani Taheri Consciousness Field on Alzheimer's disease

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. Alzheimer's disease (AD) is a growing public health concern affecting millions of patients worldwide and costing billions of dollars annually. One of the earliest pathological events in AD is the degeneration of the cholinergic system. The research in this area has revealed that Amyloid β -protein and τ -protein are the most frequently aggregated proteins in this disorder. In this study, we investigated the influence of Faradarmani as a type of TCFs on the spatial memory and avoidance behavior of a rat model of AD. Scopolamine was used to induce cognitive disorder in male Wistar rats. Moreover, we established a human neuron cell culture, as well as a traumatic brain injury (TBI) mouse model, and measured changes in amyloidopathy, tau protein content, microtubule assembly, neuronal cell survival, and finally behavior of TBI mice in the elevated plus maze (EPM) under the influence of the Faradarmani TCF. The results demonstrated that Faradarmani TCF increased learning and memory function in rats receiving scopolamine. Furthermore, we observed that Faradarmani TCF leads to complete survival of neural cell models, elimination of amyloidopathy and tau protein, establishment of stable structure of microtubule aggregations and the remarkable behavioral improvement of the treated TBI mice in the EPM. Given all the data, Faradarmani TCF can suppress AD development in both in vitro and in vivo models.

Section: 2.0

Status: Poster

Name: Daniel Beal

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Primary Topic: [02.08].....Neurology, neuropsychology and neuropathology

Abstract Title: Nutrition and Consciousness

Abstract: Consciousness is dependent on the health and function of the central nervous system which is in turn dependent on macronutrients (carbohydrates,

proteins and fats) and micronutrients (vitamins, minerals, and herbs). Disorders of consciousness are frequently related to unhealthy macronutrient proportions or deficiencies in micronutrients. Subjective Cognitive Impairment, Mild cognitive Impairment, and Alzheimer's Disease and cerebrovascular disease are related to Type 2 Diabetes which is commonly caused by over-consumption of carbohydrates. Carbohydrates are the major macronutrient in the Western Diet, leading to insulin resistance, metabolic syndrome and an inflammatory cascade that damages the brain. Fructose, the 5-carbon sugar in sucrose and high fructose corn syrup uses a metabolic pathway in the liver that evolved in our Hunter-Gatherer ancestors to harvest the energy of autumn fruit and turn it into fat to help survive the winter. In our modern diet the excess of fructose overwhelms the liver's limited ability to metabolize fructose causing NAFLD (non-alcoholic fatty liver disease) and hepatic insulin resistance, triggering systemic insulin resistance and obesity. High blood sugars follow, glycosylating proteins and leading to type 2 diabetes. Brain inflammation is triggered through several pathways, and this inflammation is exacerbated when the inflammation cascade causes amyloid precursor protein to be cleaved into four pro-inflammatory peptides that yield more inflammation, further triggering the Alzheimer's disease cascade. Overwhelmed hepatic fructose metabolism also yields an increase in systemic uric acid increasing inflammation and blood pressure, helping to drive cerebral vascular disease. Amylopectin A is an easily digested starch found in wheat and other grains that also easily broken down to glucose molecules, leading to blood sugars higher than caused by sucrose and further contributing to metabolic syndrome and systemic and brain inflammation. Wheat also contains proteins indigestible in the human gut that have multiple toxic effects, including pathological changes in the microbiome. Gliadin proteins are derived from gluten are pro-inflammatory and some of them (exorphins) attach to opiate receptors in the brain to trigger compulsive over-eating. Wheat Germ Agglutinin helps wheat battle molds and insects but is indigestible and can severely damage the gut lining causing toxins to enter the bloodstream to the brain. Phytates are another anti-pest protein in grains, they are in the "fiber" of wheat and bind to minerals including iron, zinc, calcium and magnesium, yielding micronutrient deficiencies in the brain. The entomologists, Raubenheimer and Simpson, with their Protein Leverage Hypothesis, show that all animals eat to a protein target and then stop eating. It follows that the limited protein quantity in processed foods that are so prominent in the Western Diet is a factor in carbohydrate over-consumption which contributes to type 2 diabetes and its inflammatory cascade. A change in macronutrients to a diet emphasizing fats and proteins and minimizing carbohydrates and eliminating wheat and its byproducts can reverse metabolic syndrome, its inflammatory cascade and the associated pathological changes in the brain. With brain pathology healed, normal thinking and consciousness can resume.

Section: 2.0

Status: Poster

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Primary Topic: [02.12].....Quantum brain biology

Abstract Title: Catecholaminergic Neuron Electron Transport (CNET) and Orch-OR: Comparison and Contrast

Abstract: Further experimental evidence confirms predictions made in 2018 about electron transport in ferritin structures that are present in catecholaminergic neurons, namely, their ability to provide a switching mechanism that allows groups of those neurons to route energy to one neuron of the group, to help it reach action potential (1, 2). This presentation will discuss those results and will further address the similarities and difference between CNET and Orch-OR. While both CNET and Orch-OR are quantum biological processes in neurons, Orch-OR is also a consciousness theory, whereas CNET is an action selection mechanism and integrating mechanism. CNET and Orch-OR may be compatible, but they relate to different neurological processes and quantum mechanical mechanisms.

1) <https://www.mdpi.com/1996-1944/14/16/4527>, Indication of Strongly Correlated Electron Transport and Mott Insulator in Disordered Multilayer Ferritin Structures (DMFS)

2) <https://www.mdpi.com/1099-4300/24/1/91>, Application of the Catecholaminergic Neuron Electron Transport (CNET) Physical Substrate for Consciousness and Action Selection to Integrated Information Theory

Section: 2.0

Status: Poster

Name: Michael Kutch

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Primary Topic: [02.13].....Brain networks, synchrony and scale

Abstract Title: Wiggling your Toes in the Sea of Consciousness, Without a Dock to Moor On

Abstract: At the 2020 conference, we talked about my own balancing of living life as it relates to consciousness and in terms of my understanding of the amygdalae, specifically as they associate with medicine and healing from a temporal lobectomy in the left hemisphere after 35+ years of epilepsy. With this

talk, I want to begin to share with everyone this balancing of our lives - for their sake - in terms of health, harmony, happiness, and healing - and living the truth in terms of our relationship with our temporal lobes that are so much contingent upon good managing and guiding of our emotions as they relate to thought and engagement with actuality. Emotions are good, but emotions, where we become upset, are faulty and out of touch and so bring us true problems. Our challenge with thought David Bohm said, is that it "moves toward not being correct and factual, but it moves towards self-deception, toward illusion." David Bohm once said that "science is what you make of it." He goes on to say, "(measurement) is entirely contingent and not absolutely necessary." From my studies, it appears that to live with nature and perform science without trying, naturally tends to be less fragmented, and what we get from it - the study - is much less weighted in terms of proving ourselves. While not having the self-oriented worth that we usually place on life by using words as we do, how do humans ask the question then, what is the real origin of consciousness? There is no question that what we call "consciousness" is both limited and expanded - at the same "time" - based upon our amygdalae as they develop and coordinate together with the vast sensations of our emotions to have an attitude or a way of life in terms of a raw and real organic response that is actual versus via our own particular reality that is contingent upon our means of thought. To grow consciousness, we live the truth from outside of ourselves without a division versus just telling it with words inside of our mind. The thought or excessive thought in our system is actually meant to be well managed as it springs from emotional excitation. How we memorize "truth" makes for us our way of approaching and appreciating life, juggling between being ego and allocentric. Our true source of intelligence is not necessarily in the brain but appears to be much more in terms of our grace of being enfolded into the whole. I have found that the beauty in nature naturally induces in us the right kind of mind that is not fragmented, as we perform relationships - beyond only human, and to have a healthy immune system in terms of viruses and thought. Ideally, we want to groove with the generative source of the amygdalae as they heal (heel) rather than thinking on down the line in a relationship to another day. I hope to have this experience of discussing the healing of the amygdalae as an ongoing learning exercise with the Science of Consciousness in nature versus online, but the present is all we have, and so one step at a time is completely fine.

Section: Poster

Status: 2.0

Name: Mark Valladares

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Primary Topic: [02.05].....Motor control

Abstract Title: The Principle of Semiotic Dilation: Meaningfulness as a Function of $1/f$

Abstract: The appropriation of motor cognition in the primate brain is implicated as the precursor of language acquisition in humans, indicating how a recursive scale-invariant platform consolidates acquired motor sequences into a vibrational pattern that can induce meaningful action. Corollary discharge induces embodied simulations that are the grounding against which direct sensory-motor feedback is given measure, constituting recursive processing at the level of neural assemblies. The transmission of empathic/limbic resonance via mirror neurons in primates engenders a social cognition capacity that is triggered by the observation of intentional motor behavior, a semiotic construct which is the basis of language acquisition. Empathic resonance demonstrates how vibrational signatures are not constrained by the local interactions of neural assemblies. The consolidation of learned motor behavior into limbic resonance reveals the process in which a motor signal gains meaningfulness. Empathic resonance is a meaningful packet which delivers a neural map of the acquired motor sequencing. The pattern is registered on a scale-invariant recursive processing platform or scaffolding, a multi-nested Tensegrity grid. Microtubulin arrays in neurons are shown to nest oscillatory resonances at differentiated scales indicating that the recursive processing scaffolding coordinates the timing of neural oscillations at differentiated frequency bands to manifest as syntax and provide a fundamental structure to cognition. Thus, empathic resonance can systemically induce meaningful action. Semiotic Dilation refers to how the signal opens up by permeating the fractal geometry of the multi-nested Tensegrity grid. This energy-economizing scale-invariant attribute of the cross-modal semiotic signal is imbued with a simultaneity such that it can function as a predictive anticipatory cue. At the point of dilation, motor cognition reflects a metastability, the dissipation of cognitive control. Semiotic Dilation equates meaningfulness with the coherency of a signal such that it can induce meaningful action as its relative cortical processing dissipates by a factor of $1/f$.

Section: 2.0

Status: Poster

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Primary Topic: [02.14].....Emotion

Abstract Title: Consciousness may influence epigenetics in the development of disease

Abstract: Epigenetics is a mechanism for regulating gene activity independent

of DNA sequence determining which genes are turned on or off: in a particular cell type, in different disease states or in response to a physiological or even psychological stimulus. The study pays special attention to how emotions affect health. Consciousness at its simplest is "awareness or sentience of internal or external existence". Today, with modern research into the brain it often includes any kind of experience, cognition, feeling or perception. It may be 'awareness', or 'awareness of awareness', or self-awareness. In recent years scientists have been exploring the effects that stress and emotions have on our cells – in particular, on our chromosomes and mitochondrial DNA. What they have found is that our emotions can shape our physical reality at the molecular level. How we perceive ourselves and our surroundings – our awareness or self-awareness, the same as consciousness. Depressed and stressed people have a shorter life span, here we get the answer to how negative emotions affect our consciousness and our epigenetics. Sometimes it can take years of mental stress, sometimes it is an unhappy childhood that causes ill health. The study compares 11 cases experiencing stress and trauma to 20 cases that did not. The results show that stress affects our health through epigenetics and consciousness which is confirmed by this study; the persons, who answered "yes" on the question they had been physically ill in a destructive relationship. People in the control group were healthy, happy and appreciated by their husbands. Of the 11 cases who had been deeply interviewed nine had been abused, one has lived in constant tension and fear on her job. This study is an indication that consciousness influences epigenetics in the development of disease.

3.0 COG-SCI PSYCHOLOGY

J. Kornmeier, M. Zegarac, J. Sanfrey, S. Atash, M. Lowe, C. Kaneshiro, M. Moradi, E. Stephens,

E. Menshikova (R)

Section: 3.0

Status: Poster

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Primary Topic: [03.02].....Vision

Abstract Title: Top down resolution of visual ambiguity – knowledge from the future or by footprints from the past?

Abstract: Current theories about visual perception assume that our perceptual system weights the a priori incomplete and noisy sensory information with previous memorized perceptual experiences in order to construct stable and reliable perceptual interpretations. These theories are supported by numerous experimental evidence. Theories about precognition have an opposite point of view. They assume that information from the future can have influence on perception, thoughts and behavior. Several experimental studies provide evidence for precognition effects, other studies found no such effects and/or failed to replicate the previous findings. One problem of the vast majority of precognition studies may be, that the experimental precognition paradigms did not systematically control for potential effects from the perceptual history. In the present study we used the Necker cube in order to systematically disentangle influences from the past and from the future on the perception at a present moment. We presented ambiguous Necker cube stimuli and disambiguated cube variants in alternation and systematically tested in two separate experiments whether perception of a currently observed ambiguous Necker cube stimulus can be influenced by a disambiguated cube variant, presented in the immediate perceptual past (perceptual history effects) and/or in the immediate perceptual future (precognition effects). We found perceptual history effects, which partly depended on the length of the perceptual history trace but were independent of the perceptual future. Results from some individual participants suggest at first glance a precognition pattern but results from our second experiment make a perceptual history explanation more probable. On the group level, no precognition effects were statistically indicated. The perceptual history effects found in the present study are in confirmation with related studies from the literature. The precognition-like patterns were restricted to selected individuals and did not allow for general conclusions. Overall, the present study demonstrates that any future experiment about sensory or extrasensory perception urgently needs to control for potential perceptual history effects and that temporal aspects of stimulus presentation are of high relevance.

Section: 3.0

Status: Poster

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Primary Topic: [03.05].....Emotion

Abstract Title: Transpersonal Emotions as Phenomena of Consciousness: A New Theoretical Category

Abstract: Transpersonal emotions such as compassion, forgiveness, awe, gratitude, humility, equanimity, elation, and joy seem to have a lot in common with nondual consciousness. Those transpersonal affective positions nomologically manifest as either states (i.e., more transitory conditions), or traits (i.e., more permanent dispositions) and show that they may apparently entail “going beyond” the ego-self. As phenomena, they are linked to expansion, transformation, and transcendence of the so-called ordinary consciousness. This ordinary consciousness usually consists of either the minimal self, supported by core consciousness (the “here and now” experiences) or of the narrative self, maintained by extended consciousness (a first-person self-referential experience of what transpires as one’s past, future, and present self-identity). The “farther reaches of human nature” induce crossing the boundary between a subject, the “I”, and the object, everything outside of what is considered “the self”. The result is a unified consciousness, manifested either as a sense of loss of self or as a sense of oneness, which has much in common with transpersonal emotions. The complementary concepts of nothingness (i.e., loss) and oneness (i.e., a totality of everything) point toward the ultimate nondual property of consciousness as unity-in-dichotomy and complementary pairs. This is confirmed by numerous studies of higher forms of nonduality-related and self-transcendent practices such as meditation, prayer, dreamwork, breathwork, and others. A gradual or sudden, and spontaneous or intentional, disidentification with the ego-self that occurs in both nondual awareness and ultimately in transpersonal emotions may be traced, explored, and partially validated by spiritual traditions, developmental and evolutionary studies, theoretical claims of transpersonal and other branches of psychology, neurocognitive research, transpersonal and other forms of therapy, as well as with ordinary being-in-the-world. From ancient Greece to modern times, spiritual traditions, both exoteric and esoteric, outlined transpersonal emotions as a crux of being with God, a union with Higher Power, awakening into the light, or surrendering to the Higher Self. Developmentally, transpersonal emotions may be viewed as more complex and higher-order states and dispositions as they develop later in life. Phylogenetically, they also emerged later, hypothetically during the time of the cultural Big Bang and shift from hunting to agriculture when the need for greater empathy, cooperation, and preservation of mental resources became more prominent. Neurocognitive research points to some common denominators for many transpersonal emotions and nondual awareness, such as functional and structural connectivity of certain brain regions. This presentation, which is part of much larger dissertation research, will look at this new concept and its possible validity. It will also examine a mutual interaction among six specific transpersonal emotions mostly in their trait form, the link between them and nondual awareness, and correlations between several spiritual practices (e.g., meditation, prayer), and nondual aspects of transpersonal emotions.

Status: Poster

Name: John Sanfey

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Primary Topic: [03.17].....Temporal consciousness

Abstract Title: Is consciousness physical? Time holds the key

Abstract: The relationship between consciousness and the physical world remains unknown. Consciousness has no perceptible properties, no metrics in common with the physical world. Here I show that the phenomenon of experiencing presence in time is not only specific to consciousness, but also has observable effects that can be used to reverse-engineer the properties of consciousness. The conditions necessary to support the experience of being in time, the conscious now, are easily mistaken for properties of external reality, and are quantifiable in principle. The arguments are presented in two stages. The first is designed to separate the perceptual contents of mental states from the phenomenon of experiencing presence. The second is a series of thought experiments that show that experiencing presence in time creates uncertainty about whether matter is real, or an illusion of mind. The purpose of consciousness is to heighten uncertainty which influences future actions and establishes the principle that conscious presence interacts with the physical world. The idea makes empirically testable predictions for the behaviour of neural correlates of consciousness and predicts that quantum biology plays a role in the phenomenology of consciousness, specifically in producing the instant memory necessary for experiencing the interval of time that is the conscious now.

Section: 3.0

Status: Poster

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Co-Authors: Monir Haddad; Soraya Behboodi; Mohammad Ali Taheri

Primary Topic: [03.18].....Intelligence and creativity

Abstract Title: A Comparison of the Definition of Intelligence in Psychology and Psymontology

Abstract: Psymontology, or the Interuniversal approach to the study of the mind (mento) and psyche (psychology), is a branch of the Iranian Complementary Medicine founded by Mohammad Ali Taheri that identifies the mind and the psyche as distinct and separate from one another. Psymontology holds a

very broad and holistic view of human beings and the universe and aims to identify the various existential dimensions of the mind as well as the psyche and to heal the maladies related to both. In psychology, what is known as IQ (Intelligence Quotient), representing the potential of learning, computation, language, comprehension, memory, and abstract reasoning, from the standpoint of Psymontology, are considered “Wisdom” (Aql) or “Apparent Intelligence” that are aspects of Wisdom (Aql) and are called WQ (Wisdom Quotient). In Psymontology, “Creativity” is defined as the “Inner Intelligence” (Bātin), a potential in all humans that needs to be activated. This activation requires a high degree of thirst for knowledge and discovery of Truth, in addition to other measures. According to the Theory of Intelligence in Psymontology, Intelligence is the ability to create and bring about new information in various fields; Wisdom (Aql), on the other hand, is the ability to apply, make use of, and utilize anything; while Memory is the ability to store and recall information. The ability to memorize information and events and the recollection of them is represented as MQ (Memory Quotient), which in Psymontology, unlike in psychology, is not considered among the faculties of Wisdom (Aql), but it does function in relation to Wisdom and Intelligence. Most current education systems are based on a memory-oriented approach that relies on rote memorization of the material. However, it is imperative for the education systems to be creativity-oriented if they are to foster the growth and development of individuals and help human societies thrive and flourish. For this to occur, it is necessary to activate the creative potential in children and adolescents, which are not activated through simple memorization of content; otherwise, their mental capabilities will gradually diminish over time and will be replaced by stereotypical teachings that are dry and devoid of any creative spark. Although with respect to scientific discoveries, human intuition is known to have elicited creativity, to this day, no method has been proposed to cultivate and enhance this faculty. Psymontology aims to introduce novel methods to make accessing constructive and productive insights and intuitions possible that would promote human growth and evolution and would lead to the activation of the creative genius in individuals and the emergence of new ideas in various areas of knowledge.

Section: 3.0

Status: Poster

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Primary Topic: [03.19].....Cognitive theories of consciousness

Abstract Title: Consciousness: From Correlation to Explanation

Abstract: The so-called 'hard problem' of consciousness has proved intractable, in large part because current scientific approaches in the field of neuroscience

seek correlations not explanations. In this paper, I offer an explanation as to how the quintessentially subjective element of experience arises within natural languages as an emergent property. When we think of languages, we tend to think of the sounds, syllables, words and sentences that make up the audible and visible external forms of a language. But there is another domain, as yet uncharted, that represents the most essential quality of a language and transcends its transient forms. That domain, often regarded as a proxy for thought, is Meaning. It is in and from this hidden domain that consciousness arises as an emergent property. The domain of Meaning comprises a complex system of meaning-sound relations that has so far gone unrecognized by mainstream science. Meaning is capitalized here to indicate that we are not talking about meaning as it pertains to individual words or sentences. The capitalized term relates rather to meaning instantiated at a higher, systemwide level; a level residing behind the scenes in the unconscious mind of speakers. My research reveals that the domain takes the form of a hierarchically ordered network of concepts, beginning with the concept ONE. The network constitutes a system of Meaning (a Meaning System or System) that grows in a manner analogous to biological organisms, the difference being that it grows by the bifurcation of concepts rather than by the division and subdivision of cells. The System is activated when a toddler learns a language. Functionally, a Meaning System, which is self-organizing, serves to separate out 'What is Me' from 'What is Not Me', a distinction that is a prerequisite to the emergence of consciousness. In addition to separating out the subject 'I' at the center of an individual's experience, it casts all other entities as 'Other' (i.e., that which is Not Me), and assigns names to those designated Others that are consistent with their distinguishing qualities and attributes. No meanings in Meaning Systems are arbitrary or are unrelated to the thing named, although the provenance of the names has long since been forgotten. Meaning Systems allow us to navigate in space and time with a map to Meaning that contains a foreknowledge, albeit unconscious, of the various named entities that exist out there in the world that are mediated by the senses. My presentation will identify the hard and soft evidence that supports the existence of the above-described domain of Meaning in languages. It will also identify notable design features of the same, including the design feature that gives rise to consciousness. Although the paper principally draws on evidence from the English language, the hypothesis outlined above predicts that consciousness is an emergent property of all human languages. As such, all languages, past and present, must necessarily be (or have been) similarly endowed with such hierarchically ordered systems of Meaning.

Section: 3.0

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Co-Authors: Russell T. Hurlburt

Primary Topic: [03.20].....Miscellaneous

Abstract Title: Evaluating Descriptive Experience Sampling Iterative Training: Do Participants Become More Skilled Over Time?

Abstract: By “inner experience,” we mean phenomena that are directly apprehended at some moment, e.g., visual images, inner speech, tactile sensations. Because inner experiences are private, any method that intends to investigate inner experience must help its first-person participants to distinguish between directly apprehended phenomena and anything else that might uncritically be confused with directly experienced phenomena (e.g., interpretations, explanations, or inferences about ongoing experience; assumptions or heuristics about the typicality of experience; etc.). Further, because inner experiences are rapidly changeable and evanescent, participants describing inner experience must be temporally specific—a phenomenon occurring at one moment might be hugely different from an experience a second later. Descriptive experience sampling (DES) is a method that was designed to “cleave to” (Webster: “to adhere firmly and closely or loyally and unwaveringly”) directly apprehended experience (avoiding all else) that was ongoing at a moment identified by an external beep (avoiding other times). In a typical DES investigation, participants wear a random beeper in their natural environments and are tasked with apprehending their ongoing experience at the moment of the beep’s onset. On each sampling day, participants collect approximately 6 samples of experience. Within 24 hours, participants take part in an investigator-led expositional interview, which has two main goals: (1) to provide iterative training aimed at improving the participant’s abilities to cleave to ongoing-at-the-beep experience on subsequent sampling days; and (2) to describe with as much fidelity as currently possible whatever inner experience was present at the moment of each random beep. This sampling-and-iterative-interview process is repeated over a number of days with the aim of improving the fidelity of participant’s descriptions of experience across days. DES’s methodological adequacy hinges on whether the iterative training does indeed improve a participant’s ability to cleave to ongoing-at-the-beep directly apprehended experience. However, the extent to which DES participants improve across the DES sampling process has never been directly investigated. We present a study that compares the skill of DES participants at the end of their DES participation to their skill at the beginning of participation.

Videotaped participants from prior DES investigations were randomly selected; participants' very-last-sample and very-first-sample expositional interviews were independently rated by two investigators using both quantitative metrics and qualitative analyses. Quantitatively, we rated participants' experience- and moment-cleaving at each major turn of the interview and counted the participants' subjunctification density (verbal and behavioral indicators that a participant is not providing an unequivocal description of inner experience). Qualitatively, we characterized participants' manner of cleaving (or not) to directly apprehended experience, cleaving (or not) to the moment of the beep, and their subjunctification. We found that participant's cleaving skills did improve between their first and last sampling interviews. We discuss the methodological implications of these results both for DES and for first-person methods other than DES.

Section: 3.0

Status: Poster

Name: Masoumeh Moradi

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Organization: CosmoIntel Inc.

Co-Authors: Mehri Sheykhoo; Mohammad Ali Taheri

Primary Topic: [03.20].....Miscellaneous

Abstract Title: A comparative study of the effectiveness of Taheri Consciousness Fields and the theory of mind on borderline personality disorder

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. A borderline personality disorder is a multidimensional disorder characterized by numerous deficiencies in interpersonal relationships, self-concept, cognitive, emotional, and behavioral actions with chronic disorders. However, effective and definitive treatments for this disorder have not been provided so far. It seems that the theory of mind with metacognitive strategies and interventions and teaching interpersonal relationships through special techniques of this method has taken

a positive step in improving the conditions of these patients. This study aimed to determine the effectiveness of TCFs treatment on reducing the symptoms of borderline personality disorder and to compare this to the effectiveness of teaching the patients the theory of mind. The quasi-experimental method was used in the present study with control and experimental groups and pre-test scores were monitored during the analysis process. The statistical population of this study was a population of 40 clients diagnosed with a borderline personality disorder using the (STB) questionnaire in clinics in Tehran. The patients were selected and assigned to the control and experimental group by random. The experimental group was divided into two groups of 20 patients, one group were trained on the theory of mind in 8 sessions and the other exposed to the TCFs in 10 sessions (60 minutes in each session). To determine the effectiveness of the treatments, we carried out the ANKOVA test and compared the results with the pre-test scores. According to the results of this study, treatment of TCFs and training theory of mind resulted in a reduction of about 35% and 18% in the general symptoms of borderline personality disorder compared to the control group. On the other hand, comparing the subscales, the TCFs had a significant decreasing effect on the subscales of impulsivity (24%), disappointment (43%) and the theory of mind decreases the paranoia subscale (15%). Accordingly, considering the drastically higher impact of TCFs treatment on the general symptoms of borderline personality disorder and its dominant effect on subscales in comparison with the theory of mind method, the use of TCFs introduces an alternative and complementary method to the conventional borderline personality disorder treatments.

Section: 3.0

Status: Poster

Name: Elizabeth Stephens, Ph.D.

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Co-Authors: Harris Friedman

Primary Topic: [03.20].....Miscellaneous

Abstract Title: Research Findings on Depersonalization, Dissociation, Memory, and Mental Health in Claimants of Persistent Nonduality and Spiritual Awakening

Abstract: Nonduality, defined for this research as the persistent sense that one is not a separate self, is sought by certain meditation groups or spiritual traditions as the epitome of well-being. However, the impact of the experience of nonduality on important psychological constructs, such as depersonalization, dissociation, mental health, and memory, has been unclear. The dissertation research I would like to present was designed to fill this important gap in the literature. Nonduality seekers from four meditation or spiritual communities

(N = 311) completed survey items regarding their nonduality status as well as assessments of depersonalization, dissociation, mental health, memory, and nondual embodiment. Data were analyzed using analysis of variance (ANOVA) and analysis of covariance (ANCOVA) to account for age, sex, education level, and years of seeking. Claimants of nonduality scored significantly higher than non-claimants in tests of depersonalization, dissociation, and nondual embodiment, but the two groups scored similarly in mental health and memory. Further, significantly more claimants scored higher than screening thresholds in depersonalization and dissociation. Similar results were obtained for seekers who claimed spiritual awakening. These findings have important implications towards fostering mental health in seekers of nonduality and spiritual awakening.

Status: Poster

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Organization: New Institute for Cultural Research (Moscow), Candidate of Cultural Research, independent expert, philosopher, theorist of art

Primary Topic: [03.06].....Language

Abstract Title: The Perception of "Uncertainty": The Thrill and the Will of Panic Attacks, or Post-Marsian Chronicles of Covid-19 (Andersen and Bradbury in 2020/21) 1

Abstract: A premonition of a total transformation taking place in human society, which devastated itself, burning down the meaning, as a premonition of a great misfortune: the disappearance of the prospect of existence (not the future - which is always abstract and just a 'temporary category'), but as an insight into the existential failure into which it flew "consumer society", sweeping away all the foundations of existence with the fire of rational hypocrisy (in the Russian tradition, a flatterer is a deceiver, but who remembers this?), - it is this "epiphany of time and space" that Bradbury expressed in his novel. And "total" in this combination with "transformation" means "complete", all-encompassing, like the "turning around", which Proteus demonstrated by himself, undergoing a complete wrapping: from a fish into a boar. A firefighter who considers his direct professional duty to be 'kindling a fire', and not 'extinguishing a flame', is proof of a 'complete transformation', since the bearer of the profession has forgotten the meaning of the word, which determines the type of his activity, just as the baker, 'baking', has become he would treat buns with a chemical solution, turning them into "poison" (analogies can be expanded), and maybe he would like to remember the etymology of words, but that's bad luck - dictionaries like

'enemies of the people' were burned first. The philosophers and poets always see their "present", in the hope of understanding the past, without which it is simply impossible to awaken either their own Consciousness, or eternally hibernating a society that, barely waking up, grabs a flail, while they do not care about the future at all, since it exists only in the imagination, and which slips away as it approaches it. Thus, Swift introduced 'satire' into the everyday life of his preaching activity – a necessary element of 'comprehension by reason', that is, inclining his flock exclusively to 'imagination'. Knowledge of historical processes teaches us to think analytically, in the end, "Ides of March" occur from year to year, accompanying the unhurried course of the Evolution. If social transformations as 'artificial transformations' are determined by the evolutionary strategy of society itself, then the psycho-somatic transformations of a person, and we are talking, first of all, about them, because in the next hundred years a person does not threaten to change hands for wings, and feet for hooves, he will not have a tail or gills, he will not grow a beak (biological aspect) - he is only threatened by an anthropogenic mutation - that which will change for the next hundred years (and possibly further) its qualitative characteristics as parameters of mental activity (anthropological aspect), which directly determine its "humanity". It is this "humanity" that has undergone a massive attack of alien mental drones in the past three years, which are not related to the work of a particular Consciousness, but skillfully and artificially derived empirically and aimed at storming other consciousnesses - one might say, by massive vaccination of minds. Such a transformation is carried out by the society itself on a regular basis - it is enough to look at the history of the culture of all mankind as a whole - and every time the society turns out to be prepared for it gradually: by counterparties (priests, magi, augurs, theologians, sectarians, crusaders of ideas and teachings), if you "tame" fails, then natural disasters and social bifurcations - revolutions - are turned on. In the nature of this phenomenon, which can be called a 'cyclical total transformation', we have to figure it out - hurrying while the psychosomatics of the 'past' is still alive, until the fingers have forgotten how to hold a pencil, while the manuscript remains a 'manuscript', since it is written by hand and from hand - human ability, which is strongly recommended to be forgotten by modern transformers of the Logos. 1. Fragments from the book: Menshikova E. R. Flashes of Meaning: the Singularity of Consciousness. - M., St. Petersburg: Center for Humanitarian Initiatives, 2021. - 648 p.

4.0 PHYSICAL & BIOLOGICAL SCIENCES

A. Singh, R. Sieb (R), M. Brooks, C. Rudnitski, A. Fitzpatrick, D. Smolker, S. Loeth, J. DeCarlo, P. Saeedloo, R. Singh, B. Therner, F. Barancheshme, N. Nabavi, H. Gharacheh, G. Williams, B. Biradar, C. Gergely (R), S. Jarosek, J. Ma, A. Mahmoudi, S. Mousavi

Section: 4.0**Status:** Poster**Name:** Avtar Singh**Email:** asingh11608@gmail.com**Organization:** Center for Horizons Research**Primary Topic:** [04.01].....Quantum physics, collapse and the measurement problem**Abstract Title:** OR- Objective Reduction Model Integrating Gravity and Spontaneous Decay of Particle

Abstract: This paper describes a potential theory of Objective Reduction integrating the missing physics of spontaneous decay of a particle building upon Sir Roger Penrose's proposal - "I am going to regard the superposition of the one state plus the other as an unstable state – it is a bit like a decaying particle or a uranium nucleus or something like that, where it might decay into one thing or another and there is a certain time-scale associated with that decay. It is a hypothesis that it is unstable, but this instability is to be an implication of the physics we do not understand..." A physical/mathematical description of the Objective Reduction process is developed including the quantitative effects of gravity and anti-gravity leading to the spontaneous decay or mass-energy conversion of an unstable particle as observed in its spontaneous wave-particle behavior. The Universal Relativity Model (URM) predicts coherence and de-coherence boundary or collapse of the wave function. When gravity effects dominate the antigravity governing the instability of the particle, the quantum reality or wave function collapses to classical reality of mass or particle and vice versa. The new relativistic wave-particle model of URM vindicates the empirical observations of the universe and removes many of the current inconsistencies and paradoxes of the mainstream theories. The overall URM model provides a potential quantitative mathematical framework for a universal theory of matter-mind-consciousness.

Section: 4.0**Status:** Poster**Name:** Richard Sieb**Email:** siebr@shaw.ca**Primary Topic:** [04.03].....Space, time and the nature of reality**Abstract Title:** The Neural Basis of Conscious Experience

Abstract: Sensory input activates the autonomic nervous system, endocrine system, and ascending reticular activating system to produce the

awake (conscious) state. Conscious experience makes up the content of consciousness, i.e., what is in consciousness. Direct observation and analysis of any conscious experience reveals that human conscious experience has an invariant structural mode of organization that is common to all conscious experiences and to all human beings. You can readily observe that many events in your conscious experience of a room occur at the same time (simultaneously), but in different spatial locations (desk, chair, computer, monitor, printer, keyboard, windows, door, lights, walls, floor, ceiling, etc.). Outside, many events in that conscious experience also occur simultaneously, but in different spatial locations (trees, parked cars, buildings, road, sidewalks, playground equipment, lawns, etc.). In physics, this type of separation of events is known as space-like space-time interval separation; events are separated by space, but not time. Space-like separation is a basic part of the structural organization of all human conscious experiences. You can also observe in your conscious experiences that some events are experienced at the same spatial locations, but at different times (people replacing other people in seats, replacing a glass with a cup, any moving object, replacing one conscious experience with another, etc.). In physics, this type of separation of events is known as time-like space-time interval separation; events are separated by time, but not space. Time-like separation is also a basic part of the structural organization of human conscious experiences. Events are identified through the transmission of light to the eyes. In physics, this is called light-like space-time interval separation (the electromagnetic interaction). Light-like space-time intervals are also a basic component of human conscious experiences. Three basic types of space-time intervals (space-like, time-like, light-like) completely account for the organizational structure (and appearance) of human conscious experience. Three core sources of information (what, where, when) underlie the encoding, storage, and recall of conscious experience (episodic memory). What, where, and when information is conveyed by the dorsal and ventral cortical functional streams to the medial temporal lobe of the brain where events (what) are encoded in space (where) and time (when) by hippocampal place cells and time cells within spatiotemporal contexts conveyed by entorhinal cortex grid cells and ramping cells. Place cell and time cell theta phase precession unifies the encoding of space and time in the hippocampus. Place cells and time cells reflect fundamental mechanisms by which hippocampal neural networks parse any spatiotemporal context into quantal units of where and when events occur, bridging, and thereby organizing the events, in a conceptual organization of events (conscious experience). Theta travelling waves ensure that the instantaneous output of the hippocampus consists of topographically-organized segments of space and time (space-time intervals). Space-time intervals are extracted from the hippocampus by the prefrontal cortex for the cognitive, affective, and motivational aspects of conscious experience. Greater detail may be found in "Conscious Experience, the Neural Mechanism", found in Phil Papers or relativisticconsciousness.com.

Section: 4.0

Status: Poster

Name: Mark Brooks

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Organization: From a Different Perspective LLC

Primary Topic: [04.03].....Space, time and the nature of reality

Abstract Title: A Physics Paradigm that can Unite Science, Religion and the Paranormal

Abstract: Everything that has, is now and will occur on earth must obey the same unchanging laws of physics. This includes scientific anomalies, miracles recorded in religious scripture and paranormal abilities. This presentation will show how the currently estranged beliefs of science, religion and metaphysics can be reunited under a fully wave-based physics paradigm. From a scientific anomalies perspective, this presentation will use fully wave-based physics to propose the source of magnetic field lines, the source of positive and negative atomic charges and explain how a photon can behave as both a wave and a particle (i.e., wave-particle duality).

Section: 4.0

Status: Poster

Name: Collin Rudnitski

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Primary Topic: [04.03].....Space, time and the nature of reality

Abstract Title: Constructal Law and Consciousness: Can a thermodynamics theory of flow systems be applied to the flow of information?

Abstract: The materialist approach to understanding consciousness holds that the structure of the brain, complete with the flow of information between neurons, is the source and cause of consciousness. Through a creative philosophical extrapolation of that idea, we go to a faraway world of an immense forest, filled with squirrels. The movements of these squirrels and the information they carry- with brains consisting of huge bundles of neurons in their own right- matches our brain both physically at a moment, and dynamically with respect to the information flow. Since this meets the same physicalist/materialist's requirements for the origin of consciousness, this planet must be conscious! This hypothetical is not meant to poke fun at the materialist's belief; but rather to identify what aspects of this definition can be shared with an idealist. Historical philosophies which lay the groundwork for this theory range from the universal consciousness, the Gaia hypothesis, Hermeticism, the

Gnostics, and even appear in pop-culture with films such as Avatar. The unique approach of the presenter is to use an emerging theory in thermodynamics called 'Constructal Law' (Prof. A. Bejan) which analyzes the emergence of a structured system of flow out of uniform and random distributions to formalize the study of the structure of the mind; then to use that structure to model steps that need to be taken for the exponential growth of connections between conscious beings on Earth- not just mankind. Reframing the materialist view to allow a broader understanding that incorporates evidence of non-local consciousness and psi phenomena we start with the following framework: Consciousness is a structured system of information flow that is self-sustaining, dynamic, and carries intention. This talk hopes to use the mental capacities of the audience to meditate together on how we can achieve a higher state of consciousness as a group, as a species, and as a planet- not just the individual. The future work of the presenter hopes to combine conscious and unconscious cooperation of individuals to solve humanities greatest challenges. If we combine our minds to focus our awareness on one singular intention, we can change the world. I want to ask the squirrels in the forests and the fish in the sea, and every human on earth to assist in combating the end of our existence, but I need help getting this started. I hope many will attend to spark that fire that unites the species of Earth for one purpose- survival.

Section: 4.0

Status: Poster

Name: David Smolker

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Primary Topic: [04.04].....Cosmology and integrative models

Abstract Title: Weak coupling of stock market and gravitational dynamics of Solar System Solar System may provide indirect support for Orch OR

Abstract: Penrose/Hameroff's Orch OR gravitational theory of consciousness remains directly unproven due to the experimentally inaccessible Planck-scale at which OR is theorized to occur. If Orch OR is correct and consciousness is gravitational in origin, significant changes in the observable external gravitational environment may correlate with changes in the observable character of conscious awareness and its associated behaviors thereby supplying indirect support for Orch OR. The Solar System drives changes in the external gravitational environment on Earth. It functions as a resonant, periodic system of tidal forcings, torques and exchanges of angular momentum synchronized with the orbital harmonics of the Sun and planets. These forces cause the Sun's orbit around the center of the Milky Way Galaxy to spiral in a regular cyclical trefoil pattern around the center of mass of the Solar System ("CMSS"). The pattern is driven primarily by the Jupiter/Saturn synodic cycle

averaging 19.859 years and its hemi-cycle averaging 9.930 years, which correspond to Jupiter/Saturn conjunctions and oppositions. The Sun reaches its closest approach to the CMSS at the Jupiter/Saturn opposition and then reverses direction away from the CMSS. At that point, the rate of change (“ROC”) of the Sun’s orbital angular momentum, which had been steadily decreasing, reaches a minimum and starts increasing until 9.930 years later when it reaches its farthest distance from the CMSS at the Jupiter/Saturn conjunction. At that point, the rate of change peaks and begins to slow down as the Sun reverses direction and heads back toward the CMSS. Known as the Pulse of the Solar System, this gravitational cycle overlays upon a stochastic background of gravitational waves coming from all directions generated by all celestial objects within the Universe. This vibratory noise subtly squeezes and stretches space-time such that all life on earth, including its atomic and molecular constituents, should be resonating at extremely tiny scales in synch with this noise. This background has a projected vibrational frequency in the kilohertz range which overlaps those of microtubules and neurons. Additionally, MTs appear capable of spontaneously converting incoherent signals into coherent ones. Mood is an observable conscious state of mind. Changes in mood are reflected collectively in broad based stock market indices. Monthly fluctuations of social mood shown by the stock market and the Pulse of the Solar System since 1800 are weakly, but significantly correlated ($r = -.19$, $p < .00001$). Mood exists at the edge of criticality potentially making it extremely sensitive to significant phase changes in the Sun’s angular orbital momentum. Those shifts should be distributed throughout the Solar System, including Earth, our brains, and the microtubules (“MTs”) said to be locus of consciousness under Orch OR. The neurotransmitter serotonin regulates mood. Some suggest that serotonin acts as the brain’s clutch, shifting the mind through various gears of behavioral action. Its precursor is tryptophan, residues of which are found in MT tubulin. The author suggests that the MT network, which acts both as antenna and receiver, detects and amplifies in stochastic resonant fashion shifts in the ROC in the Sun’s orbital angular momentum. This process may alter the MT resonance and in turn the rate of hydrolyzation of the MT tryptophan residues into serotonin and its transport to the mood centers of the brain. This may help explain in gravitational terms the mood shifts reflected in the stock market while lending indirect support to Orch OR.

Section: 4.0

Status: Poster

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Co-Author: Birgitta Therner

Primary Topic: [04.04].....Cosmology and integrative models

Abstract Title: The Evolution of the Living Multidimensional Cosmos with Endless Cycles of Universes and the X-Structure

Abstract: The Cosmos is undergoing an eternal dynamic cyclic evolutionary process. This means, for instance, that there is neither a beginning nor an end of time, and that our universe is just one of an endless number of universes existing in the all-encompassing multidimensional Cosmos. What we term the Big Bang actually represents one expression of a never-ending process with recurring Big Bangs where one universe replaces another. This is fundamental to the ontology of the Cosmic Worldview presented by the Danish intuitive philosopher Martinus Thomsen. In this area we also find similarities to models presented by Roger Penrose, Niel Turok, Paul Steinhardt and other physicists. Martinus describes the principles and forces behind these astrobiological processes by focusing on the “X-Structure” – the basic nature of life and reality. The Cosmos is based on the initial reality, termed X0, which constitutes the ultimate source of everything. X0 represents a living, unmanifested “Something”, characterized by wholeness, emptiness, stillness, infinity and eternity, with the ability to manifest itself through an indivisible triplementary principle with three functional aspects: X1 the creating Something, the driving force behind all creation and manifestations; X2 qualitative basic energies, constituting the ability for X1 to manifest and create a contrast to the X0-nature; X3 energy conversion, the effects of the interaction between X1 and X2, resulting in the manifested Cosmos. The X2-function basically consists of seven extremely subtle qualitative “cosmic basic energies”, which means a completely new concept of energy. Everything created consists of different combinations of these basic energies, each holding specific properties. The entire physical world is based on the interaction between the so-called expansion energy and contraction energy. These two basic energies are also the most dominant in the endless, cyclic process with its recurring phases of expansion and contraction/compression, in which new universes are born, evolve and die. These astrobiological processes are governed and controlled by the primary basic energy (the mother energy), that holds and operates via a number of so-called cosmic creative principles or morphogenetic effect constants; form-creating and structuring forces that sustain and organize life and reality. We can empirically observe the effects of these morphogenetic effect constants in the constants and laws of nature with their extremely delicate precision. The X2-function with its creative principles/effect constants, operates and functions as “transformation processes” which create contrasts to the X0-nature of emptiness, stillness, wholeness, infinity, eternity, nonduality and nonlocality which is transformed and structured into energy/matter, movement, life-units, space, time, states, distances, etc. The so-called cycle principle and motion principle (comprising the five universal classes of motion including space,

time, matter) are crucially important for the formation of the endless cycles of universes. These transformation processes with recurring Big Bangs where one universe replaces another can be seen as reincarnations and disincarnations of universes in the living multidimensional Cosmos. All forms of life evolve in the Cosmic Evolutionary spiral. New Cosmic Paradigm – NCP X-AIONS is representing the Cosmic Worldview and the branch of Martinus Cosmology that presents Ontological Principles and New Science, www.newcosmicparadigm.org

Section: 4.0

Status: Poster

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Organization: Hofstra University

Co-Authors: Dr. Michael R. Pryzdia, Senior Lecturer within the Faculty of Leadership and Integrative Studies within the College of Integrative Sciences and Arts at Arizona State University

Primary Topic: [04.05].....Emergence, nonlinear dynamics and complexity

Abstract Title: The Metastatic Consciousness of Cancer Cells

Abstract: In keeping with the growing scientific-philosophical trend of examining states of consciousness in microscopic creatures such as fungi and viruses, we are interested in and arrested by the varied states of consciousness that cancer cells demonstrate as they defend, nurture and develop micro tumor environments. In this respect, we are also prompted to wonder if it is even appropriate to assume if a “state” of consciousness exists at all. While we follow Nagel’s position that we do not know what it is to be a cancer cell, we base our conceptual inferences on their observable and consequential behavior. These behaviors, which display varied forms of intentional awareness, alertness, and watchfulness, include: mutational sequences that provide defensive molecular disguises against T-cells; defensive regressions to primal stem cell embryonic plasticity that baffle and elude the immune system; and competitive consumption with T-cells of fatty tissues, essential for cellular energies. Moreover, behaviors which entail a consciousness of knowingness as well as of novelty and creativity include: oppositional suppression of the tumor suppression gene, which substantially eliminates the body’s natural defense system against tumor development; polymorphic-holographic sexual selections, which inject hundreds or even thousands of genetic variations within a given tumor; appropriation and inversion of the natural healing process from the primary to secondary tumor site - enabling the metastatic cells to detach and colonize new and distant sites; and a classic bait and switch whereby

the immune system is tricked into thinking the tumor is a wound that never heals, initiating the reprogramming of the role of macrophages from natural eradication to maintenance of the tumor. In addition to explaining these behaviors in greater detail, we will question whether the behaviors, especially in the latter classification, are subject to computational values, and where indivisible temporal transformations and tonal resonances of intra-cellular and inter-cellular protein and enzyme cascading might apply. Lastly, the emergence of new paradigms in the study of metastasis, which is the key cause of failure of cancer therapy and mortality, reveal that some of the key biological principles that govern the mobility and plasticity/multiplicity of the invading tumor cell in route to the target site involve extra-cellular vesicle exchange, invoking concepts of memory transference and holographic morphic resonance. In sum, we will explore how this array of clarified and enhanced concepts and theories of cancer consciousness might lead to new epistemological and ontological understandings of cancerous activities, and consequently, to new areas of scientific and technological research and medical and therapeutic applications.

Section: 4.0

Status: Poster

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Organization: CosmoIntel Ltd.

Co-Authors: Mohammad Ali Taheri; Sara Torabi; Noushin Nabavi; Farid Semsarha

Primary Topic:

[04.10].....Origin and nature of life

Abstract Title: Investigating the Effect of Taheri Consciousness Field on some Biological and Biomimetic Systems

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. One of the fundamental property of proteins is to act as enzymes which

catalyze all chemical reactions in biological systems. In addition, it has been shown that catalytic and enzyme-like behavior of inorganic molecules like metals and minerals have an essential role in formation of vital structures and behaviors at the beginning of life. On the other hand, according to the theory of primordial soup, self-assembly processes of primary amphiphilic molecules are critical at the beginning of life. Accordingly, with the aim of investigating the possible effect of TCFs in the process of life initiation, self-assembly structures with enzyme-like behavior were selected to investigate the effects of TCFs on the life processes. Given the important role of hydrogen peroxide in the early atmosphere and the evolution of life, it was used as a substrate for horse radish peroxidase (HRP) enzyme. Moreover, enzyme-like behavior of gold nanozyme and micellar histidinate hematin as an enzymatic biomimetic system were used. HRP extracted from the plant tissue under the influence of TCF1 showed an increase in catalytic activity and an increase in the substrate selection power (decrease in Michaelis constant by 4%) that was associated with changes in protein conformation (confirmed using a fluorescence emission assay). In biomimetic studies, the effect of TCF1 on the physicochemical structure and function of gold Nano-chemical models was studied using electron microscopy, dynamic light scattering, and kinetic assays. It was observed that the nanoparticle size and its Michaelis constants decreased under influence of TCF1 by about 20% and 4%, respectively. Additionally, there was an 8% increase in catalytic efficiency and 40%-45% increase in zeta potential, conductivity, and mobility of the sample under the influence of TCF1 in comparison with the control. In the case of micellar model, the predominant micelle size in the sample population under the influence of TCF1 was smaller compared to the controlled group. These results indicate that TCF1 can cause limited but reproducible and significant changes in the behavior of biologic and biomimetic molecules. The ability of TCF1 to affect biological and biomimetic systems merits further research to identify the extent and mechanism of action of this T-Consciousness Field in the origin of life criterion.

Section: 4.0

Status: Poster

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Primary Topic: [04.11].....Consciousness and evolution

Abstract Title: Emergence of Consciousness from Causal Information (ECCI)

Abstract: The primary motive here is to lay down a causal account to bridge the explanatory gap between the objectively observable elements in nature and the subjective consciousness. The emergence of consciousness is shown to be based on the intrinsic association of an observable physical state with the

information of its causal dependence on precursor states of interacting systems and the information exchange (processing) resulting from physical interactions. An observable state S of a system P is said to correlate with or represent the semantic value of information of its causal dependence. Here, 'semantic value or semantics' is equivalent to (\equiv) what 'an information' expresses, the content, without any reference to a language. The causal dependence of a state is quantitatively expressible as 'disjunction of causally indistinguishable conjunctions of precursor state values (primitive semantic values) of interacting systems' as shown in 'Fundamentals of Natural Representation' (Singh, 2018, <https://doi.org/10.3390/info9070168>). Hence, the semantic value represented by the state S of P equates to this computable expression. Since the precursor states are also a product of the same causal dependence, the state S of P also represents the semantic value expressed by the same expression on what the precursor states represented', a second order representation, which allows arbitrary structured and abstract semantics to be constructed in modular hierarchy. It is shown here how a semantic value equivalent to 'a unified object U (self) as an observer of objects and actor of actions' is representable. If the semantic components of a conscious experience, such as the self, the objects of experience, and the relation of experience attributing the self as the experiencer are causally represented by a system's state, then no explanatory gap remains between the objective reality and the subjective consciousness. That is, the experiences are the reality of semantic values of relation the semantics of self-possesses. The seer, the seen, and the act of seeing, or the perceiver and the perception, are parts of uniformly represented semantic structure bearing causal consequence. Since a semantic value emerges from the uniform regularity or constancy of causal function in nature, the semantic value is inseparable from the causal function of the state that represents or correlates with it. This explanation neatly relates the objective elements in nature to subjective reality of the semantic value of relation an object has with other objects that we identify as consciousness as shown in, 'The Emergence of Consciousness in a Physical Universe' (unpublishable, circa 2021). The said work lays down the uniform mechanism of construction of arbitrary semantic values in modular hierarchy including the causal relation among objects, mechanics of computing semantic values applicable to neural systems and testable on artificial devices, and mechanisms of population coding, integration, binding, and emergence. In this presentation I will aim to introduce the subject matter.

Section: 4.0

Status: Poster

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Co-Author: Steen Loeth

Primary Topic: [04.11].....Consciousness and evolution

Abstract Title: Consciousness, Reincarnation and Immortality – Explained by the X-Structure; the Basic Nature of Life and Reality

Abstract: Today the evidence for reincarnation is overwhelming, and this will lead to a completely new understanding of Life. According to the Cosmic Worldview and the Danish intuitive philosopher Martinus Thomsen, consciousness is independent of the physical body and life continues in parapsychical planes of existence after the death of the physical body. This is made possible by the fact that in addition to the temporary physical body we, and all living beings, have an immortal parapsychical structure which the physical body is connected to and dependent on. The Cosmic Worldview focuses on the “X-structure” – the basic nature of life and reality, which demonstrates the three main levels of our total organism complex: 1. Physical (temporary status), 2. Semiphysical (temporary status) 3. Parapsychical (eternal status). The X-structure explains the principles of consciousness, reincarnation and immortality which engenders new and ground-breaking evolutionary perspectives signifying a new era in Biology. During periods of our eternal evolutionary process, we live alternately in a physical world and in a parapsychical world which presupposes and implies reincarnation and disincarnation. The complex parapsychical body includes stable storage units termed ability-nucs/talent cores. The main functions of these are to accumulate all our personal experiences, abilities, skills, qualities, etc., in order to make it possible for us to reuse and develop them, including to take them with us from life to life. The talent cores are prerequisites for the development of all forms of life and evolutionary processes. Specific “organic-talent cores” contain information for the creation of organisms and are crucial to how things take their form, grow and evolve in a particular way, dismissing the traditional theory that all this complex form-shaping and development is merely genetically programmed. The primary form-shaping and evolving processes with all the underlying information are accumulated in the talent cores and activated at the parapsychical level when the reincarnation process begins. It should be emphasized that the talent cores/ability-nucs are highly relevant in the field of epigenetics as they directly exert an influence on the genes of the DNA-spiral. During the embryonic and fetal period we repeat earlier stages of our development. This “repetition” can be observed and followed throughout the different stages; the creating and

shaping of an organism by embryological processes of differentiation of cells, tissues and the development of organ systems etc., where the organic-talent cores are of crucial importance. The stages of development that are farthest from our current level of development are repeated first and fastest. Martinus terms this process “the repetition”, which continues after birth and includes repeated sequences from past lives, lasting until the individual is about 28 years of age (applying to humans at the current level of development). All life evolves in a law-governed evolutionary process in the form of “spiral cycles” which gradually lead to ever higher forms of life – the Cosmic Evolutionary Spiral. New Cosmic Paradigm – NCP X-AIONS is representing the Cosmic Worldview and the branch of Martinus Cosmology that presents Ontological Principles and New Science, www.newcosmicparadigm.org

Section: 4.0

Status: Poster

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Primary Topic: [04.12].....Medicine and healing

Abstract Title: Taheri Consciousness Fields (TCFs) and Their Effects on SARS-CoV-2

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. The SARS-CoV-2 virus that caused the catastrophic global outbreak of coronavirus disease (COVID-19) remains a serious global public health threat. Several therapeutic agents have been suggested for the treatment of coronavirus disease. This research investigated the effect of TCFs on SARS-CoV-2 in different environments including a range of pHs and temperatures, in the presence of disinfectant, and on a variety of foods. The results indicated

that TCFs decreased the survival and infectivity of SARS-COV-2 in various environmental conditions compared to the control groups. The mRNA expression of NF- κ B, TNF- α , IL-1 β , and IL-6 genes was also examined in blood samples of COVID-19 patients, both under the influence of Faradarmani as a type of TCFs and in control groups. It was found that TNF- α gene expression was significantly increased while the expression of IL-6 did not show significant change, and a significant decrease was observed in the expression of NF- κ B and IL-1 β genes. Therefore, it seems that Faradarmani TCF can inhibit the cytokine storm by affecting immunomodulation of NF- κ B and IL-1 β in COVID-19 patients. Considering the global predominance of the mutant D614G virus, and its increased transmissibility, we investigated the effect of Faradarmani TCF on this variant as well as the Wuhan strain. We observed that the replication of the mutated virus was less than non-mutated under the influence of TCFs. Finally, the effect of Faradarmani TCF on COVID-19 patients (n=82) admitted to the ICU of Firoozgar hospital (under the supervision of Iran University of Medical Science) in May 2020 was evaluated. The patients were randomly assigned into 2 groups of 41 control and treatment (age range 38-62). The results revealed that 100% of the patients in the experimental group under the influence of Faradarmani TCF who received standard medication recovered, while 22% of the patients in the control group who were treated with standard medication alone did not survive. The findings of these experiments demonstrate the existence of TCFs as non-material/non-energetic fields that have an effect on matter and energy. We suggest further in vitro and in vivo experiments to identify and explore the range of effects of TCFs on various biological systems.

Section: 4.0

Status: Poster

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Primary Topic: [04.12].....Medicine and healing

Abstract Title: Effects of Taheri Consciousness Fields on Survival and Behavior of Cancer Cell Lines: In vitro, Ex vivo and In vivo Studies

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy,

which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. Previously, using MTT assay, cell cycle analysis and expression of genes related to the apoptosis, it was found that TCF1 induced MCF-7 cancer cell line proliferation and survival in two-dimensional (2D) cell culture. In order to investigate the reproducibility of the results, various experiments with different cell lines including U87, SW-480, HT-29, Jurkat and LA-N-5 were conducted under influence of TCF1 and TCF2. For the purpose of this research, cellular viability was evaluated by MTT assay for 6-72 h under the influence of different TCFs. Consequently, cell cycle analysis was performed to evaluate the apoptotic cell death. Accordingly the expression of Bcl2 and Bax genes in some of the cell lines was evaluated to validate the obtained cellular scale results. In a complementary cell study, human MSCs were isolated from bone marrow and the morphology, proliferation of cells, length of telomere, and activity of telomerase were evaluated under influence of TCF1. Finally, the influence of TCF1 on the 4T1 cell line in 3D Microfluidic controlled microenvironment device and on the 4T1 orthotopic breast cancer spontaneous metastasis Balb/c mouse model have been studied. The results of the MTT test indicated that TCF1 increased the survival of the cells by about 1% to 14% in different hours significantly (in the case of HT-29 and Jurkat after 12 hr, U87 after 48 and 72 and SW480 after 48 hours), however LA-N-5 cell line demonstrated no change. In contrast, the results of MTT and flow cytometry assays demonstrated that TCF2 decreased survival and induced apoptosis of the SW480 and HT-29 cell lines. Similar results were obtained in respect to effect of TCF2 on the C6 cell line, using MTT assay and measuring the expression of Bax/Bcl2 apoptotic genes. In addition, tracking of cell cycle progression using flow cytometry indicated the possibility of cell cycle arrest at the G2 and S phases in the case of Jurkat and LA-N-5 cell lines, respectively. Also, to investigate the effect of TCF1 on cell survival, in a study, TCF1 was applied to human mesenchymal stem cells for 24 hours and it was observed that TCF1 in sample increased the proliferation by 20%, the telomeres length by 12% and the activity of the telomerase activity by about 11% in comparison with the control group. Moreover, the results of the TCF1 on the 4T1 cell line under ex vivo conditions were in accordance with previous cancer cell lines indicating an increase in cell viability. Finally, in the mice 4T1 breast cancer model, the effect of TCF1 was investigated in two ways including pretreatment (simultaneously with tumor injection until the end of the experiment) and post-treatment (after the formation of tumors). According to the results, in contrast to the in vitro experiment, not only it did not have the effect of increasing tumor cell survival, but also in pretreatment group TCF1, it had anti-tumor effect and prevented the metastasis in mice. Also, the size of the tumor was significantly

smaller than control. Hence the tumor had no effect on survival behavior and natural vital functions of the treated mice in comparison with the control group. In conclusion, the TCF1 has a positive effect on cell survival outside of a living organism whereas, TCF2 has an apoptotic effect and reduces the survival of cancerous cells under in vitro conditions. Similarly, in vivo investigation showed that TCF1 inhibited growth, metastasis and proliferation of cancerous cells. We suggest that these experiments be repeated and the effects of TCFs be investigated on various cancers in vitro and in vivo. These studies will shed more light on the potential benefits of TCFs in the prevention and treatment of cancers.

Section: 4.0

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Primary Topic: [04.12].....Medicine and healing

Abstract Title: In vitro and in vivo studies of the effects of Faradarmani Taheri Consciousness Field on different types of viruses

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. This research evaluated the effects of Faradarmani as a type of TCFs on the titer of various viruses including enveloped and non-enveloped as well as DNA and RNA types, using the TCID50 method. The results showed that the Faradarmani TCF changed the viral titers by 0.4 to 1.85 logs compared to the control. The immune response induced by the vaccine against Foot and Mouth disease virus (FMDV) in rats under the influence of the Faradarmani TCF was also investigated. FMD is an acute, highly contagious viral disease of livestock

that causes severe economic losses to the affected countries. In this study two types of inactivated FMDV vaccines with different adjuvant (Freund adjuvant and Alum adjuvant) were used and replication of virus, titer and RNA copy number as well as humoral immune response in rats were evaluated. It was observed that the levels of antibody in treated groups increased significantly in rats with both types of vaccine adjuvants. Hence, it seems that the Faradarmani TCF can have protective effect in vivo by enhancing the immune response against FMDV serotype O. In contrast, replication of the FMDV in vitro was induced by Faradarmani TCF. Our results provide in vitro and in vivo evidence that Faradarmani TCF can affect viruses and it seems that behavior of viruses under influence of Faradarmani TCF are different under in vitro and in vivo conditions. Further studies investigating the range and mechanism of the effects of TCFs on the behavior of viruses are warranted.

Section: 4.0

Status: Poster

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Primary Topic: [04.14].....Quantum theories of consciousness

Abstract Title: Can the Psi Data Help us Make Progress on the Problem of Consciousness?

Abstract: The inherently subjective nature of consciousness severely limits our ability to make progress on the problem of consciousness. The inability to acquire objective, publicly available data on the phenomenal aspect of consciousness makes evaluating alternative theories very difficult, if not impossible. However, the anomalous nature of subjective states with respect to our conventional theories of the physical world suggests the possibility of considering other anomalous data around consciousness that happen to be objective. For such purposes, I propose that we examine the psi data gathered under laboratory conditions, which generally receive little attention. I wish to consider whether we have theories or frameworks of consciousness that attempt to account for subjective qualia but also fit the psi data. I argue that Russellian monism can be combined with an argument regarding quantum holism to arrive at a version of cosmopsychism that fits very well with the psi data. While I do not argue that such a framework exhausts the theoretical possibilities, I do suggest we can move forward with a framework that has attractive theoretical features and is also consistent with objective data currently on the table.

Section: 4.0

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Primary Topic: [04.14].....Quantum theories of consciousness

Abstract Title: Hameroff-Penrose Orch OR Model: The Road Ahead for the Emperor

Abstract: The poster starts off by summarizing key challenges to the Orch OR Model from philosophy & the mechanics of quantum theory. Next, I propose ways to address some of these challenges. In the second half of the poster I propose & argue how the Orch OR Model also can also in principle shed light on the debates on causality, on the notion of time, on mental causation, and on the significance of altered states of consciousness.

Section: 4.0

Status: Poster

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Co-Authors: Éva Bajzik

Primary Topic: [04.14].....Quantum theories of consciousness

Abstract Title: Quantum brain - the ability of the intellect to arrange and the wave function

Abstract: Science, especially quantum physics, has long assumed that quantum physics may play a significant role in the functioning of the brain and consciousness, but its exact functioning has not yet been fully elucidated. As an organizing principle, the human intellect is able to organize the world around it. This phenomenon has been observed by many, and many theories have been born on the subject. Our goal was to provide a common basis for observations and theories through which this choice and arrangement can be understood. The system of The Theoretics by Balázs Török-Szabó describes the functioning of conscience, the nature of attention, and the functioning of the brain on a completely new basis. In this moving system, the intellect does not mean conscious intention or cleverness, but the organizing principle and

the driving force, characteristic of the man. The abilities of the intellect include processing information, working with notions and information, organizing them in thinking and reality. The individual is thus able to arrange reality according to his own will, to choose an orderliness - which is in line with the quantum brain propositions of quantum physics - and to collapse the wave function based on that orderliness. Our memory stores the events in fragments that have happened to us before, but we haven't understood them, and the mind is able to create an individual outside world continuously around us, projecting it onto the actual reality. Decisions, that is, the collapse of the wave function, are a reaction to the outside world in the case of most people in most situations. Since the reaction is an action, it always affects reality. Therefore in these cases, based on our past experiences that we haven't understood, we modify and organize our outside world, and through it, the reality around us, out of reaction (which therefore it is not a conscious change). Through development, which is also an intellectual ability, everyone has the opportunity to see their own outside world, their projections, the difference between reality and projections, and to make informed, conscious decisions, that is, to collapse the wave function according to their own actual intentions. The choice from a simple reaction also collapses the wave function in the same way as a decision derived from observing reality. This is what only man is capable of due to having intellect and does so continuously, whether one is aware of it or not. This can be seen as the defining perspective of man, and the fact of for what and how we use it, matters to us, to the people, and to the whole world, as our defining perspective is constantly shaping the world around us - even at this moment.

Section: 4.0

Status: Poster

Name: Stephen Jarosek

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Primary Topic: [04.14].....Quantum theories of consciousness

Abstract Title: Towards a Synthesis of Quantum Mechanics with Semiotic Theory

Abstract: Thus far, neither the physical sciences nor the life sciences have accomplished the kind of interdisciplinary consistency in which we might hope to arrive at a Theory of Everything. A Peircean-Uexküllian synthesis of semiotic/biosemitic theory, however, is emerging as a possible contender at least in the life sciences. Might a semiotic interpretation of quantum mechanics facilitate our search for a TOE? Recent developments in the study of cellular and neural plasticity, viewed through a semiotic lens, provide new insights into the nature of both the mind-body problem and the so-called "hard" problems of consciousness. Quantum entanglement, particularly in the context of DNA

entanglement, has implications for the binding problem, and this further extends the reach of the semiotic narrative on the mind-body and hard problems of consciousness. The contention being explored in this paper is that a synthesis of quantum mechanics with the semiotic and biosemiotic paradigm will provide promising leads in our quest towards a TOE.

Section: 4.0

Status: Poster

Name: Jin Ma

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Organization: Nanjing Medical University

Primary Topic: [04.16].....Miscellaneous

Abstract Title: The CNS independent consciousness system and the strong AI

Abstract: We have developed a coupling theory of consciousness. It claims that mental activities are the outcome of two subsystems of the mind: the consciousness system and the central nervous system (CNS). An unknown More Fundamental Element (MFE) derives these two subsystems with its two types of coupling singularities: Type A is about the 'material' world such as particles, atoms, neurons, and the universe; while type B the mental world such as the memory, emotion and the consciousness system. The interactions under Type A follow the law of current physics with forces, under mass and space, and the interactions under Type B are independent of the force and beyond mass and space (in the concepts of Physics.). While MFE is difficult to test directly (which are beyond modern physics and biology), we attempted to establish a scientifically-sound approach to understand it and the consciousness system, using testable hypotheses related to CNS independent outcomes of MFE. The working assumption for the testability mentioned above is that the structures of the CNS and the rules by which CNS generates neural signals are identical among people; but the structure of the consciousness system varies among them. Therefore, consciousness signals will be dissimilar from one 'mental twin' to another. By 'mental twin', we meant 2 or more individuals who have the same kinds of consciousness system. Note that there exist three excitation levels (correspond to three psychology states: memory, subconsciousness, subjective consciousness) and eight processing procedures under our physical model about the mechanism of processing consciousness signals. With all of these, the mental twins can be identified with specially designed questionnaires related to logic thinking traits in four elements (linear, nonlinear, divergent, and convergent) details of which are beyond the space of this writing. Thus, measuring the consciousness signals which are mixed with neural signals is possible experimentally with quantified psychological specification for 'mental

twins' to extract the "real" NCC (neural correlates of consciousness) data by filtering out the noisy neural signals from their paralleled consciousness processes. Additionally, and as a part of our initial efforts to establish this theoretical system, we have provided logical rational to argue the existence and independence of the consciousness system, by explaining the mechanisms behind the dream, emotion, and hard memory which is beyond the space of this writing too. We are also extremely interested in the link of our research with artificial intelligence (AI) especially strong AI. Briefly, we have two comments: 1) The information processing in Human brain is in the formation of the concepts in mind but the information processing by current AI technology is in the formation of the data in material. We attempted to examine the difference and provide rational for how essential the high-level formation of information is for strong AI; 2) Intelligent systems should integrate four subsystems: intention, cognition, decision, and action. Like human, strong AI should have these four self-controlled subsystems especially the intention.

Section: 4.0

Status: Poster

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Primary Topic: [04.16].....Miscellaneous

Abstract Title: Effects of Faradarmani Taheri Consciousness Field on Bacterial Population Growth and Microbial Antibiotic Resistance

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research, the existence of T-Consciousness is proven as an indisputable fact. Five studies were conducted. The first assessed bacterial population growth by turbidimetry, colony counting, and tetrazolium chloride reduction assays with and without the

influence of the Faradarmani TCF. The results showed that Faradarmani TCF reduced the growth rate of various strains of bacteria (by up to 46%). In addition, along with a decrease in bacterial population, evidence of increased survival (of up to 60%) was observed in the surviving population of bacteria. Two other studies examined the influence of Faradarmani TCF on antibiotic resistance of various gram-negative and gram-positive bacteria treated with different types of antibiotics (bactericidal and bacteriostatic) using two methods of disk diffusion and MIC. The effect of Faradarmani TCF on bacterial strains indicated that the resistance in the bacterial populations was modified. In most bacteria, the Faradarmani TCF decreased drug resistance and in some this resistance was increased in comparison with the control groups. The fourth study measured the susceptibility of *Candida albicans* and *Aspergillus fumigatus* to antifungal drugs, including nystatin and amphotericin. In both fungi, drug resistance to nystatin decreased significantly under the influence of Faradarmani TCF. The final study investigated the effect of Faradarmani TCF on bacterial contamination of Vero cell culture. The application of Faradarmani TCF led to the protection of Vero cells against bacterial contamination in cell culture flasks infected with bacteria. Overall, the existence and effects of the Faradarmani TCF were demonstrated by the above experiments. Further research is needed to identify the in-depth mechanism of action and range of effects of the TCFs on various biological systems.

Section: 4.0

Status: Poster

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Organization: CosmolIntel Inc.

Primary Topic: [04.16].....Miscellaneous

Abstract Title: Investigation of changes in the structure and behavior of materials under Taheri Consciousness Fields

Abstract: Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought with over 40 years of history, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science. In Sciencefact, T-Consciousness is introduced and defined as one of the constituent components of the Cosmos in addition to matter and energy, which T-Consciousness Fields (TCFs), as non-material/non-energetic fields are derived from it. Since the direct measurement of T-Consciousness is not as of yet possible, in Sciencefact, its existence is investigated and proven via indirect measurements, through studying the effects of TCFs on matter and energy under reproducible laboratory conditions and in the initial phase of research,

the existence of T-Consciousness is proven as an indisputable fact. In this study, the effect of TCFs on the matter was studied repeatedly in laboratory research following standard methods. In investigating the effect of two different TCFs on the alkaline reaction (cancer) of concrete, one of the TCFs accelerated the reactivity and destruction of concrete, and the other acted to control and delay it. The chemical composition of the concrete, the elements that composed the cement, and Loss on ignition (LOI) showed significant changes, indicating the effect of TCFs on the studied material. Pure 1000 series aluminum samples were cast at ambient temperature and once preheated in a mold at 300°C to investigate the effect of T-Consciousnesses Bond Field (TCBF) on the material. Ductility, electrical conductivity, and corrosion of the samples were measured. According to the results and the theory of T-Consciousness, the TCBF applies a variable T-Consciousness on materials. The pure materials (elements of the periodic table) that are in their steady state may remain stable or demonstrate no significant change of properties under the influence of TCFs. However, the crystal defects were generated with 1000% and 500% more irregularity. In studying the effect of T-Consciousnesses Bond Field on the plant synthesis of nanosilvers, the size of average nanosilver particles was 29% larger and had a more uniform dispersion. In addition, the silver crystalsizes were 44% smaller, and the phase formation of silver was shown to be 28% higher. Therefore, it was concluded that the TCBF played a role in changing the size of nanoparticles. Furthermore, in the study of the effect of T-Consciousness Bond Field on mechanical crushing of pure silica, microstrain was reduced by 80%. The zeta potential at the beginning of the mill with high dispersion cannot be calculated and is equivalent to zero, which is not consistent with the 99% purity and uniformity of DLS (Dynamic Light Scattering) results. After the ultrasound test and investigating the effect of micro-particles, the zeta potential was measured, where no micro-particles were observed. The results showed that T-Consciousness Bond Field affected the particle's surface charge at the beginning of the mechanical synthesis. Another study investigated the tensile strength and electrical resistance of standard electrical wires under two T-Consciousness Fields. The TCFs were applied on the finished wire and during the extrusion of the P.V.C coating. Increased strain (E) elongation was observed in both fields and methods. The change was almost doubled under the influence of bond TCF and during the coating process (13.11% compared to 7.5%), and the tensile strength of all samples decreased. Overall, the results of these studies demonstrated the existence of TCFs and their influence on the material properties.

Section: 4.0**Name:** Cengiz Mordeniz, MD, Assoc. Prof.,**Email:** cengizmorster@gmail.com**Organization:** Tekirdag Namik Kemal University, Medical Faculty, Department of Anesthesiology, Intensive care and Pain Medicine, Traditional and Complementary Medicine**Primary Topics:** [4.16]**Abstract Title:** Does the Heart Play Any Role in Pain Perception?

Abstract: Pain is not only a sensory experience, associated also with emotional, cognitive, and social components. The heart is considered the source of emotions, desire, and wisdom. The ancient Egyptians believed that the heart was the source of human wisdom so did the traditional Indian (TIM) and Chinese medicine (TCM) as well as Ayurveda and Tibetan medicine taking the heart as the centre of energy and the master of body mind alignment. Dr. Armour, in 1991, discovered that the heart has its own "intrinsic cardiac nervous system", which is composed of approximately 40,000 neurons that are alike neurons in the brain. The vagus nerve, which is 80% afferent, carries information from the heart and other internal organs to the brain. Signals from the "heart brain" redirect to the medulla, hypothalamus, thalamus, and amygdala and the cerebral cortex. Thus, the heart sends more signals to the brain than vice versa. The heart's rhythmic beating patterns not only reflect the individual's emotional state, but play a direct role in determining emotional experience. At the physiological level, afferent input from the heart is conveyed to the subcortical regions of the brain that are involved in perceptual, cognitive, and emotional processing, and affect diverse aspects of behavior and consciousness experience. The heart plays a unique role in synchronizing the activity of multiple systems of the body across different levels of organization in orchestrating the flow of information throughout the psychophysiological network. As the most powerful generator of rhythmic electromagnetic field and information patterns in the body, the heart is in continuous connection with the brain and other bodily organs and systems through multiple pathways:

neurologically (through the transmission of neural impulses),

biochemically (through hormones and neurotransmitters),

biophysically (through pressure and sound waves), and

energetically (through electromagnetic field interactions).

The heart and the brain, together in a wide process system, are involved in receiving, processing, and decoding intuitive perception but the heart receives intuitive information before the brain and have stronger influence.

Baroreceptors modulate not only sympathetic vasomotor and parasympathetic cardiac neural autonomic drive, but also a wide range of non-cardiovascular physiological responses via projections from the nucleus of the solitary tract to regions of the central nervous system, including the spinal cord. These projections regulate pain perception, sleep, consciousness, and cognition.

Numerous studies showed that stimulation of carotid sinus baroreceptors evokes multiple non-cardiovascular effects on arousal, consciousness, pain, and memory and increases in either arterial or venous blood pressure are associated with hypoalgesia in laboratory animals and humans. There is a functional relationship between arterial and central venous pressure on nociceptive behaviors and pain perception in rodents and humans that is mediated by the activation of the carotid sinus and cardiopulmonary baroreceptors.

Research has demonstrated that pain perception is modulated by neural pathways and methods targeting the heart such as vagus nerve stimulation and heart-rhythm coherence feedback techniques. The heart is not just a pump, but has its own neural network and is probably a key moderator of pain.

5.0 EXPERIENTIAL

S. Megumi, M. Cremo, B. Meleski, A. Mitchell, R. Reynolds (R), R. Miller, F. Féron

Section: 5.0

Status: Poster

Name: Satkowski Megumi

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Organization: CodeGumi

Co-Authors: Abhik Chowdhury

Primary Topic: [05.02].....Meditation and mindfulness

Abstract Title: Newly Breathe: Trauma Informed Meditation and Mindfulness through Spatial Computing

Abstract: Meditation, Mindfulness, and Breathwork can induce altered states of consciousness that can help with processing trauma, reducing suffering, and increasing the wellbeing of an individual. Spatial Computing creates the opportunity to combine both physical and digital worlds through virtual, augmented, and mixed reality systems. "Newly Breathe" is a prototype of an immersive Spatial Computing Meditation Application that educates users on various techniques through interactive displays of Trauma Informed Mindfulness tools. This paper explores using the Magic Leap and HTC Vive, a virtual reality and augmented reality system, to education on techniques such as "Box Breathing" and others.

Section: 5.0

Status: Poster

Name: Michael Cremo

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Primary Topic: [05.04].....Psychedelic and other altered states of consciousness

Abstract Title: A Retrospective Account of a DMT Experience: Was It Part of a Cold War Research Program?

Abstract: From the fall of 1966 through the spring of 1968, I was a student at the George Washington University in Washington, D. C. During that time a fellow student and I sometimes experimented with cannabis and other drugs. One day, this friend invited me to an evening lecture, where a scientist was going to speak about psychedelics. I went. The scientist said he was involved into research on DMT. He gave the history of its synthesis. He explained that

the military was interested in drugs that would temporarily incapacitate enemy combatants. They had first tried LSD, but its effects were too long lasting. They found DMT an intense but short lived experience, about 45 minutes. For that reason, he said, it had become popular with professional people who could experience an LSD-like trip during a lunchbreak. After the lecture I was talking with my friend, and another guy he apparently knew joined us. In our conversation it emerged that there was some laboratory grade DMT available on campus. Would I like to try it? I agreed. So the three of us went to a nearby apartment. There I was given the DMT and had a powerful experience. Many decades later I put together the following facts: my friend spent the previous summer as an intern at the CIA in Langley. During the 1960s, the CIA and other agencies, as part of a program called MKULTRA, were using unsuspecting citizens as subjects of psychedelic drug experiments. American universities were involved in such CIA funded programs. George Washington University was one of them. From this I conclude that my friend was involved in recruiting me as a subject for a DMT experiment run out of the university and funded by the CIA. The other person in the apartment was likely a researcher involved in the project, perhaps as a graduate student, and the program was likely being run by the scientist who gave the talk. During the DMT experience my sensory perceptions went through big disorienting changes, but throughout it all I remained aware of being a conscious individual person. I interpret it in light of descriptions of visions of the universal form given in the Vedic texts of ancient India.

Section: 5.0

Status: Poster

Name: Bruce Wayne Meleski

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Organization: Body Logic Institute

Primary Topic: [05.04].....Psychedelic and other altered states of consciousness

Abstract Title: Mystical Experience Occasioned by Non-Medicinal Embodied Therapy and Integration Process for Mental Well-Being

Abstract: Abstract Expansion of psychoactive hallucinogens in mental health continues to be a major trend. Several psychoactive molecules including psilocybin and MDMA continue to move through the FDA approval process with clinical trials (MAPS 2021). In the meantime, off-label ketamine medically supervised programs and indigenous plant ceremonies continue to expand (Fotiou 2020, Winkelman 2021). This study explores the potential benefits of High Intensity Neuroception Training System (HINT) and its ability to mimic

psychoactive states of mind (Meleski 2020). The study employs a questionnaire of mystical experience, developed at Johns Hopkins, the Mystical Experience Questionnaire (MEQ), that assesses mystical experiences in seven domains. Fifty-six participants who finished the HINT System program, completed the questionnaire. Comparative data from Psilocybin participants, post psilocybin, as well as a placebo group (non-psilocybin) provide reference data (Griffiths et al., 2006, 2008). Results show that 51% of HINT participants report a strong or extreme mystical experience because of HINT System. Another 30% of HINT participants report a moderate strength of mystical experience. Results suggest that HINT System can provide an efficacious system for mystical experience and body-mind integration.

Section: 5.0

Status: Poster

Name: Arthur Mitchell

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Primary Topic: [05.05].....Transpersonal and humanistic psychology

Abstract Title: Old Dogs Really Can Learn New Tricks: Aging, Reengaging, Neuroplasticity, and the Importance of Consciousness Shifts

Abstract: Aging is not a problem, handicap, or disease. It is inevitable, encompassing opportunity, change, and loss. Reengaging can be a problem when confronted by ageism, depression, and health issues. A different way of relating to the inevitability of our mortality and the older aging experience is needed. We can change the script of our stories about aging that limit our beliefs and reengage with action and service. Rabbi Zalman Schachter has said, “without extended consciousness, the extended lifespan is a depressive thing.” Expanding consciousness is about transformation. Do we need to be afraid of this transformation? Our awareness affects our reality and informs our thoughts, beliefs, and actions. Our perspective impacts our health and wellbeing. Our attitudes impact our self-concept and can prevent us from realizing opportunities enabled by older age. How can an extended lifespan, expanded consciousness, and activism transform our stories from individual aging to collective and planetary healing? If you change your mind, your consciousness, then you will take the actions needed to transform your life. But what holds us back? Is it a normal human condition to identify the need for change but hesitate when the opportunity for change presents itself? And once inspired, how do we stay on track and engaged? Consciousness and intention about aging are crucial, not just for those of us going through it but also for those of us working with any aspect of our aging community. The proximate and ultimate causes of depression and dementia among older adults are not entirely determined by physical decline and genetics. The psychological and

psychic toll of institutionalized and internalized messages of ageism, including unrealistic expectations of retirement and loss of purpose, are debilitating factors of mental and cognitive decline among older adults. What messages do you accept about aging? What negative feelings arise from age discrimination and the prospects of your own future? It can be difficult to awaken from a trance of negative self-talk and resignation. Rewiring, refiring, or rebooting – not retiring – is required for rewriting our stories and reengaging. There is a neurological balance between stability (maintaining, functioning) and plasticity (adapting, learning). The consciousness of many older people has tipped toward stability way too long – way too early – giving up and giving in – becoming resigned to a fate. The relationship between plasticity and stability must be perturbed to effect change. Neuroplasticity or rewiring creates new pathways and connections in the brain. Encouraging this plasticity can provide a real reason for hope for many older people. Several experiential methods can shift us from disconnection and alienation to reconnection and engagement. These can break the trance and shift how we view ourselves as older and our place in nature. Methods can include meditation, mindfulness practice, and transcranial magnetic stimulation (TMS) as well as guided use of substances (e.g., ketamine, LSD, psilocybin, MDMA). The speaker presents process and results of experimentation with psychedelic macrodosing and microdosing for breaking the trance, including potential benefits and risks of psychedelics for older adults.

Section: 5.0

Status: Poster

Name: François Féron

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Organization: TranceScience Research Institute

Co-Authors: Corine Sombrun; Audrey Breton

Primary Topic: [05.04].....Psychedelic and other altered states of consciousness

Abstract Title: State of the art on self-induced cognitive trance

Abstract: During an initiatory stay in Mongolia, Corine Sombrun discovered that shamanic trance is a non-ordinary state of consciousness that can be mastered by the vast majority of the population and implemented by the sole will of each person. She named it cognitive trance and, more precisely, self-induced cognitive trance (SICT). In recent years, two case studies exploring the brain markers of SICT were published. The first, using quantitative electroencephalography (EEG) mapping and low resolution electromagnetic tomography source imaging, revealed that SICT induces a shift from the normally dominant left analytical to the right experiential mode of self-

experience, and from the normally dominant anterior prefrontal to the posterior somatosensory mode (Flor-Henry et al., 2017). The second, with the help of transcranial magnetic stimulation combined with electroencephalography, demonstrated that SICT triggers changes in phenomenology (e.g., more dissociation) and neurophysiological processes (e.g., global and local changes in cortical reactivity, synchrony and phase locking) (Gosseries et al., 2019). During the conference, more details on the findings of these two studies as well as preliminary results of a comparison between individuals experiencing either SICT or meditation or self-hypnosis, will be presented. Flor-Henry, P., Shapiro, Y., & Sombrun, C. (2017). Brain changes during a shamanic trance: Altered modes of consciousness, hemispheric laterality, and systemic psychobiology. *Cogent Psychology*, 4(1). Gosseries, O., Fecchio, M., Wolff, A., Sanz, L. R. D., Sombrun, C., Vanhauzenhuyse, A., & Laureys, S. (2020). Behavioural and brain responses in cognitive trance: A TMS-EEG case study. *Clinical Neurophysiology*, 131(2), 586–588.

Section: 5.0

Name: Carl Flygt

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Organization: University of Nevada, Reno

Primary Topic: [01.04].....Ontology of consciousness

Abstract Title: Conversation, Consciousness, Sociology

Abstract: To resolve the personal uncertainties and even the hard mystery of self-conscious existence, Western thought since Aristotle has turned to the a priori structure of the mind, in particular to its reasoning capacity. To an extent, as with Rousseau and Marx, this turn has also looked to the structure of society to get some sort of purchase on the hoped for resolutions. However no attempt to turn a priori to the structure and control of interpersonal conversation to resolve generally the hard and deep mystery of self-conscious existence has been undertaken by any Western thinker. The author believes this control structure exists as a natural algorithm, that it is easy for anyone (for everyone) both to understand as a scheme and to recognize as a rule and, as an atomic theory of rational society, that it is empirically testable, extendable and suited to interact robustly with a beneficial form of artificial intelligence. The algorithm stipulates universal subjective satisfaction at each conversational time step. As such, it is predicated on nothing more (and on nothing less) than the positive social attributes and virtues of sympathy, satisfaction and happiness. The presentation will give the details of what is thought to represent the actual theory of conversation, it will begin to explain how the brain produces self-conscious conversation and it will propose a durable, non-ideological but religiously tinged frame for consciousness and society. It will also point at the

economic and financial pressures currently guiding societies all over the world and suggest a way science and capital could over time be used to produce a benign and highly resilient social order.

6.0 CULTURE & HUMANITIES

R. Reynolds, O. Colbert, N. Rezaie

Section: 6.0

Status: Poster

Name: Rebecca Reynolds

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Organization: Rutgers University School of Communication & Information

Co-Authors: Gretchen Stahlman

Primary Topic: [06.10].....Education

Abstract Title: Appropriation of E-learning by the Wellness/Self-Improvement Industries: A Study of Expertise and Knowledge Boundaries

Abstract: The interdisciplinary field of information science focuses on the collection, organization, transmission and use of information (including mis- and dis-information) to formulate individual and collective knowledge. As wellness and self-improvement e-learning/training programs are increasingly conducted within highly networked online environments, misinformation, disinformation and conspiracy theories have become prevalent in the global wellness industry and intersecting “self-improvement” market. Such mis-informational forms of communication and messaging occur through a variety of mechanisms: deployment of non-rigorous evidence as marketing support for products and services; evidence-free claims of effectiveness in programs, informational publications (books, events, e-courses etc.) and supplement product packaging; and even outright nefarious intentional disinformational conspiracy propaganda e.g., anti-vaccination advocacy and messaging aimed towards galvanizing susceptible communities around subversive rhetoric. These potentially-harmful campaigns operate in opposition to the public interest and government/official public health mandates and guidelines from agencies attempting to manage and stem infectious disease, global mass death and disability. [/P]. The study presented here deploys an information science approach to exploring wellness and self-improvement mis- and dis-information campaigns in a particular domain: e-learning technology, pedagogy and online courses. Research on e-learning occurring in fields of education, learning sciences, cognitive science and information science has not yet tracked this increasingly

troubling phenomena; we aim to map this terrain of influencers', marketers' and other non-expert sources' declarations as knowledge authorities offering educational e-courses capitalizing on the public and governing bodies' struggle in times of acute information need, such as global health crises, to discern and identify high quality informational sources. [P]. Such sources are observed to harness slick-looking e-learning interfaces and experience design features such as synchronous web conference classes integrated with asynchronous "lessons" and materials, to disingenuously create a facade of credibility, thus confusing and amplifying mis- and dis-information's propagandizing effects. Just as with supplement products, there is no regulation of such pseudo-scientific, conspiracy-laden informational balms, salves and snake oils in the wellness and self-improvement industries, many of which are also used to tout and promote adjacent goods and services that have limited basis for effectiveness at best, leading into risky, harmful, dangerous and life-threatening outcomes for vulnerable customers / participants, at worst. Our research explores the appropriation of various genres of pedagogy used by such sources, that deceptively deploy many of the same e-learning affordances also used by formal authoritative and expert educational sources such as schools and institutions in more established learning settings. [P]. This presentation will justify the importance of this research program, first through exploration of the boundaries of credible knowledge within and beyond scholarly and science communication systems, and a discussion of authoritative sourcing of information, knowledge and science in the wellness sector. We will problematize the practice of e-learning and pedagogy deployed by uncredentialed 'experts,' pseudo-experts and marketers, and report some initial findings from data analysis that define, categorize, and classify the topography of this misleading e-learning landscape in the wellness sector, deploying genre analysis and other qualitative and quantitative methodologies. We will conclude with a discussion of the next steps in our ongoing research agenda.

Section: 6.0

Status: Poster

Name: Olga Colbert

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Organization: Southern Methodist University

Primary Topic: [06.01].....Literature and hermeneutics

Abstract Title: Literature and Dreams as Models of Reality in Martin Gaité's Novel *The Back Room*

Abstract: *The Back Room*, a 1977 novel by Spanish writer Carmen Martín Gaité, sets out to do two paradoxical tasks, one personal and one literary. On the novel's first page, the protagonist indicates her life-long wish of entering the dream world consciously. This desire to have what is known as a WILD (Wake-Induced Lucid Dream) in Stephen LaBerge's terminology, is incompatible with the literary project that the protagonist intends to pursue: to write a novel in the fantastic genre. Each requires something different: lucid dreaming requires consciousness while in the dream state, while the fantastic genre is a space for ambiguity and demands, paraphrasing the words of one of the novel's main characters, that the readers don't know whether what is narrated is a dream; that the author doesn't even know. My work seeks to illuminate the text by placing it under the lens of scientific research on dreaming and other altered states of consciousness. I draw on the work of Stephen LaBerge on lucid dream induction, Oliver Sacks' writings on hypnagogic and hypnopompic hallucinations, and other scholars' research to explore the parallels between the novel's hybrid features and those of lucid dreaming. I will argue that the dialogueical relationship of the protagonist with the novel's other characters can be better understood by examining the relationship established in lucid dreams between the dream self and other dream characters. I discuss the protagonist's failure to conduct reality checks despite the incongruities of the "reality" she is in. Neither reader nor protagonist are able to easily separate reality from dream or imagination in the novel. This is consistent with LaBerge's contention that both external reality and dreams are ultimately constructions whose main difference is the source of the stimuli used by the brain to produce these models: sensory experience in the waking state; the mind in dreams. In my view, literary fiction is another type of construction that feeds from the mind (memory, imagination), dreams, external reality, and other works of fiction. WILD and MILD lucid dreams (according to LaBerge terminology), false awakenings, hypnagogic and hypnopompic states, sleep paralysis, and daydreaming will also be addressed and discussed in my analysis. I conclude with the contention that literature and dreams are closely alike: dreams are mental constructions that are built by the brain without access to sensory perception, mostly using memory, expectations, etc. In my view, literary fiction is another type of construction that feeds from the mind (memory, imagination), dreams, external reality, and other works of fiction.

Section: 6.0

Status: Poster

Name: Naghmeh Rezaie

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Organization: CosmoIntel Inc.

Co-Authors: Mohammad Ali Taheri

Primary Topic: [06.01].....Literature and hermeneutics

Abstract Title: The Word's Unity of Existence

Abstract: This study revisits the concept of the original and originating texts and rethinks the origin of languages through the theory of T-Consciousness by Mohammad Ali Taheri (T-Consciousness as the third fundamental element which is neither matter nor energy.) Based on Taheri's theory of T-Consciousness Governing the Universe, the article introduces the Word's Unity of Existence/ Vahdat-e Vojoood-e Kalameh to conceptualize a unified unmanifest –the Untextualized Text– of which every other text would inherently be a transcription, or an adaptation, and each emerging language approachable as a revelation. Although the analytical findings of the theory of intertextuality and adaptation theory, as its interdisciplinary partner, confirm that no so-called original text is the definitive origin to itself, they cannot claim to have tracked down the original resources of the existing texts beyond the systems of languages, cultures, traditions, or above the dimensions of time and space. Grounded in the territory of cognitive science, the chain of intertextuality can theoretically interconnect every single text with unlimited historicized texts, tracing down the roots of secondary texts within the body of primary texts. However, this approach eventually faces an impasse in its quest for the origin of the languages and literature when reaching the realm of consciousness beyond the text. This study aims to bridge a gap in the discourse of transtextuality by theorizing the possibility of the immaterial word's existence beyond materialized transcriptions, the emergence of human languages as revelation, and the evolution of languages as detection rather than innovation. The paper draws on the concept of the Uni-Body/Tan-e Vahedeh to argue that the multiplicity of human languages, in their recurring patterns and dialogic interrelations, entails non-lingual unitedness in the T-Consciousness level, the realization of which is expected to initiate border-crossing dialogues in phenomenology, hermeneutics and literary criticism.

ART-TECH EXHIBITS, PERFORMANCE 6.0

6.0 ART-TECH HEALTH – DEMOS, EXHIBITS, PERFORMANCE

K. Kohler, S. Nelson -Isaacs, G. Bustillos, R. Miller, A. Iribas-Rudin (R), C. Y. Cherif (R), A. MacDonald (R)

Section: 6.0

Status: Art - Tech - Health Demo

Name: Richard Miller

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Organization: Self-Healing Research Foundation

Primary Topic: [06.12].....Visual Art Forms

Abstract Title: Quantum Seeing

Abstract: This portfolio lays out a new, interdisciplinary art practice that combines fine art photography with Natural Vision Improvement and a form of meditation called Time, Space and Knowledge. This art practice, which I have named “Quantum Seeing,” is based on three experimental findings from quantum physics: the wave of possibility, discontinuity and nonlocal correlation. Stories about the development of this new art practice along with photographs provide illustration, documentation and further elucidation. At its core this is a research project that seeks to find common ground between science, meditation, creativity and healing.

Section: 6.0

Status: Art - Tech - Health Demo

Name: Karen Kohler

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Organization: Fin Alley Arts

Primary Topic: [01.09].....Philosophical theories of consciousness

Abstract Title: Songs, Psychedelics and Seizures: A One-Woman Flow

Abstract: This talk orients on three points of access to flow states: Performance art, psychedelic tripping and epileptic seizures. Structured as a one-woman performance monologue, this talk considers three gateways through which I have passed repeatedly out of my neurological backyard, my DMN, and into the alternate landscape of flow. Using stories from my life as a professional singer and storyteller, I outline the similarities first between flow states and

psychedelics, then between psychedelics and seizures and finally draw a circle around them all to investigate the larger question of what truly constitutes an altered state. All three landscapes of flow share certain metaphysical traits (a sense of timelessness, spaciousness) and signal physical characteristics (the "tingle" of flow onset, the lift/rising into psychedelics, the aura of seizures). They share determining grounds (practices, rehearsals, set and setting, trigger events), and mental capacities (curiosity, play and the pleasure of discovery). And all three offer potentials for deep insight, revelation and "downloads" that issue from and are integral to each kind of experience. I observe that a kind of surrender can be engendered in all three conditions - art-making, conscientious engagement with psychedelics, and the neurological detouring that characterizes seizures - which can soften and reorder beliefs curated by the DMN. As an artist, I am able to induce a flow state endogenously, sustain it, and create something out of nothing. What is that? Well, it's a manner of defaulting outside the default mode network. It's fair to say that artistic inspiration occurs outside the DMN, and we artists make our living by entering altered states of being. We default outside the default, applying ourselves in this space that exists outside of normal operational parameters. But then what is normal, and what is real? In my talk, I scan Csikszentmihalyi's Eight Characteristics of Flows States and add a few from my own lived experience as a stage artist, psychonaut and one who has experienced seizures. I address how psychedelics facilitate "gate-hopping" between the DMN and broader consciousness, and along the way, I open the pages of the Hippocratic Corpus and ask: Sacred illness or sacred surrender? I wish to offer an expanded view of epilepsy as more than a mysterious etiology, and rather as a window/portal into the mystery where creation is the default. The talk's broader implication is that flow states are original, natural and unexceptional in the broader view of consciousness and that barricading within the DMN is the unnatural state, the altered state. Impulses as basic to the human condition as creativity can be accessed at will. Everyone finds their thing and most, if not all of us, are drawn to and called to it at a very young age. The invitation I leave on the table is for us to consciously bring flow back into daily life so we may return to ourselves and our unaltered relationship to our planet and to each other.

Section: 6.0

Status: Art - Tech - Health Demo

Name: Sky Nelson Isaacs

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Primary Topic: 6.0 and 4.0

Title: Digging into time

Abstract: The difficulty in characterizing consciousness can be highlighted by our description of time. In science, time is usually characterized quantitatively, as a duration or interval. This was known by Hippocrates as Chronos. But maybe time can also be thought of as having depth. This is the premise I have explored within the foundations of quantum mechanics. Many non-physicists are familiar with the Schrodinger equation, but are unaware that this equation has great difficulty incorporating time into its formalism. There are two versions, the time-independent and the time-dependent (TDSE). To solve the TDSE, Dirac proposed a recursive method of integrals within integrals within integrals. Here I show that this recursion in time can be thought of as "digging into time" and the TDSE can be formulated as a signal processing rule. The essence of the equation is to sample the potential energy function over time, at varying levels of resolution. Each level of temporal resolution provides more granular information about the behavior of the system over a fixed time interval. I extend this to speculate that qualitative time (or Hippocrates' notion of Kairos or "right time"), may better reflect our conscious experience of time, may provide a foundation for the phenomenon of synchronicity, and may provide an explanation for the recurrence of meaningful experiences.

SKY NELSON-ISAACS is a theoretical physicist, speaker, author, and musician. He has a master's degree in physics from San Francisco State University and a BS in physics from UC Berkeley. A childhood student of Sri Swami Satchidananda, the study of experience and conscious awareness has always been a strong interest for Nelson-Isaacs. His background as an educator, scientist, software programmer and speaker led him to found the Synchronicity Institute to educate, inspire and train a new generation of geek monks. His paper "Spacetime Paths as a Whole" (Quantum Reports, Spring 2021) reformulates space and time as holistic. He has two books, *Living in Flow: The Science of Synchronicity and how Your Choices Shape Your World*, and *"Leap to Wholeness, How the World is Programmed to Help Us Heal, Grow and Adapt"*.

Section: 6.0**Status:** Art - Tech - Health Demo**Name:** Celia Yahia-Cherif**Email:** celiaycherif@gmail.com**Primary Topic:** [06.12].....Visual Art Forms**Abstract Title:** Painting Feelings Into Reality

Abstract: Unexplained phenomena appeared in a series of photographs that I took over the course of 2021 in the southern part of the province of Quebec, Canada from the camera of various mobile phones. I consider these photos to be art in that they lead me to seek a force that is elusive, both while taking the pictures and also while contemplating over them. I do not claim these photographs to be scientific proof of anything. They feel to me like an outer projection of my inner feelings, which entails a questioning into the nature of reality, intentionality, representation and the multi-dimensional aspects of undifferentiated consciousness. 15 August 2021: - 5:55 PM Blue Note: <https://share.icloud.com/photos/Oa0zTOGaQM7rEqvPAJP2tiuEw> A blue shape-shifting light flies across trees. Zooming into the first live photograph reveals a dark blue spot that resembles an ink stain. This dark blue ink does not appear again in the second live photo, which instead shows a purple aura enveloping the top part of the apparent blue shape-shifting phenomenon. - 5:04 PM Friend: https://share.icloud.com/photos/0f7XaBYbNI8S6XqD0_8xkDTeA A UAP hovers just above the tree line and flies across the entirety of the skyline in less than 1 second. The sun shines at its brightest when the blue lens flares and the UAP are closest to each other. - 2:49 PM High Power: <https://share.icloud.com/photos/09cCK9416TkUXbt9Ej1lIFXDMw> A thick vertical shadow without anything that could possibly cast it is seen traveling horizontally across a mountain in the far distance. The white swirl of light can be seen hovering just above me as I move my camera to the left. I return to photographing the mountain again and now the shadow looks like a couple of weak fumes. June 23rd, 8:45 PM Saint-Jean-Baptiste: https://share.icloud.com/photos/Od0538ofEjYwIOAfQ1il2Et_g UAPs sporadically appear in a series of photos taken less than 0:00:05 seconds apart. Blurry birds standing on electric cables appear in a single shot of those shots. September 19th, 5:55 PM Winged Ones: <https://share.icloud.com/photos/058shTFOWsokXlx-c8s1hN43w> A light in the form of a winged insect is visible near the left extremity of the scene at timestamp 0:50, travels across to the right side, and is out of frame before the timestamp reaches 0:51. October 29th, 5:05 PM Welcome Home: https://share.icloud.com/photos/Oebgn6iBn_4Mi1lmexFOMN2fw Wings of light appear to be swiftly riding rays of sunshine into my home. My intent while taking the photos had been to feel that I was inviting beings of light into our home as is tradition during smudging ceremonies. September 15th, 4:33 PM Djinn: <https://share.icloud.com/photos/0b4e45ZBSE9lxu3YdiWF2PVdA> A white smoke-like phenomenon appears to emanate from the top right and spirals to the bottom left.

Section: 6.0**Status:** Art - Tech - Health Demo [R]**Name:** Alan MacDonald**Email:** alanmacdonald56@gmail.com**Primary Topic:** [06.12].....Visual Art Forms**Abstract Title:** Visualizing The Invisible. A visual these exploring the notion Primacy of Consciousness and implications for individuals

Abstract: My ongoing art project, Field Notes of A Terranaut, is a collection of visual metaphors in graphic book form exploring the notion; Primacy of Consciousness plus implications for individuals arising from this. The informal field-note style is inspired by the working drawings of Da Vinci and Michelangelo that convey the essence of their insights. The term Terranaut questions the materialist science assumption that Consciousness is epiphenomenal, and that we are from 'here'. Equally it explores the worth of ancient spiritual texts and orthodoxy. I assume the role of a naturalist illustrator accompanying scientists on a 'dive' to the material plane. My search explores the notion we are fractals of consciousness interacting with the material plane as a feedback mechanism to the "One Subject of All Objects", (Collision With The Infinite, Suzanne Segal, 1998). Subjective research from years of meditation and study of ancient texts produced necessarily limited results. Insights derived from art making informed by well-reasoned speculations and findings arising from collaborations between metaphysics, arts, computer science, and quantum physics enabled by the internet has proven more useful. Key findings from my exploration follow. Ancient texts are of little use as they are no longer relevant to current cultural and educational norms and so easily dismissed by scientists. A phrase attributed to Yeshua the adept states: "You cannot put new wine into old skins." I am convinced this conveys the notion that the truth of existence must be continuously updated according to current conditions, the brain acting as a transceiver processing both local and non-local signals. These updates are downloaded by adepts, as 'revelations,' light bulb moments, unconnected to local reptilian inherited memory, local mammalian learned orthodox memory. I have located considerable account by artists and musicians who download complete works, scientists, technologists, who download profound solutions to meet an urgent need, bearing no relationship to local memory. Given the range of occupations, I am convinced that the field of consciousness, transmits solutions to these individuals as a way of describing the relationship to them according to each receiver's propensities and attributes. It has been interesting to note that Einstein, Tesla and Freud alluded to this notion of mind and matter having a shared property. Another important theme is the incidence of primary trinities in mythologies around the world. Rishi, Devata, Chandas from Vedanta (Knower, Known, Process of Knowing). Father, Son, Holy Spirit from Christianity,

I choose to term it, Holo Trinity (Mind, Matter, Information). There are many other examples. Chapter 2 in my visual thesis, explores dreams as daily status reports from the field of consciousness, regarding our level of alignment with it. I propose dreams only seem fantastic as the local memory has to supply a local symbol for the non-local events of the night. The term yoga (yoke) means union with non-local consciousness. Any activity can serve as a yoga, the key being, learning to distinguish between local and non-local signals, in everyday situations presented in real time. Science describes 'How', Metaphysics explains 'Why'.

Section: 6.0

Name: Gisella Bustillos

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Primary Topic: (6.12)...Visual Art Forms

Abstract Title: Narration, Time, Travel and Time Travel

Abstract: In this talk I will discuss making my documentary "A Brief History of Time Travel", as well as some of the things that I've learned along the way. Specifically: 1) how time travel narratives have appeared throughout history, mythology, and rituals, 2) time travel in cinematic storytelling: specifically, cinema's properties as an allegorical time machine and experimental play with sequential logic in linear storytelling, 3) concepts in time in mass media and 4) personal views of time travel from interviewees regarding the nature of reality and time.

ADDITIONAL ABSTRACTS

Presentations will be uploaded on the Science of Consciousness YouTube Channel

Section: Concurrent 12 (R)

Status: Concurrent

Name: Phillise Todd

Email: ptodd@pierce.ctc.edu

Organization: Pierce College

Primary Topic: [04.08].....Quantum brain biology

Abstract Title: A Photochemical Signal Transduction Model of Magnetoreception in Cryptochrome

Abstract: For decades scientists have documented the ability of numerous animal species to sense the Earth's magnetic field. Migratory birds detect and use this magnetic information to navigate their migratory paths. The precise mechanism underlying this apparent biological compass is unknown and remains an active area of ongoing research. A bio-compass, based on the chemistry of magnetically sensitive radical pairs, is one of the leading theories under investigation. The quantum spin dynamics of entangled electrons in this chemical process is known to form under illumination in the cryptochrome photoreceptor, which has been found within the retina of migratory birds. This work seeks to create a model that details how a cryptochrome-based bio-compass could signal magnetic information. The model developed here considers the physical mechanism by which signal transduction could occur given the unique biology of the cryptochrome protein structure. Further, a quantitative description of cryptochrome magnetic sensitivity and signaling is devised based on well documented, as well as approximated, aspects of the receptor's photocycle. The functioning threshold for a biologically feasible chemical compass is thus proposed based on a signal-to-noise ratio. Flavin adenine dinucleotide (FAD), the light sensing chromophore of cryptochrome, is widely viewed as a likely site of radical pair chemistry. Using the Runda-Kuta method to solve the first order kinetics of the cryptochrome photocycle provides a baseline for analyzing the effects of different magnetic field orientations on the steady state concentrations of flavin redox states. These concentration fluctuations constitute magnetic information that can be signaled along a neural pathway. Flavin has been found to form radical pairs with tryptophan or superoxide, both potentially magnetically sensitive. Modeling both radical pair formations suggests that a flavin-tryptophan radical pair strongly aligns with light effects observed in behavioral experiments on migratory birds, while a flavin-

superoxide does far less so. Still, the model suggests a flavin-superoxide radical pair may have a role in explaining magnetic sensing under dark conditions. The model also suggests further experiments that may elucidate which radical-pair, flavin-tryptophan or flavin-superoxide, and which flavin signaling state, semi-reduced or fully-reduced, contributes most strongly to the magnetic sensitivity of the biological compass.

Section: Concurrent

Name: Broc Pagni

Email: bpagni@asu.edu

Primary Topic: [2.19]

Co-Authors: Broc A Pagni⁴; Daniel Perkins^{1,2,3}; Jerome Sarris^{2,5,6}; Paulo C R Barbosa⁷; Richard Chenhall⁸

Affiliations: 1 School of Social and Political Science, University of Melbourne, Melbourne, Australia, 2 Psychae Institute, Melbourne, Australia, 3 Centre for Mental Health, Swinburne University, Melbourne, Australia, 4 School of Life Sciences, Arizona State University, United States, 5 NICM Health Research Institute, Western Sydney University, Sydney, Australia, 6 Florey Institute for Neuroscience and Mental Health, Melbourne, Australia; 7 School of Philosophy and Human Sciences, Universidade Estadual de Santa Cruz, Brazil; 8 School of Population and Global Health, University of Melbourne, Melbourne, Australia.

Abstract Title: Effects of facilitated ayahuasca consumption on mental health, wellbeing, personality, and substance use of naïve participants: results of a longitudinal observational study

Background: Naturalistic and placebo-controlled studies suggest ayahuasca, a potent psychedelic beverage originating from Indigenous Amazonian tradition, may improve mental health, alter personality structure, and reduce alcohol and drug intake. To better understand ayahuasca's therapeutic potential and to identify factors that influence therapeutic efficacy, we conducted a naturalistic, longitudinal study of facilitated ayahuasca consumption in naïve participants using a comprehensive battery of self-report questionnaires.

Materials and Methods: Ayahuasca naïve individuals registering for ayahuasca ceremonies were asked to complete a range of validated questionnaires assessing mental health, substance use, relationships, personality, and connection to self and spirituality, prior to and 1 month after attending an ayahuasca ceremony. Data for two mental health measures (the DASS-21 and PANAS) and acute subjective effects via the MEQ-30 were also assessed 7 days post-ceremony. Repeated measures ANOVA were used to examine pre-to-post changes, and Pearson correlations explored predictors of improvement in outcomes.

Results: Fifty-three attendees (32 women, 21 men) completed pre and post ayahuasca assessments with 55.6% of the sample reporting a complete mystical experience based on the MEQ-30. One-month post-ayahuasca, significant reductions were identified in depression, anxiety, stress, alcohol and cannabis use, body dissociation, accepting external influence, self-alienation, impulsivity, and negative affect/emotionality. Significant increases were identified in positive mood, self-efficacy, authentic living, extraversion, agreeableness, open-mindedness, spirituality, and satisfaction with relationships. While facets of the mystical experience held little predictive validity on outcome measures, baseline traits, particularly high negative emotionality and body dissociation, and low sense of self-efficacy, robustly predicted improvements in mental health, personality traits, and substance use.

Discussion: This study suggests facilitated ayahuasca consumption in naïve participants may precipitate wide-ranging improvements in mental health, relationships, personality structure, and alcohol use. Associations between baseline traits and therapeutic improvements mark an important first step toward personalized, precision-based medicine and warrant randomized controlled trials to confirm and elaborate on these findings.

Section: Concurrent C 9

Name: Yang Pachankis Cao

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Primary Topic: (4.03)...Space, time and the nature of reality

Abstract Title: White Hole Observation: A Conscious Experiment

Abstract: In the natural cosmic chain of happening, no effects can precede causes. However, by conscious experiment as someone out of the systemic causal chain, the conscious being can supersede natural causes as the time traveller. Information, signal, and consciousness becomes the key elements to the concept of time travel. Such a time travelling process was made possible by my anti-human-trafficking and anti-surveillance experience that happened to get to see the American cyberspace via the user interface. This is the prerequisite of my black hole research and white hole observation experiment with data practice. With the shifted time-length on the perception, the personal devices became a memory extension to the signal mapping of the solar instrumentation. The theoretical projection on the black hole and white hole juxtapose to the actual universe is then made possible. Apart from the memory aid, quantum consciousness served as the pragmatic rationale on the experiment and the effects were anticipated before the actual causes hit the instrumentation as angular momentum. The paradox of the time-travelling problem was then transversed to the knowledge production with mind-body dualism, whereby I travelled back in time in the body while forward in time in

the mind. The collection of the accidental experiment consists of the proofs for superstring theory with the white hole observation. I approached the white hole observation with my own black hole and white hole juxtapose theory, which was proven by the multispectral data research. Thereon I used the Harvard-Smithsonian MicroObservatory to do white hole observation with deduced dimensions. The solar observations developed into resonance imaging on the white hole as a supplement to the space based data. Therefore, the time of the signals from space based telescopes diverged to solar time on the ground-based observatory with particle filtering effects. The Trifid Nebula observation generated the interior regions of the white hole in below absolute zero environment with metal-insulator formation from the oscillation activities on the juxtaposed pair. This can be the lagged response from the ALLWISE density survey. The signal noise suggests warm dark matter contains the most violent astrochemical reactions and may contribute to the sustainment on the below absolute zero Kelvin thermo environment. The Kerr-Newman oscillation of NGC 3034 from the multispectral data suggests possible antimatter nuclear force and electromagnetic variations may be key to contain the coexistence of fusion and fission in the adjacent spatial areas. This means that the incompleteness of electromagnetism on particle physics is key to quantum gravity and anti-gravitational virtual particles as a compressed time model of the cosmos. The Southern Pinwheel observation captured the juxtapose with the active galactic nuclei portal. It suggests that the soft hair on black holes are white hole radiation, which corroborates with the ALLWISE data on NGC 3034. The resonance imaging is made possible by the white hole radiation and has a direct influence on the solar system as with the moon observation. The M87 observation suggests black hole seeds are made observable by resonance with the warm dark matter, but no successful attempts were made directly capturing the warm dark matter in M87. The variations of resonance imaging on the respective types of juxtaposes suggest dark matter's radiation locks have direct influence to the visibility of gravitons and the shapes of black body radiation. The combination of M87 observation suggests it to be a Reissner-Nordström black hole, the Southern Pinwheel to be a Kerr black hole, Trifid Nebula to be a Kerr-Newman white hole, and the Small Magellanic Cloud to be either a Kerr-Newman or Reissner-Nordström black hole. The data reduction on NGC 3034 suggests the existence of white hole seeds and this may be a contributive factor on the signal noises in the MicroObservatory data.

Here I share some of my experiences on the altered state of consciousness that contributed to the evidence generating activities with superstrings. The moon observation is the best evidence generated for white hole in the context of super strings. But due to the distance on the depth-of-view, no specific determination on the black hole type is concluded for the observation result. I will present my observation results with a repertoire of theoretical techniques used in the data compilation and observation, along with the consciousness

mustering and my own theoretical rationale that coexisted behind the theoretical tools as pragmatic consciousness. Two of the main psychological theories behind the research are Joseph E. D.'s The Consciousness of Being Conscious and Albert Bandura's human agent theory, apart from Edward T. Hall's Beyond Culture that served as a theoretical guide to the knowledge production beyond the Big Bang model of collective unconsciousness. The experiment put light into solar instrumentation signal-information sphere, Einsteinium gravitation, and Lorentz transformation as initial astrochemistry approach with multispectral data. The observation results prove the many-world interpretation with quantum physics and the white hole observations are both a proof to its celestial existence and to the quantum system with light sources from below absolute zero forms. It is in this regard, both the local dynamics of black hole and white hole juxtapose and solid state boundaries of the quantum chemistry affect the detection of gravitons in the quantum realm. Between theoretical and pragmatic consciousness, I regard the quantum realm as a collective unconsciousness as the many apparatus that serve as the extensions to a common scientific purpose and human knowledge generation.

The research and observation experiment proved that event horizon of black holes only come from the instrumentation limitation, and propose the use of light clocks in combination to atomic clocks to charged juxtaposes may further advance the study and shape a discipline on astrochemistry. The preliminary detection on the metal insulator on the white hole in the Trifid Nebula as a dark matter candidate implies the material's possible values to further gravitation theories. String theory in this context may further advance the sustainability of astrochemistry.

Section: Concurrent C 11

Name: Mitchell Head

Email: M.Headsience@outlook.com

Primary Topic: (2.19) Psychedelics and psychopharmacology

Abstract Title: Native Pharmacology of Consciousness: Indigenous considerations on the commercialization of psychoactive medicines derived from native entheogenic species

Affiliation: Te Kotahi Research Institute, University of Waikato, Hamilton, New Zealand

Mitchell A. Head^{1,2}, Maui Hudson²

¹ Faculty of Science and Engineering, University of Waikato, Hamilton 3216, New Zealand, ² Te Kotahi Research Institute, University of Waikato, Hamilton 3216, New Zealand

Abstract: While plant medicines continue to show promise as a valuable source

of psychoactive molecules, and the development of such molecules for the treatment of mental health issues increases in popularity throughout the globe, navigating this research landscape in such a way that ensures Indigenous Peoples and Local Communities (IPLCs) are involved in this process becomes exceptionally important.

Here we discuss a range of issues which we have navigated in partnership with local indigenous tribes along the journey of exploring the wealth of pharmacology and traditional knowledge that IPLCs are guardians of.

We cover issues of access and benefit sharing, best practices for engaging with IPLCs throughout the R&D process, as well as considerations around IP, and associating Traditional Knowledge labels with the outcomes of research work.

Further nuance is involved around genetics, as commercialization partners may be interested in developing products derived from the bioactive molecule of interest, yet outside of the native species. Do the IPLCs therefore have rights and IP around the derived product? Does the engineered medicine that was originally expressed in nature, still hold the same spirit and traditional knowledge when it is extracted from nature and engineered for commercialization?

IPLCs hold a wealth of Traditional Knowledge and act as guardians of these healing species, and although these may be useful for the development of medicines, we must ensure that this knowledge is held in association with the medicines and derived products, and that these guardians are involved in the R&D process; both to protect the long-held wisdom of its use, and to ensure fair, sustainable and equitable use to continue for generations to come.

Name: Ana Eva Iribas Rudín

Title: Do robots and humans know about art? Suggestions for CAPTCHA designs

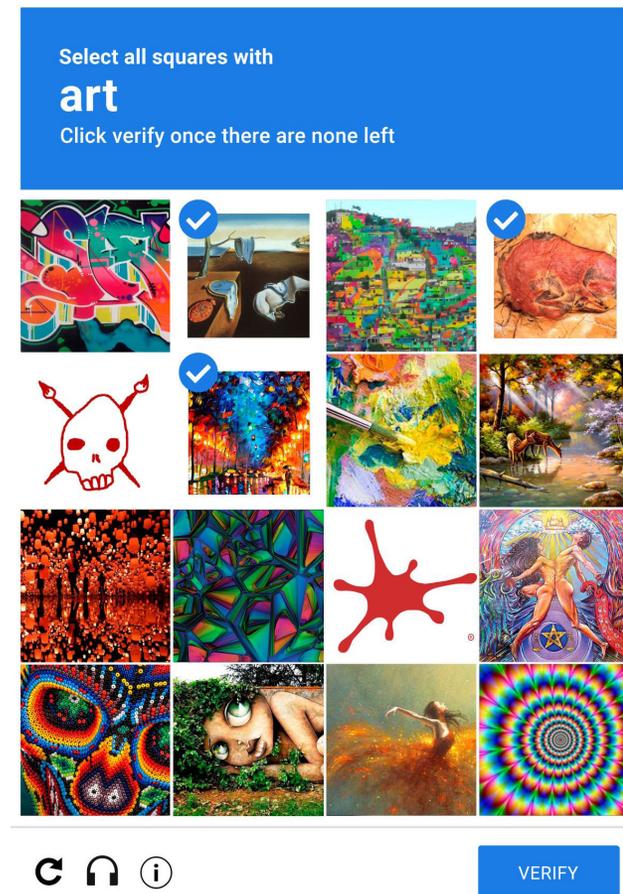
Description: CAPTCHA are automated processes operating as access doors to forms, allowing humans to proceed and blocking the way for robots. A modality of visual CAPTCHA offers a number of images that must be correctly selected, following simple instructions.

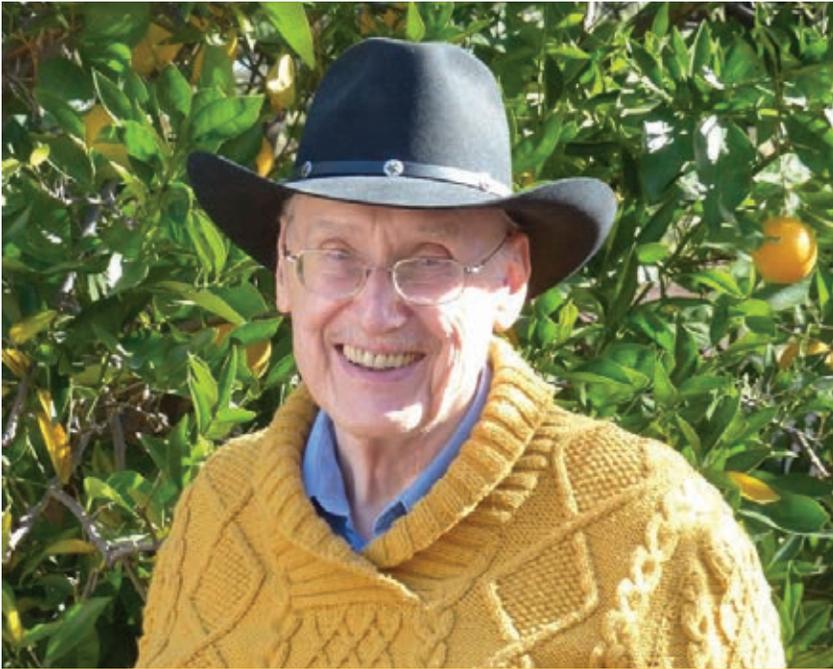
This conceptual art piece suggests the creation of CAPTCHA about the concept of art. It offers several design versions along with questions and issues that these CAPTCHA models may arouse.

Keywords: CAPTCHA, robot, human, art, design

Author: Ana Iribas-Rudin

Affiliation: Universidad Complutense de Madrid, Spain





Alvin J. Clark is Professor Emeritus of Molecular Biology and Genetics at the University of California, Berkeley. At present he is associated with the laboratory of Professor of Neuroscience Linda Restifo at the McKnight Brain Institutes, University of Arizona. Professor Clark's interest in consciousness studies stems from his exposure to a monistic philosophy that was part of the Shaivism taught and practiced in 10th and 11th century Kashmir. As he understands it, that philosophy asserts that consciousness is the ultimate source of all that is. Professor Clark is therefore curious about the relationship of that ultimate consciousness with the consciousness that he experiences as a human. His main interest at the moment is to understand what influence human genetic diversity has on human consciousness.

**THANK YOU
ALVIN J. CLARK**

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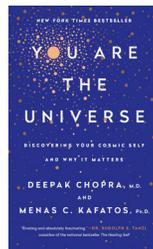
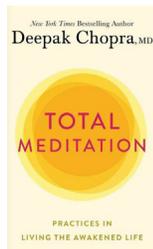
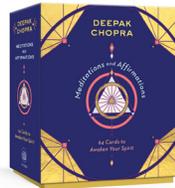
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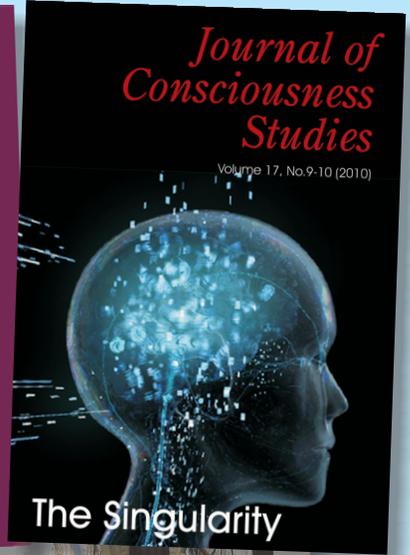
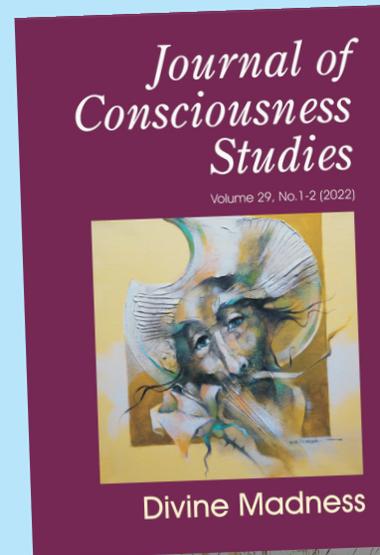
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