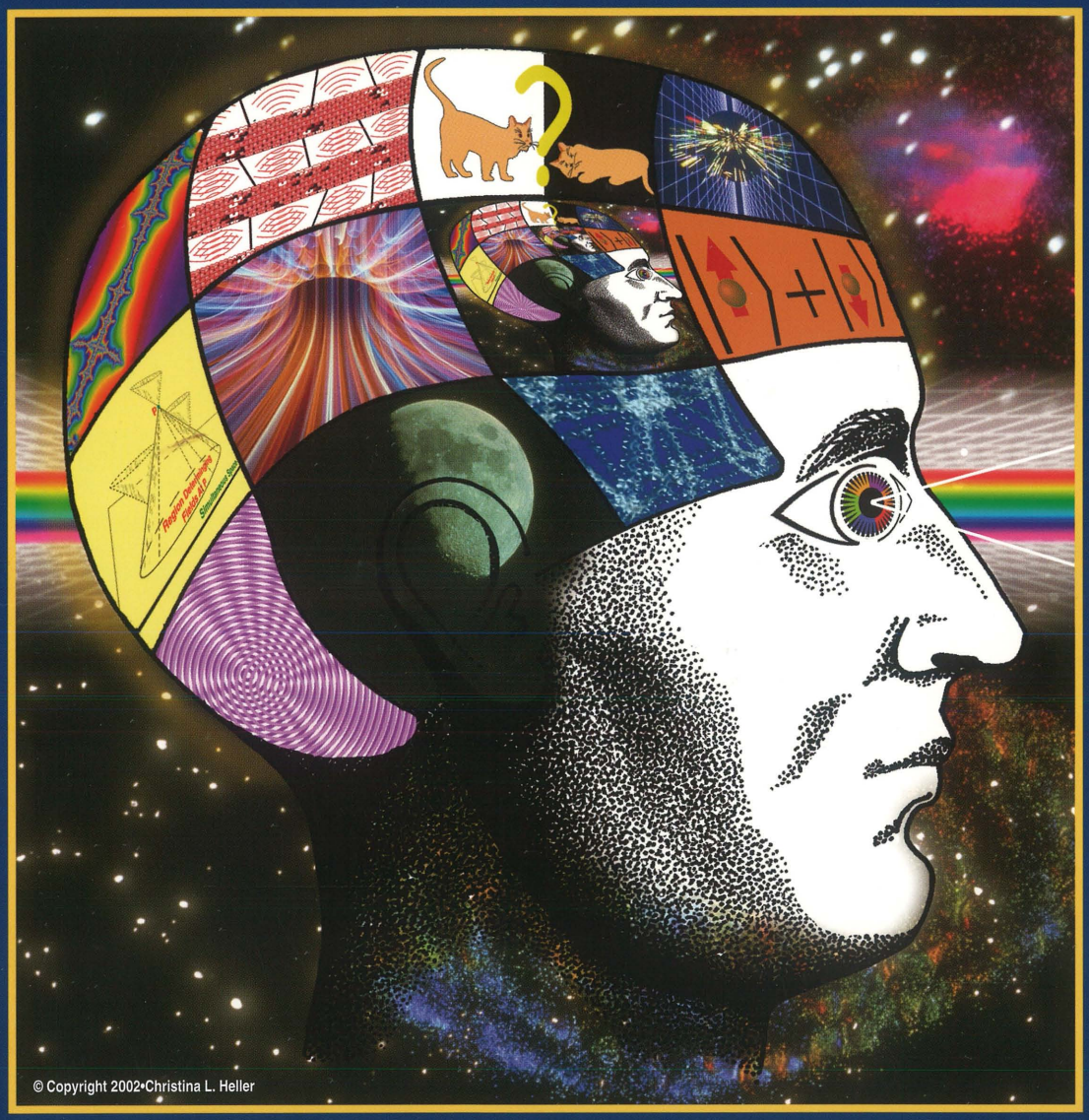
QUANTUM MIND 2003

CONSCIOUSNESS • QUANTUM PHYSICS • THE BRAIN

Could quantum information be the key to understanding consciousness?
Can consciousness enable future quantum information technology?



MARCH 15 - 19, 2003

TUCSON CONVENTION CENTER AND LEO RICH THEATER

THE UNIVERSITY OF
ARIZONA®
TUCSON ARIZONA

Center for Consciousness Studies, The University of Arizona
www.consciousness.arizona.edu/quantum-mind2

Being in the know is boring.

Being in the mystery, the continual mystery is fun!

Fred Alan Wolf

Lord of the Wind Films
Presents

"WHAT THE #$*! DO WE KNOW!?"

A work in progress

Please join us for a test screening
Sunday, March 16th at 8 PM
TCC Maricopa Room
Discussion to follow

Table of Contents

Welcome 1
Conference Map 1
Program Outline — Conference At-A-Glance 2
Conference Program — Complete 4
Abstracts 10
Post-Deadline Abstracts 67
Author's Index 67

Welcome to Quantum Mind 2003 — and Tucson, Arizona

Downtown Tucson has many interesting social venues within easy walking distance of the conference hotels. Some of Tucson's convenient, exciting social activites can be sampled at Hotel Congress/Club Congress; the 4th Avenue area; the Arts District; the Rialto Theatre (http://www.rialtotheatre.com/); and the Tucson Museum of Art.

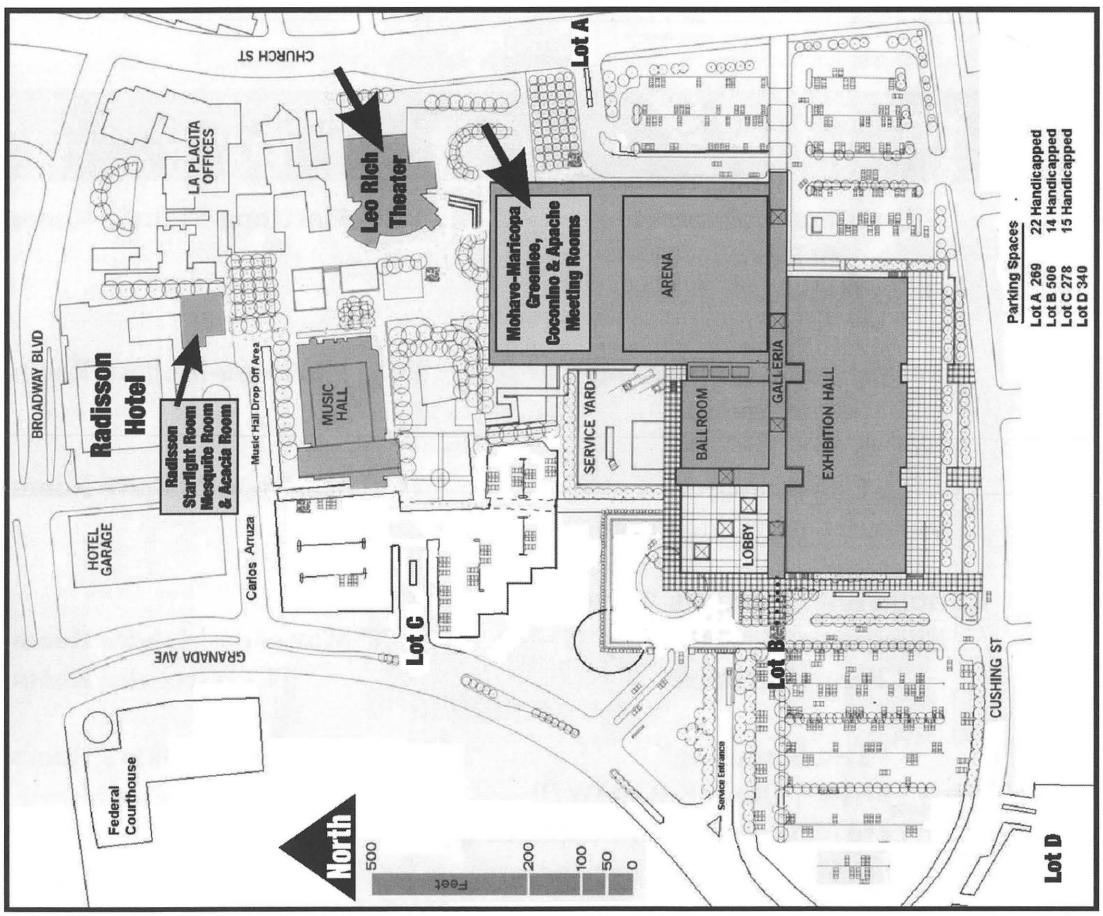
Historic Hotel Congress is known as the site where John Dillinger and his gang were captured in 1934 by Tucson police after evading the FBI. Today it hosts the hip and funky Club Congress and The Cup Cafe. Dancing at Club Congress gets going at around 10 pm or so, and Monday nights (e.g. after the poster session) is the popular *80's Night* (see http://www.hotcong.com/). Some good Mexican Restaurants downtown include El Charro, Poca Cosa and El Minuto. The University of Arizona Campus is about a half hour's walk away. Quantum Mind 2003 occurs at the end of the regular college basketball season, just prior to the NCAA tournament. Expect lots of excitement about the Arizona Wildcats, currently top-ranked nationally.

Downtown Tucson is just a small piece of the greater Tucson area. Other sites worth seeing for visitors require cars, and/or tours arranged through the Radisson Hotel concierge desk (http://www.radisson.com/tucsonaz). The Arizona Sonoran Desert Museum (http://www.desertmuseum.org/) is definitely worth visiting. Other day trip sites include Sabino Canyon, Mount Lemmon, The Biosphere, Bisbee, Tombstone, and Nogales, Mexico (drive and park on the US side of Nogales and walk across the border for great shopping – and a taste of Mexico). If you have a few days, rent a car and drive north to Sedona and the Grand Canyon.

Complimentary refreshments will be available at breaks between sessions. Lunch and dinner *on your own* except for the Tuesday night Conference Dinner for all registrants. See accompanying restaurant list for convenient lunch and dinner locations.

Tucson · Things You Want To Know

Population: _____ 515,039 Elevation _____ 2,435'
Temperature Range: March _____ 45.1° – 73.3°
Average Rainfall: March _____ 0.81"



Tucson Convention Center Complex And The Radisson Hotel

Quantum Mind 2003
Program Outline — Conference At-A-Glance

Saturday March 15

8:30 – 11:30 Tutorials	**Quantum Mind Overview** Pylkkanen, Hagan, Hameroff	**TCC Maricopa-Mohave Room**
1:00 - 2:30 Plenary 1	**Quantum Mechanics & the Brain/Mind Problem 1** Stapp, Mahler	**TCC Maricopa-Mohave Room**
2:45 – 4:15 Plenary 2	**Quantum Mechanics & the Brain/Mind Problem 2** Rosenblum, Römer	**TCC Maricopa-Mohave Room**
4:30 - 7:00	**Concurrent Sessions 1 and 2**	
Concurrent 1	**Quantum Biology**	**TCC Maricopa-Mohave Room**
Concurrent 2	**Time**	**TCC Greenlee Room**
7:00 - 10:00	**Reception**	**Radisson Hotel Starlight Room**

Sunday March 16

8:30 - 10:40 Plenary 3	**Quantum Coherence in Brain?** John, Bernroider, Pribram	**TCC Maricopa-Mohave Room**
11:10 - 12:40 Plenary 4	**Transpersonal Implications** Wendt, Walach	**TCC Maricopa-Mohave Room**
2:00 - 4:10 Plenary 5	**Cell Biology 1** Satinover, Mershin, Hagan	**TCC Maricopa-Mohave Room**
4:30 - 7:00	**Concurrent Sessions 3 and 4**	
Concurrent 3	**Experimental Nonlocality**	**TCC Maricopa-Mohave Room**
Concurrent 4	**Platonic Realism**	**TCC Greenlee Room**
8:00 – 10:00	**"Test Screening"** **"What The #$*! DO WE KNOW?"** A work in progress from Lord of the Wind Films/Captured Light Studio (*viewers will be asked to provide feedback – see complete program for details*)	**TCC Maricopa-Mohave Room**

Monday March 17

8:30 - 10:40 Plenary 6	**Quantum Information Science** Benioff, Porter, Augustyn	**Leo Rich Theater**
11:10 - 12:40 Plenary 7	**The "Near Death Experience"** van Lommel, Britton	**Leo Rich Theater**
2:00 - 4:10 Plenary 8	**Experimental Nonlocality in Brain** Bierman, Wackermann, Standish	**Leo Rich Theater**
4:30 – 7:00	**Concurrent Sessions 5 and 6**	
Concurrent 5	**Philosophy and Ontology**	**TCC Coconino Room**
Concurrent 6	**Nonlocality**	**TCC Apache Room**
7:00 – 10:00	**Poster Session**	**Leo Rich Theater Backstage**

Tuesday March 18

8:30 - 10:40 Plenary 9	**Cell Biology 2** Pollack, Ho, Schuessler	**Leo Rich Theater**
11:10 - 12:40 Plenary 10	**The "Orch OR" Model** Penrose, Hameroff	**Leo Rich Theater**
2:00 - 4:10 Plenary 11	**Space-time and Consciousness 1** Matsuno, Roy, Kafatos	**Leo Rich Theater**
4:30 - 7:00	**Concurrent Sessions 7 and 8**	
Concurrent 7	**Experimental approaches**	**Radisson Hotel Mesquite Room**
Concurrent 8	**Mathematical and physical approaches**	**Radisson Hotel Acacia Room**
7:00 - 9:30	**Conference Dinner** *open to all registrants*	**Radisson Starlight Room**

Wednesday March 19

8:30 - 10:40 Plenary 12	**The Cell Cytoskeleton** Tuszynski, Woolf, van Wijk	**Leo Rich Theater**
11:10 - 12:40 Plenary 13	**Space-time and Consciousness 2** Zizzi, Pylkkanen	**Leo Rich Theater**

For complete conference details, see the *Complete Conference Program* on pages 4—9.

Quantum Mind 2003
Conference Program - Complete

Saturday March 15

Tutorials/Overview — 8:30-11:30 — **TCC Maricopa-Mohave Room**

Getting the Most out of the Conference

Paavo Pylkkanen *Why quantum physics may be required to explain consciousness*
Scott Hagan *Quantum theory: What, where and why?*
Stuart Hameroff *Quantum biology: At what levels are quantum effects relevant?*

Plenary 1 — 1:00-2:30 — **TCC Maricopa-Mohave Room**

PL 1 — Foundations of Quantum Mechanics and the Brain/Mind Problem 1

Henry Stapp *How mind influences brain*
Guenter Mahler *Closed quantum worlds and their partitions*

Plenary 2 — 2:45-4:15 — **TCC Maricopa-Mohave Room**

PL 2 — Foundations of Quantum Mechanics and the Brain/Mind Problem 2

Bruce Rosenblum *The only objective evidence for consciousness: The quantum experiment*
Hartmann Römer *Weak quantum theory: Complementarity and entanglement in physics and beyond*

Concurrent Sessions 1 and 2 — 4:30-7:00 — **TCC Maricopa-Mojave & Greenlee Rooms**

C1 Quantum biology — **TCC Maricopa-Mohave Room**

Huping Hu *Spin-mediated consciousness theory: Possible roles of oxygen unpaired electronic spins and neural membrane nuclear spin ensemble in memory and consciousness.*
Andrea Fantasia *Looking for quantum processes in networks of human neurons on printed circuit board.*
Beverly Rubik *The "biofield hypothesis".*
Jean Faber Abreu *Information processing in brain microtubules.*
Frank Smith *Penrose-Hameroff quantum tubulin electrons, Chiao gravity antennas, and Mead resonance.*
Christopher Davia *Simplicity theory: Is the brain a catalyst and can enzyme catalysis shed light on consciousness?*

C2 Time — **TCC Greenlee Room**

Stanley Klein *Temporal anomalies involving causality and free will.*
John Leach *Dynamic spatial information and the subjective relativity of time perception.*
Michel Planat *Time perception, cyclic groups and quantum computation.*
John Sanfey *Time and observation.*
Joseph Naimo *Space-time-event-motion (STEM): A new metaphor for a new concept.*
Ralph Hunt *Humean induction and tensed-time futurity.*

Reception — 7:00 - 10:00 — **Radisson Hotel Starlight Room**

Sunday March 16

Plenary 3 — 8:30 – 10:40 — **TCC Maricopa-Mohave Room**

PL 3 — Quantum Coherence in Brain Function

E. Roy John *A field theory of consciousness*
Gustav Bernroider *Dimensional analysis of neurophysical processes related to mentation*
Karl Pribram *Brain mathematics*

Plenary 4 11:10 – 12:40 **TCC Maricopa-Mohave Room**

PL 4 — Transpersonal Implications of the Quantum Mind

Alexander Wendt *Quantum mind and social science*

Harald Walach *Generalized entanglement - Possible examples, empirical evidence, experimental tests*

Plenary 5 2:00 – 4:10 **TCC Maricopa-Mohave Room**

PL 5 — Cell Biology 1 - Is the Brain Really "Warm, Wet and Noisy"?

Jeffrey Satinover *Varieties of computational experience: Molecular biology and quantum information processing*

Andreas Mershin *Experimental "quantum brain"?*

Scott Hagan *Quantum models of consciousness in brain microtubules: Decoherence and the issue of biological feasibility*

Concurrent Sessions 3 and 4 4:30-7:00 **TCC Maricopa-Mojave & Greenlee Rooms**

C3 — Experimental approaches to nonlocality **TCC Maricopa-Mohave Room**

Fred Thaheld *Biological nonlocality: Problems and potential.*

Todd Richards *Preliminary evidence of correlated functional MRI signals between physically and sensory isolated human subjects: Two case studies.*

Serguei Korotaev *Experimental evidence of macroscopic nonlocality of the dissipative processes.*

Katherine Creath *Effects of intention, musical sound and noise on the germination of seeds: Evidence of entanglement between human and plant systems.*

Mark Germine *Further validation of the "one mind model" of quantum reality.*

Lewis Mehl-Madrona *Effects of participation in a prayer ceremony upon QEEG.*

Aroutioun Agadjanian *Information transmission between killed and survivor individuals of the same population on several species.*

C4 Platonic realism **TCC Greenlee Room**

William Lawless *A quantum model of organizations: Formation, information processing and decision-making.*

Michael Betancourt *Paranoiac-criticism, Salvador Dalí, Arcimboldo and superposition in interpreting double images.*

Jonas Mureika *Toward a theory of quantum aesthetics.*

Peter Ells *Naturalistic, libertarian free will.*

H. Froning, Jr. *Quantum representation of idealism's view of consciousness.*

Nancy Morrison *The biology of morality.*

Test Screening 8:00 –10:00 **TCC Maricopa- Mohave Room**

"What The #$*! DO WE KNOW?" *A work in progress from Lord of the Wind Films/Captured Light Studio*

What The #$*! DO WE KNOW? is part documentary, part story and part elaborate visual effects and animation. The protagonist, played by Academy Award winner Marlee Matlin, has a series of surreal experiences and questions her reality. A "Greek Chorus" of fourteen scientists and mystics explains her experiences in terms of quantum physics.

The scientists include William Tiller, Amit Goswami, John Hagelin, Fred Alan Wolf, David Albert, Andrew Newberg, Daniel Monti, Joseph Dispenza, Jeffrey Satinover, and Stuart Hameroff. The film is slated to open in theaters later this year.Viewers at the conference will be asked for feedback in a post-film discussion period. For information about the film see www.whatthebleep.biz.

Monday March 17

Plenary 6 8:30 – 10:40 **Leo Rich Theater**

PL 6 — Quantum Information Science

Paul Benioff *Towards a coherent theory of physics and mathematics together*

Mitchell Porter *Topological quantum error correction: Applications to microtubules*

Ken Augustyn *Quantum sensors*

Plenary 7 — 11:10 – 12:40 — **Leo Rich Theater**

PL 7 — The "Near Death Experience"

Pim van Lommel *About the continuity of consciousness: Near-death experience during cardiac arrest*

Willoughby Britton *Near-death experiences and the temporal lobe*

Plenary 8 — 2:00 – 4:10 — **Leo Rich Theater**

PL 8 — Experimental Tests of Nonlocality in Brain Function

Dick Bierman *Does consciousness collapse the wave function?*

Jiri Wackermann *Correlations between electrical signatures of separated brain states: few facts, some ideas, and lots of doubts.*

Leanna Standish *EEG evidence of correlated event related signals between distant human brains.*

Concurrent Sessions 5 and 6 — 4:30 – 7:00 — **TCC Coconino & Apache Rooms**

C5 Philosophy and Ontology — **TCC Coconino Room**

Kathryn Laskey *An integrated physical and informational ontology for conscious agents.*

Edwina Taborsky *Complex semiotic dynamics.*

Elizabeth Hill *A phenomenological approach to the measurement problem. Where do these ideas take us?*

Patrick Heelan *Phenomenology of scientific observation and paradoxes of measurement.*

Uziel Awret *The embedded molecule, self organization and quantum mechanics.*

C6 Nonlocality — **TCC Apache Room**

Shan Gao *A quantum method to test the existence of consciousness.*

Don Page *Mindless sensationalism.*

Ken Mogi *On the nonlocal nature of the physical basis of consciousness.*

Logan Trujillo *Do entangled systems share information non-locally? A key question for understanding the non-extended nature of qualia.*

James van Pelt *The use of probability fields in the defense of mind-body dualism against the critique of causal overdetermination.*

James Beichler *From quantum to complete consciousness.*

Poster Session — 7:00 – 10:00 — **Leo Rich Theater Backstage**

First authors listed: for co-authors and affiliations see abstract. Posters may be posted from lunch Monday, March 17 till mid-morning break Wednesday, March 19

1. Experimental approaches - Non-locality

Gabriel Aramburo *Electromagnetic detection of non-local mind-energy*

Iris Bell *Trait absorption and treatment choices in fibromyalgia patients under double-blind conditions*

Edmond Chouinard *Experimental program on mind-matter interrelationships*

James Hurtak *Distant intentionality on biological systems and healing at a distance (DH).*

Leila Kozak *EEG evidence of neural signal transfer between distant subjects who have undergone primordial sound meditation (PSM) training.*

Lewis Mehl-Madrona Effects of amethyst crystals upon QEEG.

Lewis Mehl-Madrona *Systems science, psychiatry, and non-locality.*

Gary Schwartz *Bioenergy detection and biofield entanglement: The role of awareness training and individual differences in absorption*

Richard Shoup *Anomalies and constraints - Psi within known physics?*

Manish Vekaria *Preliminary results on the effect of intentionality on ultra-weak photon (biophoton) emission from the human hand*

2. Experimental approaches - Decoherence

Pierre St. Hilaire *Investigation of dephasing times in the human rhodopsin complex by photon echo experiments*

3. General models/Ontology/Foundations

Wolfgang Baer *Reality models in the human psyche*

Donald Bedford *Spontaneous state reduction revisited*
Donivan Bessinger *Pulsed-nonlocality: Towards a unification of approaches to consciousness.*
Gerard Blommestijn *Quantum mechanics allows energy-less information and cause-transfer between mind and matter.*
Steven Ericsson Zenith *Toward a proof that awareness is not reducible and the limits of discovery in quantum conciousness*
Colin Hales *Metamatter and mind*
Jeremy Horne *The most fundamental law of the ontology of consciousness*
Zbigniew Jacyna-Onyszkiewicz *Consciousnees and origin of the principles of quantum theory*
Kenneth Miller *Vibrational relativity theory*
Nathan Munn *Turning philosophies into hypothesis: Scrutinizing materialism vs. primacy of consciousness using diverse consciousness studies data sets and quantum mechanics*
Anatoly Nichvoloda *System completion theory of consciousness environment.*
Stefan Schmidt *Is there space for non-locality in a causal world?*
Amanda Seipel *Probability and a five-dimensional model of experience*
Inna Semetsky *The triadic mind*
Mikhail Shatnev *Consciousness and complementarity*
Michael Steiner *Consciousness and the measurement problem of quantum mechanics*
Timen Timev *Quantum semiotics and quantum linguistics*
Jerry Wheatley *How delineating cosmological structure leads to an understanding of consciousness*
L. Frederick Zaman III *The localized quantum mind of classical particles and systems*
Xin-Yan Zhang *Essence of the consciousness*

4. Time

Richard Atkinson *Time perception in waking and hypnosis: Moderating influences of hypnotizability*
Edward Close *Putting consciousness into the equations; Physics, consciousness and three-dimensional time*
Danko Georgiev *On the dynamic time scale of conscious experience? A novel neuromolecular approach*
Karen Gilbert *Slowness: An economy of differential rates of being*
Scott Hitchcock *Deep change and the origins of time*
Amarjeeth Pinnamaneni *Time is energy where consciousness is regarded as physical benchmark*
Stephen Robbins *Subject, object and time*
Alexander Zaslavsky *The system of time and its own worlds*

5. Physics/Cosmology

Christopher Altman *Quantum state engineering with the rf-SQUID*
Giovanni Fantasia *The conscious mind and the Schrödinger's cat*
Joel Fontes *From gravity to consciousness*
Ralph Frost *What do you get when you build a tetrahedron out of magnets? (...Or, why unification is too big an attribute to be anything but a primary tenet)*
Ivan Godfroid *Does the theory of psychiagenia (TOP) have experimental applications; No risk of a quantum decoherence in the brain according to the theory of psychiagenia (TOP)*
Alexei Melkikh *Quantum consciousness and internal structure of elementary particle*
Pavel V. Polyan *Numbers in space*
Avtar Singh *Consciousness based solutions to mysteries and paradoxes of quantum mechanics*
Richard Yannopoulos-Ruquist *A dark matter model of consciousness*

6. Quantum Psychology/Biology/Neuroscience

Balaraju Battu *Quantum theory and perception: Quantum state as "sense-data" and "emotion" as quantum measurement process*
Massimo Bondi *Quantum electrodynamics (QED) and "unified synaptic channel" (USC) in the identification of consciousness*
Gregory Brack *Jung/Pauli dialogue: The influence of quantum consciousness on psychology.*

Russell Ceballos *Synchronous oscillations and phase encoding in the brain*
Guido Del Prete *The role of hypnagogic state in the quantum brain model: A preliminary study on a mind model based on three values logic*
Constantinos Evripidou *Visual perception: A treatise to human consciousness*
Robert Fujimura *Gene expression to memory to consciousness*
Catarina Geoghan *On the origin and function of biological synchronisation*
Sheilla Jones *Can anomalous brain function point to evidence of quantum amplification?*
Frank McLafferty *Path integrals, Bohm theory and a model of the brain: A nonlocal, holistic, and contextual picture*
Denis Perevalov *Using the quantum mind theory for multidimensional visualization*
Barry Ridge *Parameciun-based cytoskeletal information processing model*
David Saunders *Does the brain produce binding by combining a correlated redundant neural network with a speed-of-light neural network?*
Hendrik Treugut *Virtual reality causing EEG-alterations*
S. Zdravkovic *About modulation and demodulation in DNA molecule*

7. Education

Tom Bender *Quantum nonlocality, consciousness, and architecture*
Bill Potter *The map of the mind*
Walter Ratjen *Modelling cognition using Schroedinger's cat*
Guy Vandegrift *A student's map to quantum mechanics*

8. Sacred Traditions

Diaa Ahmed *A model for the quantum mind*
Stephen Bost *Consciousness studying itself*
Meera Chakravorty *The matter-mind continuum: Exploring the Sankhya paradigm in Indian philosophy*
Alfred Collins *Consciousness and the self: Reflections on quantum mind and Indian self psychology*
John Gonsowski *Is the mandala mind a sign of string theory in action?*
Syamala Hari *Stability as a criterion to detect tachyons. The matter-mind continuum: Exploring the Sankhya paradigm in Indian philosophy*
Paul Skinner *Spiritual consciousness: Causality and reality*

Tuesday March 18

Plenary 9 — 8:30 – 10:40 — Leo Rich Theater

PL 9 Cell Biology 2: Is the Brain Really "Warm, Wet and Noisy"?

Gerald H. Pollack *Cells, gels and ordered cytoplasm*
Mae-Wan Ho *The quantum coherent organism*
Hans Schuessler *Lasers in the biosciences.*

Plenary 10 — 11:10 – 12:40 — Leo Rich Theater

PL 10 The Orchestrated Objective Reduction ("Orch OR") Model of Consciousness

Roger Penrose *Testing the physical basis of the Orch-OR model of consciousness*
Stuart Hameroff *Testing the biological basis of the Orch-OR model of consciousness*

Plenary 11 — 2:00 - 4:10 — Leo Rich Theater

PL 11 Space-time and Consciousness 1

Koichiro Matsuno *Nonlocal simultaneity from quantum mechanics or the other way around?*
Sisir Roy *Space-time representation and information processing in the brain*
Menas Kafatos *Consciousness and the universe: Generalized principles of unification*

Concurrent Sessions 7 and 8 ____ **4:30 -7:00** ____ **Radisson Hotel Mesquite & Acacia Rooms**

C7 Experimental approaches ____ **Radisson Hotel Mesquite Room**

Eduard Van Wijk *Photon emission studies in consciousness research.*
Franco Musumeci *Delayed luminescence as a tool to investigate cell organization.*
Anita Goel *Molecular motors*
James Lake *Toward testable hypotheses of neuro-dynamic and quantum field mechanisms underlying anomalous conscious states.*
Charles Victor Davis *Quantum mechanistic event associated with electron flux migration through a semiconductor substrate and the conscious perception of reality.*
Afzal Kamboh *Universal spintronic device for manipulating quantum information.*

C8 Mathematical and physical approaches ____ **Radisson Hotel Acacia Room**

Brian Josephson *Organised complexity and quantum mind.*
Chris King *Chaos, quantum-transactions and consciousness: A biophysical model of the intentional mind.*
Erhard Bieberich *Fractal compression algorithms: Implementation of brain and machine consciousness.*
Douglas Matzke *The math over mind and matter.*
Michael Lipkind *The concept of irreducible field applied for consciousness understanding.*
Burton Voorhees *Virtual stability and the quantum mind.*

Conference Dinner ____ **7:30 – 10:00** ____ **Radisson Hotel Starlight Ball Room**

Buffet dinner open to all registrants

Wednesday March 19

Plenary 12 ____ **8:30 – 10:40** ____ **Leo Rich Theater**

PL 12 The Cell Cytoskeleton

Jack Tuszynski *From tubulin to neurons: An overview of the physical properties of tubulin and their potential for affecting the functioning of neurons*
Nancy Woolf *Fluorescent labeling of cytoskeletal proteins in PC12 cells grown in culture*
Roeland Van Wijk *Cellular photon emission and cytoskeletal activity*

Plenary 13 ____ **11:10 – 12:40** ____ **Leo Rich Theater**

PL 13 Space-time and Consciousness 2

Paola Zizzi *Qualia and quantum space-time*
Paavo Pylkkanen *Consciousness and our concept of reality*

• End of Program •

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The Center for Consciousness Studies, The University of Arizona
The Fetzer Institute
The YeTaDeL Foundation
The Samueli Institute for Information Biology
School of Computational Science, George Mason University

Abstracts

Plenary

Plenary Session 1
Foundations of Quantum Mechanics & the Brain/Mind
Problem 1

How mind influences brain. Henry Stapp <HPStapp@lbl.gov> (Professor of Physics, University of California, Berkeley).

Our conscious thoughts do not enter into the dynamical equations of classical physics. They are considered to be either passive observers, or perhaps just reorganized expressions of the classically described physical processes. In either case they can do nothing that is not already done by the local mechanistic laws, which act exclusively at the microscopic level, and completely specify from the initial conditions of the universe the course of physical events for all time. Quantum theory was born by injecting the actions and observations of human agents into the dynamical laws. Formalized by von Neumann as Process I, this crucial insertion of the human agent into quantum dynamics allows a person's conscious thoughts, per se, to influence the dynamical processes occurring in his brain. Thus quantum mind-brain dynamics combines naturally the bottom-up local mechanistic brain process with a genuine top-down action of mind on brain that is not just a reorganized expression of the mechanical bottom-up process. The details will be described.

Closed quantum worlds and their partitions. Guenter Mahler <mahler@theo1.physik.uni-stuttgart.de> (Institute of Theoretical Physics I University of Stuttgart).

Quantum mechanics is often believed to be counter-intuitive if not mysterious. At the same time this theory has met with unprecedented success, from Planck's explanation of the blackbody radiation to present day nano-technology experiments. But how can the familiar classical and the unfamiliar quantum features be reconciled? How does our classical world emerge from its quantum substrate?

I will show that the well-known thermal equilibrium emerges as a typical "local" property of closed quantum systems partitioned into parts: It derives from entanglement between the system of interest and its quantum environment. While "entangled states" (a generalization of superposition states to composite systems) abound on the level of the total system, these strange quantum states just give rise to that fairly classical appearence of our physical world, to which we have no access other than via some of its parts! The huge space of correlations associated with any entanglement does not show up locally. (Neither does the ability to support massive quantum computation.)

In the classical domain partitions are not fundamental; they often are a matter of convenience. In quantum mechanics the partitions define the pertinent "perspective", a kind of generalized reference frame, whithout which we cannot even formulate "elements of reality" (just as you cannot define an angle without referring to a given direction). In a theoretical simulation of a closed quantum world one can easily change partitions and thus "change reality", without even touching the underlying total quantum state at all.

But who selects the partitions in our real world? To some extent the experimentalist does; in fact, this is a prerequisite of empirical science to begin with. But in most other respects the experimentalist is a player like other human beings on a stage, which nobody is free to define to ones's liking. So, are the partitions (specifying the material world as it appears) to an overwhelming extent the result of (collective?) consciousness?

I do not know. But I think, it could prove useful to consider (define?) consciousness as such a partitioning agent (which would thus have to transcend any local system including the brain!) rather than as the immediate local companion of any computing device of high enough internal complexity (as some computer specialists would like us believe). This role of consciousness would be much broader and more "exquisite" then that of taking care of the notorious "quantum jumps" (believed to define microscopic "facts" within a given partition). Is there any empirical evidence for that assertion? I cannot judge. One might look for induced changes of partitions (as in the theroretical model above), hopefully not only in a metaphorical sense.

References:

J. Gemmer, A. Otte, G. Mahler, Phys. Rev. Lett. 86, 1927 (2001)
J. Gemmer, G. Mahler, Europhys. J. D 17, 385 (2001)
J. Gemmer, G. Mahler, Europhys. Lett. 59, 159 (2002)
G. Mahler, J. Gemmer, M. Stollsteimer, Superlattices and Microstructures 31, 75 (2002)
J. Gemmer, G. Mahler, quant-ph/0201136: Europhys. J. D, in press (2002)

Plenary Session 2
Foundations of Quantum Mechanics & the Brain/Mind
Problem 2

The only objective evidence for consciousness: The quantum experiment. Bruce Rosenblum <brucero@cats.ucsc.edu> (Department of Physics University of California at Santa Cruz), Fred Kuttner.

In the absence of objective, third-person evidence of conscious experience, i.e., qualia, one can logically deny the very existence of consciousness beyond the so-called “easy problems” of consciousness. Consciousness has, in fact, been claimed to be no more than the behavior of a vast assembly of nerve cells and their associated molecules. However, objective evidence for a physically efficacious consciousness actually exists, and the experimental facts are undisputed. We will illustrate a physical manifestation of consciousness with a theory-neutral description of a quantum mechanical thought experiment. It’s a version of the two-slit experiment, and therefore realized in practice. The obvious rebuttal to our argument, that an unconscious robot could do the experiment, will be countered by assuming the predictions of quantum theory (the most battle-tested theory in science) are all correct and showing that the only escape from our conclusion must deny one’s ability to freely (or randomly) choose behavior. Moreover, such denial of “free will” must also involve a strange and unexplained connectivity between physical phenomena. Therefore the conclusion that consciousness itself, though yet unexplained, is physically efficacious is at least as modest an hypothesis as any other. Basically, of course, we are dealing with the quantum measurement problem. A difference is that we treat it directly from the experiment without appeal to quantum theory. We finally relate our treatment to the way the problem is usually treated, i.e., from the point of view of the theory.

Weak quantum theory: Complementarity and entanglement in physics and beyond. Hartmann Roemer <hartmann.roemer

@physik.uni-freiburg.de> (Universitaet Freiburg).

The concepts of complementarity and entanglement are considered with respect to their significance in and beyond physics. A formally generalized, weak version of quantum theory, more general than ordinary quantum theory of material systems, is outlined and tentatively applied to some examples.

Plenary Session 3
Quantum Coherence in Brain Function

A field theory of consciousness. E. Roy John <roy @brl4.med.nyu.edu> (Brain Research Laboratories, New York University School of Medicine), Leslie S. Prichep.

Understanding the basis of subjective awareness and consciousness is the most challenging task facing neuroscience today. Apart from the need to elegantly resolve mind-brain dualism, there are pressing practical needs to make progress on this problem. Alterations in the quality of consciousness are fundamental to many behavioral disorders. Understanding the brain processes which generate consciousness may lead to better treatments. In spite of voluminous studies by cognitive neuroscientists, a comprehensive theory of consciousness is still lacking. These studies can be characterized largely as either in the "particle " domain (Studies of neuronal characteristics) or in the "wave domain" (Studies of EEG, MEG, EP). In recent years, imaging studies of processes reflecting metabolic processes in large cell masses have expanded the wave domain. This theory attempts to unify the particle and wave domains.

Complex neuroanatomical/neurochemical homeostatic systems, genetically determined, regulate baseline levels of 1) local synchrony, 2) global interactions among regions, and 3) periodic sampling of the signal space. This regulation defines the most probable configuration of activity in the resting brain, considered to contain no information, a ground state of maximum entropy. Deviations from these baselines are considered as negative entropy. Such changes are consistently found during information processing and cognitive activity, in many developmental, neurological, and psychiatric disorders, after administration of centrally active substances, during seizures accompanied with loss of consciousness, and in sleep, coma, and anesthesia.

Research on anesthetic effects shows, independent of any particular anesthetic, that upon loss of consciousness, certain abrupt and distinctive changes always take place in the local power spectra, the distribution of power and interactions among brain regions. A subset of these changes always reverses before return of consciousness. These robust findings have been combined with a number of critical observations from particle and wave research to build a theory of consciousness.

Information is encoded by nonrandom synchronization of neuronal ensembles or cell assemblies within a brain region, rather than by discharges of dedicated cells. Since random neural activity is the most probable, deviations from the regulated levels of local synchronization, regional interactions and sampling periods constitute negative entropy. Integration of activity encoding sensory information, recent and episodic memories, expectations, planned actions, interoceptive stimuli, affective states and levels of motivation is required to yield a global percept. Spatially extensive, essentially statistical information must be transformed into a seamless subjective experience. The inadequacy of connectionist concepts to account for this process points to the need for a paradigm shift.

How information fractionated into specialized analyzers is integrated into a holistic percept constitutes the binding problem. How a percept defined by a spatial distribution of statistically nonrandom neural activity is subjectively experienced constitutes the problem of consciousness. In this theory, the building blocks of consciousness arise from the occurrence of local negative entropy, within a set of neuronal populations widely distributed throughout the brain. Pyramidal cells serve as coincidence detectors binding dispersed coherent neuronal ensembles into Global Negative Entropy. Consciousness is postulated to arise from an electromagnetic field resonating in a critical mass of electrotonically as well as synaptically coupled cells

Dimensional analysis of neurophysical processes related to mentation. Gustav Bernroider <gustav.bernroider@sbg.ac.at> (University of Salzburg, Institute of Zoology, Brain Imaging Group).

Recent decoherence calculations of brain states have failed to identify neural subsystems relevant to brain signalling with dynamical properties that require non-classical physical descriptions [Tegmark, Phys. Rev E 61, 2000]. Others have plausibly suggested neural environments that may protect a neural subsystem such as microtubules from environment-induced einselection up to time-scales relevant for classical signals [Hagan, Hameroff & Tuszynski, 2001].

In this work, I will systematically apply the Lagrangian concept of action order to brain processes at different scales of resolution in order to clarify the current dispute whether classical neurophysics suffices to analyse higher level brain functions or a whether a quantum physical approach is necessary. The critical issue is to estimate action orders over those quantities that are truly pertinent to the relevant brain phenomena and to see whether the appropriate action orders require a quantum notation. Compared to estimates about decoherence times, dimensional evaluation has several advantages; i) it is the most natural approach to delimit the domain of validity between classical and quantum theories, ii) it avoids ambiguity in the definition of 'environment' (which, at the present stage of knowledge is hardly possible for 'real'physiological systems), iii) it avoids 'assumptions' about relevant physical (and physiological) magnitudes but expresses a system in the most natural standard of 'action' and iv) it does not anticipate the interpretation and correspondence problem (e.g. to calculate the decoherence time of a neuron in superposition of 'resting' and 'firing' is to take a 'Schrödinger cat state' literally – whereas classicality behind neurophysiology clearly only involves stable and 'einselected' pointer states).

Finally v) in the Lagrangian formalism physical actions are treated as integrals over magnitudes that conserve the integrand along spatio-temporal translations. As within this view action can be expressed by the combination of many different physical magnitudes (e.g. electrical quantities can be represented by purely mechanical units and actions involving energy can be calculated by masses, time and length) the present approach accesses a wide range of empirical control benefiting from the enormous amount of available physiological data.

The results presented here encompass processes established at the macroscopic single cell level to processes at the sub-molecular level and the 'concerted' molecular population level. 'Spiking' action at the single cell level for example is found to involve

1.8 x 10 to-15 Lagrange (using mechanical units) down to 2.1 x 10 to -16 L (involving electrical units). This is between 10to18 up to 10to19 x Planck's constant, which is in good agreement with the time-scale differences for neural state decoherence and spiking time calculated by Tegmark (10to19 s). However, of particular interest at the molecular level are actions behind selective ion permeation and channel gating. With up to 10to5 ions permeating per msec and employing a 'saturating barrier model' with one or two ions crossing at the time [Hille, 1992 and Joao H. Morais-Cabral et al, Nature 414, 2001], action based on mechanical units gives 0.48 x 10to-34 L, which is exactly in the range of the quantum constant h-bar (1.05459 x 10to-34 MKSA units). It is remarkable that this result, based exclusively on empirically established ion-conduction properties, yields precisely the dimension of a quantum domain (actions above this dimension would imply classical validity, actions at the 'sub-Planck scale' would be traditionally considered insignificant, except some quantum versions of classically chaotic systems that scale as small as [(h-bar)2 / action], and have recently been reported to be highly effective in the selection of preferred pointer states by the environment [Zurek, Nature 412, 712, 2001].

Whereas classical neurophysiology has considered selective diffusion of ions across the cell membrane basically as the constructing mechanism leading to brain signals (e.g. action potentials), with no particular coding potency as such (e.g. Barlow's doctrine in perception), more recent progress in molecular and sub-molecular neurophysiology at the synchrotron 2 A resolution opens a new perspective [Zhou, et al, Nature 414, 2001]. It becomes apparent that the classical level of nerve impulse signalling 'reflects' on a functionally indispensible lower level, involving energetically delicate concerted ion-protein and ion-ion interactions [Berneche & Roux, Nature, 414, 2001], with possible signalling properties of it's own relevance. It is this view that the present work tends to adopt. This is also supportive of quantum models of higher level brain functions in general [e.g. Hameroff & Penrose, J. Consciousness Stud. 3,36, 1996]. Results from this work demonstrate, that the brain spans over roughly 10to20 magnitudes of action orders with physiologically significant signal properties. Thus the following question is put into the center of attenion: how does the brain resolve the problem of correspondence between the extensive quantum Hilbert space governing ion dynamics on one hand and stable, einselected pointer states of propagating membrane potentials on the other hand? In this paper some proposals for this decisive question concerning the relation of mentation and brain processes will be discussed within the frame of a quantum-neurodynamical concept.

Brain mathematics. Karl Pribram <pribramk @georgetown.edu> (Cognitive Neuroscience Program, Department of Psychology, Georgetown University and School of Computational Sciences, George Mason University).

The current paper stems from the finding that there is a parallel between the formalisms of quantum physics and those that describe certain information processing aspects of brain function. Of course the brain processes represented are not necessarily of the order of quantum physics. Essential to the formalisms is the Fourier relationship that states that any space-time pattern can be transformed into the spectral domain characterized by a set of waveforms that encode amplitude, frequency and phase. Inverting the transform realizes the original space-time configuration. The domain is "spectral" not just "frequency" because the Fourier relation encodes both the cosine and sine of a waveform allowing the interference between the 90 degree phase separation to be encoded as coefficients. The advantage gained by transforming into the spectral domain is that a great variety of transformed patterns can be readily convolved (multiplied) so that by performing the inverse transform the patterns have become correlated. Image processing as in tomography such as PET scans and fMRI are prime examples of the utility of the transformation.

In quantum physics the Fourier transformation is primarily applied in relating the position in space of a particle to its linear momentum (that is, a constant velocity). Much has been written regarding the indeterminacy of this relationship at the lower limit of measurement, that is, that at the limit it is impossible to accurately measure both position and momentum. This is also known as Heisenberg's uncertainty principle.

In classical physics the terms momentum and position refer to an unchanging status: "momentum" to the inertia of velocity of a mass and "position" of its location. By contrast, "energy" in classical physics refers to change, the change being measured as a quantitative amount of work necessary to effect the change. In quantum physics change is measured in terms of frequencies, of wave-length (times Planck's constant). The Fourier relation envisions the wave form not as a linear continuum but as a clock-face-like circle - thus one can triangulate and obtain the cosine and sine of the wave form to produce their interference and create phase in the spectral domain. This was Fourier's definitive insight (or was it that of the mathematicians in Egypt with whom he discoursed during Napoleon's expedition?) that has made his theorem "probably the most far reaching principle of mathematical physics" as Feynman has declared it. Thus, the Fourier energy-time relation becomes, in a sense, spatialized.

In quantum physics very little has been made of the uncertainty involved in relating energy and time. Dirac called attention to this indeterminacy in discussing the delta function, but for the most part quantum physicists (e.g. Bohr) have focused on the relationship between energy and mass as in Einstein's equation: E=mc*. By squaring c, the constant representing the speed of light, a linear measure of time becomes "spatialized" into an area-like concept, Minkowsky's space-time. We will return to a discussion of this version of time when considering brain processes. For quantum physicists interested in the composition of matter, the Einstein/Minkowsky space-time formulation comes naturally.

For brain function, Dirac's indeterminacy in the relation between energy and time is the more cogent. During the 1970s and 1980s the maps of dendritic receptive fields of neurons in the primary visual cortex were described in such terms. The maps fit a space-time constrained Fourier relation, the Gabor elementary function, essentially a kind of wavelet in phase (Hilbert) space. Gabor had used the same mathematics that Heisenberg had used; he therefore called his unit a "quantum of information" warning that by this he meant only to indicate the formal identity of the formulation, not a substantive one.

Gabor had undertaken his mathematical enterprise to determine the minimum uncertainty, the maximum compressibility, with which a telephone message could be transmitted across the Atlantic cable without any loss in intelligibility. He later related this minimum uncertainty to Shannon's BIT, the measure of a reduction of uncertainty. In turn, Shannon had related his measure of uncertainty to Gibbs' and Boltzman's measure of entropy. The stage

was set for the issues that currently concern us: a set of identical formalisms that refer to widely different substantive and theoretical bodies of knowledge. What is needed is something like the discovery of atomic number in chemistry that related the periodic table to its physics underpinnings.

To begin, contrast the referents of the formulations in classical and quatum physics to those in thermodynamic theories: First there are no references to the momentum and position of a mass. Second, the emphasis is on energy as measured not as a pseudospatial quantity but as dynamic "free" energy. The utility of this free energy for structured work (as in a steam engine) is of concern; its dissipation in unstructured heat is measured as entropy. In the diagram of the Fourier relation, thermodynamics focuses on the upper part of the relationship (the dynamics of energy and time) just as physics focuses on the lower part (the statics of momentum and location of a mass or particle).

The distinction devolves on the conception of time. Time in relativistic and quantum physics has been spatialized as clock time, the chronos of the ancient Greeks. Time in thermodynamics is a measure of process, its duration, which may vary with circumstance. It is the "Duree" of Bergson, the Kairos of ancient Greece.

Brain processes partake of both aspects of time as developed in the space-time constrained Fourier measure utilizing the phase between cosine and sine aspects of a wave form. In vision, for example, a two-dimensional spatial frequency relation represents the momentum of a movement (velocity) and location of a point in visual space. In audition, a time-frequency process allows a distinction to be made between the duration of a tone and its pitch. What is important is that in both cases the results of the process are projected into the environment of the organism. Bekesy demonstrated this by arranging the phase relations among vibrators placed on the skin; stereophonic systems demonstrate the projection in the arrangement of speakers in an engineering artifact; and in vision it is an ordinary observation that we see things "out there" not on our retinas or in our brain cortex. The projective nature of the brain process is what distinguishes it from both the quantum physical and thermodynamic processes.

The brain organizations that make projection possible describe an internal, semi-closed, self-organizing set of processes. However, that is not the whole story. The formal, mathematical descriptions of our subjective experiences (our theories) of observations in the quantum, thermodynamic and communications domains are non-trivially coordinate with each other. They are also coordinate with brain processes that, by way of projection, unify the experiential with the physical. By this I mean that the experiences of observations in quantum physics, in thermodynamics and in communication appear to us to be "real", that is, extra-personal. Adaptation to living in the world makes it likely that this coordination of the mathematical formulations in physics, thermodynamics, and brain processes thus represents the useful reality within which we exist.

Plenary Session 4
Transpersonal Implications of the Quantum Mind

Quantum mind and social science. Alexander Wendt <awendt@uchicago.edu> (University of Chicago).

Social science in both its positivist and interpretivist or humanistic forms is based on the metaphysical assumptions of classical physics. The effects of this worldview have been clearest on positivist scholarship, in which human beings are conceptualized as machines and as such can be studied like any other material object, in an objective, third-person manner that has no need to take consciousness into account. Interpretivists reject the machine model and its deterministic implications in favor of a phenomenological, first-person perspective that makes consciousness central. But their approach too is subtly indebted to classical physics, which they have taken as their reference for what it means to study society "scientifically." This has led many interpretivists implicitly to accept a problematic Cartesian dualism, and even to reject the idea of social science altogether. If consciousness is a quantum rather than classical mechanical phenomenon, then these basic parameters of contemporary social scientific discourse and debate will be called into question, and radically new models of human agency, social structure, and the epistemology of social inquiry will need to be developed. Some ideas about what these might look like are proposed.

Generalized entanglement - Possible examples, empirical evidence, experimental tests. Harald Walach <walach@ukl.uni-freiburg.de> (University Hospital Freiburg, Institute of Environmental Medicine and Hospital Epidemiology, Germany).

Weak Quantum Theory (WQT) uses the formalism of algebraic quantum mechanics (QM) to build a generalised version of a formalism applicable to all sorts of systems beyond the realm of QM proper and material systems. WQT drops some restrictions specific to QM, like Planck's constant, but retains the handling of non-commuting or complementary observables. From the theoretical framework of WQT it can be derived that entanglement, which is well known as EPR-correlations for material systems described by QM proper, could also be operative between parts of systems not normally treated by QM. Most notably, WQT predicts that entanglement should ensue between parts of a system, if a local observable describing one part of the system and a global observable describing the whole system are complementary. While the notion of complementarity is well defined within QM proper, it is more difficult to handle in the context of everyday or non-formal scientific language. "Complementary" denotes two elements which are mutually incompatible and yet necessary to describe one whole or system. This fact is mathematically modelled by the non-commutativity of operations. If this prediction of WQT is true, then we would expect generalised entanglement between elements of macroscopic systems to be a rather common phenomenon. In this lecture, I will give a few empirical examples, which are suggestive of generalised entanglement, and derive some empirical and experimental predictions.

One such example is the correlation of improvement rates of patients treated by pharmacological treatment and placebo within the context of randomised double blind clinical trials. These improvement rates we and others have shown to be highly correlated ($r = .78$). I suggest that this is due to entanglement, rather than to classical processes, and will present data from a meta-analysis of 121 clinical trials to make this case plausible. Another example is the correlation of EEG of spatially separated subjects, as presented by Wackermann et al. in another lecture. A further example could be the well known transference and countertransference phenomena, as witnessed in psychotherapy. It is possible that generalized entanglement is also used by subsystems of the body. If some genes act as pattern specifiers, rather than as specifier of particular building blocks, this would explain some of the puzzles of genet-

ics, as suggested by Michael Hyland. Apart from that this would predict a hyperfast communication system in the body, which could be tested empirically.

By that mechanism quite a few other hitherto unexplained phenomena, which are deemed unscientific, could be explained. Among them would be relational phenomena as the basis for healing, ritual, and other branches of complementary and alternative medicine, or parapsychological phenomena. Consciousness, possibly being itself a variable complementary to matter, would enter the field by ways yet to be explored and would take a new role.

Plenary Session 5
Cell Biology 1 - Is the Brain Really "Warm, Wet and Noisy"?

Varieties of computational experience: Molecular biology and quantum information processing. Jeffrey Satinover <jeffrey.satinover@yale.edu> (Condensed Matter Theoretical Physics & W. H. Keck Foundation Center for Quantum Information Physics, Yale University).

It remains widely believed that biological processes can be wholly understood using the models and mathematical methods of classical physics, chemistry and thermodynamics. In this view, quantum theory merely provides for the rules of material interaction; the quantum statistics of many-body systems gives these interactions a distinct cast in circumstances of exceptional isolation and control but are washed out in the thermodynamic conditions that prevail in living systems. This view is flatly wrong. Without appeal to any theory of consciousness, nor to formal (qubit-based) "quantum computation," there are innumerable processes critical to living matter that depend directly upon quantum effects that play themselves out on a mesoscopic scale, and whose consequences are as baffling as all quantum results. These processes are also inherently computational in character. This presentation will describe examples of such processes and explain how their quantum and computational characteristics distinguish them from qubit-based quantum computation. It will be argued that the evidence for such processes in living systems is already (a) ubiquitous and unique, (b) of enormous theoretical significance, (c) readily assimilable at (scarcely beyond) the advancing edge of current scientific research, (d) becoming central to emerging, rigorously scientific, biological models and (e) that it can help provide accountability and rigor for the more speculative ideas that are a large part of, for example, this conference. To crib from Richard Feynman: "Imagination, but imagination in a strait-jacket."

Experimental "quantum brain"? Andreas Mershin <mershin@physics.tamu.edu> (Texas A&M University) A.A. Kolomenski; H.A. Schuessler.

It has been suggested that tubulin has a permanent electric dipole moment which changes direction as the protein undergoes a conformational change. It has been argued that this property can be used as the basis for an electronic binary switch. Biophysical analysis has yielded predictions that under certain circumstances, dipole-moment "flip-waves" can propagate along microtubules (MTs) and that MTs are ferroelectric. There have also been indirect indications that optical and quantum effects play a significant role in the function of these intracellular cytoskeletal structures. Although crucial to these hypotheses and to a better understanding of MT structure, function, polymerization, energy transduction and anesthetic and other drug binding, so far, the electric dipole moment of tubulin has never been experimentally determined and flip waves or quantum behavior have not been observed.

This talk concentrates on avenues of experimental investigation of the dielectric and possibly quantum properties of tubulin, microtubules and associated proteins, as these pertain to their possible role in storing and processing information in biomolecular circuits. Our theoretical as well as experimental in vitro and in vivo methods used to try to answer these questions will be described.

A QED-cavity, quantum optics derived model of MTs implying dissipationless energy transfer along MTs and quantum teleportation of biomolecular states will be shown. Surface Plasmon Resonance (SPR) laser optical techniques for determining the polarizability and consequently dipole moment of tubulin and MTs will be presented. The applicability of SPR and femtosecond laser pulses to detection of long-lived, room-temperature quantum superposition and entanglement among tubulin dipole states will be discussed. Evidence in support of crucial involvement of neuronal MTs in Drosophila fruit-fly associative olfactory memory formation will be shown.

Quantum models of consciousness in brain microtubules: Decoherence and the issue of biological feasibility. Scott Hagan <Scott_Hagan@bcit.ca> (Department of Mathematics, British Columbia Institute of Technology Burnaby, British Columbia, V5G 3H2, Canada).

Enigmatic features of subjectivity and consciousness have motivated several approaches that postulate an ultim ately quantum basis for these phenomena. In the most prominent model - the orchestrated objective reduction t heory of Penrose and Hameroff - the neuronal cytoskeleton is the site of quantum level superpositions that avo id environmental decoherence long enough to interact with classical neurophysiology. Such models have been cr iticized, both as regards their motivation and their biological feasibility, in a report by Tegmark. The repo rt suggests that quantum coherence could be maintained in microtubules for only about 10-13 seconds, far too s hort to be neurophysiologically relevant.

On critical examination, however, the calculations do not appear to justify the claim. Tegmark's formulation of the decoherence time, for instance, predicts exactly the opposite temperature dependence to that which is observed in practice. The derivation, once corrected for several discrepancies between Tegmark's account of the model and the actual hypothesis, also appears to determine a result that invalidates the assumptions on which the derivation proceeds. The assessment of decoherence times is further based on an equilibrium model, clearly inappropriate in the context of a living system continually supplied with energy, especially when Tegmark himself allows that non-equilibrium ordering processes could in fact counter short-range sources of decoherence like ion scattering. Revised estimates for the decoherence time due to the tidal influence of Coulomb forces (the case investigated by Tegmark) are presented as well as results for the decoherence time due to other potential sources of decoherence. All are found to be within tolerances allowed by the model.

Tegmark also questions the motivation for introducing quantum models in the first place and argues that classical (non-quantum) models can accomplish these same ends. His formulation is reviewed to demonstrate that his classical characterization of sub-

jectivity is not, in fact, about subjectivity. It is shown that the solution he envisions to the binding problem cannot succeed, specifically because of constraints that apply to all classical (non-quantum) phenomena.

Plenary Session 6
Quantum Information Science

Towards a coherent theory of physics and mathematics together. Paul Benioff <pbenioff@anl.gov> (Physics Division, Argonne National Laboratory).

Some work based on my long standing interest in the relation between physics and mathematics at a foundational level will be discussed. Included will be consideration of very general aspects of a possible framework for a coherent theeory of physics and mathematics together. Emphasis will be placed on two basic conditions that such a theory should satisfy; the theory should maximally describe its own validity and strength and it should be maximally valid and strong. Some aspects of the basic observation that all language necessarily has physical representations (language is physical) will also be discussed.

Topological stabilization of quantum states in the microtubule. Mitchell Porter <Mitchtemporarily@hotmail.com> (Brisbane, Australia).

Topological quantum effects offer a natural way to resist decoherence, and are the starting point of a major new approach to quantum computing. I describe how topological quantum error correction and topological quantum computation work, and discuss the evidence that the microtubule has been evolutionarily optimized with these roles in mind.

Quantum sensors. Ken Augustyn <ken.augustyn @veridian.com> (Ann Arbor Research & Development Center).

A wide variety of quantum technologies are currently under development in universities across the world. The motivation for this substantial effort is to realize the promises of quantum computing, quantum cryptography, and quantum communications. These promises appeared rather suddenly and unexpectedly in the 1980's from both theoretical breakthroughs, such as David Deutsch's original quantum computing algorithm, and from nearly simultaneous experimental breakthroughs, such as Aspect's demonstration of EPR phenomena.

These three big areas -- computing, cryptography, and communications -- are all in the more general area of quantum information technology. However, there are yet other areas that are likely to benefit from the technologies being developed.

One such area is sensors. A sensor is a physical device that produces information about the world, such as a thermometer, or a camera, or an MRI scanner.

Sensors are of two types, active or passive. Passive sensors such as a microphone merely respond to their environment. Active sensors in some way probe their environment. Sonar, for example, is an active sensor.

Although many active sensors are trivial extensions of passive sensors, such as a camera with a flash, other active sensors have no passive counterparts. For example, synthetic aperture radar (SAR), computes an image of the ground from a large set of radar return pulses collected from an airplane. The image formation processing is an integral part of the sensor; without it there is nothing to see. The same can be said for many other computer-dependent sensors such as computer-aided tomography.

Quantum effects such as superposition and entanglement are now moving into the domain of sensor engineering, and it is nearly certain that entirely new kinds of sensors will result; sensors with properties that cannot be explained in terms of classical physics. For example, Paul Kwiat's quantum zeno effect experiment, conducted while he was at Los Alamos, can be interpreted as a very unusual kind of sensor. Here, a physical pathway between two points can be monitored from a remote location, where one can know whether or not the "beam" between these two points has been broken by the insertion of an opaque object. But this "beam" is not made of anything classical, like a beam of photons or electrons or atoms. Our classical language breaks down; it is a "beam" of probability amplitudes. Equipped with a photon detector, or any other kind of detector, an intruder is highly unlikely to detect this beam. Yet it can reliably detect this intruder's detector when it breaks the beam.

In laboratories such as JPL's Quantum Sciences and Technology Group new kinds of gravity gradiometers have been developed that are a thousand times more sensitive than the best classical instrument. They use atom interferometry, a quantum effect that has no classical counterpart.

Boston University's Quantum Imaging Laboratory has developed many practical applications based on the properties of entangled photons, or biphotons. These include entangled photon microscopes, spectroscopes, and tomographic sensors.

At Veridian's Ann Arbor Research & Development Center, we are investigating a wide range of potential new quantum sensors, such as:

- Sensors that can detect hazardous chemical or biological aerosols or surface deposits from a large "standoff" distance. Generally, biohazard sensors work by illuminating molecules by ultraviolet light and inducing fluorescence. Since atmospheric ozone is a strong absorber of UV light, distances are limited. By down converting UV photons into entangled pairs of green photons, and by utilizing entangled two-photon fluorescence, we think we can solve this standoff distance problem.
- Virtual State Spectroscopy sensors that use the differential fluorescence response to subtle variations in entanglement time, relative delay, and other entangled two-photon parameters to give unique material signature information.

In the process, we are developing new technologies such as our Biphoton Detection Device, which can distinguish the unique case of the simultaneous arrival of an entangled pair of photons from the simultaneous arrival of an "ordinary" (not entangled) two-photon pair. This device is thought to be key to a number of sensor concepts that rely on the distinction of biphotons detection events from background photon detections. Without it, one can only infer (by means of coincidence detection) that an entangled pair has arrived, and the reliability of this inference goes down as the background photon flux level increases.

We are also involved in quantum computing, both in developing algorithms that would run on full, Turing-equivalent quantum computers and in developing special-purpose quantum computing devices.

Full Turing-equivalent scalable quantum computers are still some years away. But many sensor applications will not need their universality. With sensors such as SAR and MRI, "doing the computing right" is the largest part of the engineering job, and for

many of the new sensors we are envisioning, a small on-board quantum device will do the specific required computing job. For example, we have developed a special-purpose quantum computing device to rapidly compute the so-called cross-ambiguity function needed by many sensor types.

We are also working on algorithms for universal quantum computers. For example, we have developed a quantum computing algorithm for optimization that uses information about the problem (density of states) to speed up the process of finding the optimal solution.

To me it is clear that as more applications become real and tangible, more bright young people will be attracted to careers in what will be called quantum engineering. The number of people working in this field is increasing rapidly already because of the excitement of quantum computing. Tangible, practical applications such as quantum sensors will further stimulate and attract bright new minds to this new field. We are only at the very beginning of the quantum engineering era.

What does all of this have to do with the philosophical problems of interpreting quantum physics, especially with the problem of understanding conscious awareness and the relationship of consciousness to the physical world?

I believe that the future rapid growth of quantum applications will attract and provide the economic infrastructure to greatly increase the number of people working in quantum engineering jobs. All of these new people will be qualified to think in quantum terms, and their jobs will enable them to be continuously immersed in real-world quantum problems. And many of them will want to deal with the quantum foundations of consciousness – if not on the job then on their own time – and they will knock their heads against the wall as most of you have been doing. They will be younger, and better educated. Their physics education will, I hope, be "quantum from day one" rather than quantum bolted onto a classical framework. And, they will have all of your work to build upon.

So, while I have no solution of my own to propose to the quantum-mind problem, I am confident that practical quantum applications, such as quantum sensors, will provide the economic infrastructure to support a growing army of new quantum engineers. Through them, a more satisfactory understanding of quantum physics and consciousness will come in time.

Plenary Session 7
The "Near Death Experience"

About the continuity of consciousness: Near-death experience during cardiac arrest. Pim van Lommel <pimvanlommel @wanadoo.nl> (Division of Cardiology Hospital Rijnstate Arnhem The Netherlands).

Recently our article in the Lancet was published, entitled: " Near-death experience in survivors of cardiac arrest: a prospective study in the Netherlands".

A near-death experience (NDE) is the reported memory of all impressions during a special state of consciousness, including specific elements such as out-of-body experience or a life review. There are three theories that should explain the cause and content of NDE.

The physiologic explanation: The NDE is experienced as a result of pancerebral anoxia. In our study all patients had a cardiac arrest, they were clinically dead, unconsciousness that was caused by insufficient blood supply to the brain, and the EEG has become flat. In patients cardiac arrest (ventricular fibrillation) is sometimes induced for testing internal defibrillators. In these patients the EEG becomes usually flat within 10-15 seconds from the onset of syncope due to the (reversible) total loss of function of the brain. According to this theory, all patients in our study should have had NDE, but only 18% reported NDE.

The psychological explanation: NDE is caused by fear of death. But in our study only a very small percentage of patients said they had been afraid the last seconds preceding the cardiac arrest. And also the given medication made no difference.

Finally there is a theory that consciousness can be experienced independently from the normal body-linked waking consciousness.

Research on NDE pushes us at the limits of our medical concepts of the range of human consciousness and the relationship between consciousness and memories with the brain.

First we will discuss the content of certain elements of NDE, like the out-of-body experience, the holographic life review and preview, the encounter with deceased relatives, the return to the body and the disappearance of the fear of death. These elements of NDE show that people can experience consciousness, with self-identity, cognitive function and memories, including the possibility of perception outside their body, during a flat EEG. Consciousness can get into a dimension without our conventional body-linked concept of time and space, enabling simultaneous existence of past, present and future events (review and preview). It is also possible to become connected with personal memories and with the personal consciousness of others, as well with fields of consciousness of deceased loved ones (interconnectedness). Finally, the return of consciousness into the body is experienced, including the accompanying sense of limitation.

We will discuss some neurophysiology of the normal function and of anoxia of the brain. Quantum field theory is important, because of the similarities found in NDE and in the concepts of non-locality, universal interconnectedness, a non-material dimension without our time-space relationship, and in the concept of subjectivity. All events are related and influence each other instantaneously and in reciprocity, and only subjectivity remains. The fleeting, highly ordered 4-dimensional patterns of germs of subjectivity (virtual photons), generated by assemblies of dendritic trees of a specialized neuronal network, should be thought as the final product of chaotic, dynamically governed self-organization. Such patterns encode for subjective (conscious) experience (Romijn).

The role of DNA is essential in explaining the continuity of consciousness in a permanent changing body with 50 billion cells dying and being renewed each day. DNA must be the place of resonance, and the function of DNA in receiving, "translating" and transmitting information from (virtual) photons must have been permanently changed after an NDE because of the possibility of receiving not only your personal (evolving) consciousness, but also the consciousness and emotions of others and sometimes even receiving future events into your day-consciousness.

The current concept in medical science, however, states that consciousness is the product of the brain. According to this concept all aspects of NDE and its transformation should not be possible. Could then the brain be a kind of receiver (interface) for consciousness and memories, like TV, radio, mobile telephone or laptop? What you receive is not in the receiver (music, voice,

internet), but electromagnetic informational waves (photons) transmitted from elsewhere are made visible or audible for your sense organs.

Our opinion on death changes fundamentally because of the almost unavoidable conclusion that on physical death consciousness can continue to exist in another dimension in which all past, present and future is enclosed. Could death, like birth, then be a mere passing from one state of consciousness to another?

Reference:

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Near-death experiences and the temporal lobe. Willoughby Britton <wbritton@email.arizona.edu> (Sleep Research Laboratory Department of Psychology University of Arizona), Richard R. Bootzin.

Introduction: A small number of individuals react to life threatening trauma with an atypical response called a near-death experience (NDE). The NDE is typically characterized by dissociation from the physical body, entering an unearthly realm, euphoria and the transcendence of space time and self. The reason why some individuals report NDEs while others do not remains unknown. In addition to quantum models, the most common theories about NDEs propose psychological defense mechanisms or stress/hypoxia induced neurophysiological alterations as explanations. The temporal lobe has been implicated in NDEs because direct stimulation the temporal lobe and TL epileptic seizures produce similar subjective experiences. NDErs and TL epileptics also tend to undergo similar personality changes in which they become more spiritually oriented and less materialistic.

Methods: In order to determine if NDErs show more signs of temporal lobe epilepsy, 23 near-death experiencers and non-traumatized age and gender-matched controls were screened for paroxysmal EEG discharges during an overnight EEG sleep study. Twenty-seven channels of digitized polysomnographic EEG were sleep stage scored and screened for epileptiform activity that was independently rated by a registered EEG technician at the UMC Epilepsy Unit. Subjects also completed the Dissociative Experiences Scale, the Civilian Mississippi Scale for PTSD, a temporal lobe symptom questionnaire, the COPE, the Anomalous Experiences Inventory, and a dream questionnaire.

Results: Near-death trauma survivors were found to have more temporal lobe paroxysmal activity and reported significantly more temporal lobe ($p<.005$) and partial complex epileptic symptoms ($p<.001$) than controls. All of the epileptiform activity in NDErs was lateralized to the left side (T3-T5) with one bilateral case. Paroxysmal activity in the left temporal lobe was associated with the near-death experience ($p<.05$), but not PTSD or history of head trauma. Near-death experiencers also showed differences in sleep patterns: they slept significantly less than controls ($p<.05$) and had longer REM latency ($p<.05$). REM latency was significantly associated with the near death experience ($p<.05$), even after sleep reduction was accounted for. The near-death group were marginally more dissociative ($p<.1$) but were no different than controls on measures of PTSD. Conclusion: Individuals who have had NDEs were found to be distinct from the general population on three physiological measures: left temporal lobe epileptiform activity, reduced sleep time and increased REM latency. These physiological differences were not associated with maladaptive trauma responses, but rather positive coping styles.

Plenary Session 8
Experimental Tests of Nonlocality in Brain Function

Does consciousness collapse the wave function? Dick Bierman <Bierman@psy.uva.nl> (Dept. of Psychology, University of Amsterdam).

In 1977 Hall et al reported an experiment that, according to their description, tested the most radical solution to the 'measurement problem', namely the proposition that: …. The reduction of the wave packet is a physical event which occurs only when there is an interaction between the physical measuring apparatus and the psyche of some observer….

They defended their experiment writing: … although we concur that there is a genuine problem of the reduction of the wave packet, we do not intend in our paper to defend this opinion against those who maintain that it is a pseudo problem….

The measurement problem is still not solved although there seems to be growing consensus that maybe there is no reduction of the wave packet at all. We too, do not wish to fight this or any other position with regard to the proper interpretation of the quantum formalism and the role of the measurement therein, but like Hall and his collaborators, we investigate the issue experimentally.

The Hall experiment is conceptually easy to understand. A quantum event, in this case a radioactive decay, is measured in a counter and the signal is displayed on a scaler. An observer A is observing the scaler. The scaler signal is transmitted through a delay unit and displayed again. This time it is observed by observer B.

Observer A will sometimes observe but sometimes not observe the scaler. Observer B has to 'guess' if a quantum event observed by him or her has already been observed by observer A.

The results of this experiment were precisely at chance. I.e. the second observer B guessed 50% correct. Hence it was concluded that observer B was unable to detect if the observed signal had already been observed earlier. It was concluded that this experiment did not provide support for the hypothesis that it is the interaction with consciousness which causes the wave packet to collapse.

It should be made explicit that there is an implicit assumption here that our brains in some way are able to detect the difference between a superposition state and a singular state. And secondly that this difference can be communicated consciously.

In a comment later added to the article the authors note that the used delay was extremely short and that …. The delay time should be in the order of psychologically discriminable intervals…

In the present conceptual replication the time between the first observation and the second one can be adjusted. Indeed Libet's seminal work on the processing time needed for conscious experience sets a lower interval of about 300-400 msecs because one should require the first observation to be a conscious one before the second observation starts.

The difference with the original experiment goes a bit further than just adjusting the interval. Rather than asking the second observer for a conscious guess we measure the brain responses to the stimulus (Evoked Potential). If consciousness is the crucial element for wave packet reduction the conscious decision will be

based on the physical state of the wave packet which is singular at the moment of conscious guess even if no pre-observation has taken place.

By measuring brain potentials of the second observer before consciousness can arise one taps into the non conscious interaction of the brain with the wave packet which supposedly is still in superposition during the first 300-400 msecs of brain processing by the second observer (in case the first observer was not observing).

Results of this experiment will be presented at the conference.

Correlations between electrical signatures of separated brain states: few facts, some ideas, and lots of doubts. Jiri Wackermann <jw@igpp.de> (Institute for Frontier Areas of Psychology Dept. Empirical and Analytical Psychophysics).

In a recent study [1], correlations between brain electrical activities (EEG) recorded from pairs of spatially and sensorily separated human subjects were explored. One member of the pair was visually stimulated while the other, non-stimulated member relaxed. EEGs recorded from non-stimulated subjects at stimulation times showed significant deviations of mean effective voltages from their distributions during the inter-stimulus periods. The results indicated a kind of correlation between two brains, for which no neurobiological basis is known. However, no responses similar to visual evoked potentials (so-called 'transferred potential', [2]) were found in the EEGs of non-stimulated subjects. The results did not support the assumption [2,3] of an 'empathic bond' established by pairwise meditation playing a crucial role in such correlations.

This and earlier studies [2,3] were implicitly based on an asymmetrical, 'signal propagation' model. Adopting tentatively the 'entanglement' paradigm, symmetrical experimental arrangements and/or symmetrical analysis strategies may be more appropriate. For example, experimental designs may involve elements of shared, goal-oriented intention, e.g. co-operative games, in which correlated actions are positively rewarded. Data-analytic strategies may benefit from global approach to analysis of brain electrical activity [4], embedding parallel streams of EEG data into a common state space and identifying periods of high synchronisation in the activity of such a 'super-brain'.

It is still questionable whether the results of [1], or any follow-up studies based on symmetrised experimental designs, have any bearing on the notion of quantum entanglement in macroscopic, e.g. biological systems, or on the `physics of consciousness' at all. Even if correlations between brain states not mediated by direct physical communication were an established experimental fact (which is not the case yet), the consequences for our understanding of consciousness would be unclear (if any). Also, there is no a priori argument that understanding of such `nonlocal' inter-organismic interactions would require quantum 'nonlocality' as the explanatory basis.

The epistemological situation of this type of research is entirely different from usual experimentation or observation: neither well-proven theorical basis nor self-evident phenomenal experience are available. It is thus incorrect to speak of 'experimental evidence'; a more appropriate expression would be 'experimental coercion' of phenomena intended to feed theorical speculation. Such epistemological traps are well-known in certain areas of science, e.g. parapsychology. To escape the trap, we should not ask 'what can laboratory research do to substantiate the new paradigm?' but, rather, 'is there any reliably observable phenomenon requiring necessarily a new paradigm?'

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EEG evidence of correlated event related signals between distant human brains. Leanna J. Standish <ljs@bastyr.edu> (Bastyr University Research Institute), L. Clark Johnson (University of Washington), Todd Richards (University of Washington), Leila Kozak (Bastyr University Research Institute).

Purpose: Since 1965 there have been scattered and controversial reports of correlated event-related brain potentials detected in humans who are separated and isolated from one another by distances of up to 14 meters. In order to replicate and further investigate these findings sophisticated EEG software and statistical signal detection methods were developed.

Methods: Simultaneous digitized EEG was recorded from the occiput of pairs of healthy human adult subjects (n =60; 30 pairs) who knew each other well and claimed to have a sense of emotional and psychological connection with their partner. Subjects were separated from each other by 10 meters in sound attenuated rooms. Prior to each experiment, one member of the pair was randomly designated as the "sender" and the other as the "receiver". Pattern reversal visual evoked potentials were triggered in the "sender's" brain by flickering black and white checkerboard stimuli. Senders were presented with an alternating schedule of stimulus on (flickering pattern)/stimulus off (static pattern) conditions. Receivers were presented with a static pattern (stimulus off) throughout the whole session A statistical signal detection algorithm was developed to determine whether brain activation during the 80-180 msec interval in the "receiver" was higher when the "sender "was visually stimulated compared to when the sender's monitor showed a static image of the same checkerboard stimulus. "Receiver" subject EEG data collected during the Static condition was used to construct a within-subject control statistic by which to compare EEG data collected from the "Receiver" during the Sender's flicker condition. A Runs test was applied to compare EEG "hits" in the "Receiver's" EEG during the 'Sender's' Flicker condition than during the "Sender's" Static condition. Those subjects with Runs Test results with p values < 0.01 were considered to provide evidence of a correlated brain signal associated with their sending partner's Flicker condition. Pairs in whom at least one subject had significant results were invited back to the lab for a replication experiment.

Results: Of the 60 subjects (30 pairs) tested, five subjects (four women and one man) showed significantly higher brain activation ($p < 0.01$) during their sending partner's Flicker condition compared to the Static condition. One subject in one pair replicated the effect in a second trial.

Discussion: These EEG results indicate that in some pairs of healthy human subjects a signal can be detected in the brain of a distant member of the pair when the brain of the other member is visually stimulated. These data represent a rigorous demonstra-

tion of correlated event related potentials between human brains at a distance. These anomalous findings warrant further replication.

Plenary Session 9
Cell Biology 2 - Is the Brain Really "Warm, Wet and Noisy"?

Cells, gels and ordered cytoplasm. Gerald H. Pollack <ghp@u.washington.edu> (University of Washington).

Conventional wisdom in biology emphasizes 1) the role of cell membrane ion pumps and channels in control of cell activity, and 2) an aqueous cell interior. However close scrutiny reveals that cells can maintain ion and voltage gradients and function normally in the absence of an intact membrane. Phase transitions and ordered water in cytoplasmic protein gels (e.g. assembled actin) in cell interiors can account for ionic fluxes and voltage gradients between cells and their environments. Cell interiors are highly ordered by protein gels whose extensive surfaces may intermittently order all cell water, and whose dynamics can account for cell function. Possible implications of ordered water and cytoplasmic gels for mesoscopic quantum states in living neurons will be considered.

The quantum coherent organism. Mae-Wan Ho <m.w.ho@i-sis.org.uk> (Institute of Science in Society, PO Box 32097, London NW1 0XR, UK www.i-sis.org.uk).

The quantum coherent organism is the prerequisite of mind and mental processes. I shall present theoretical, heuristic arguments and empirical evidence that organisms are indeed quantum coherent. This leads to new conceptions of organic space-time as opposed to Newtonian time. Key contents: Maxwell's demon, molecular energy machines, stored coherent energy, liquid crystalline organism, Onsager's reciprocity relationship, Morowitz theorem of cycles, principle of internal entropy compensation, thermodynamics of organisms, Frohlich's coherent excitation, quantum coherent organism, factorisability, time and entropy, organic, fractal space-time, time and freewill.

Lasers in the biosciences. Hans Schuessler <schuessler @physics.tamu.edu> (Texas A&M University), Andreas Mershin, Alex A. Kolomenski, Dimitri V. Nanopoulos.

Exploiting the coherence properties of laser light has revolutionized the way we approach and think about the interaction of light with biomolecules.

Laser methods have proved to be instrumental in studying, processing and manipulating biomaterials and bio-systems. Some examples include laser spectroscopy, laser scissors and tweezers, fluorescence imaging and biosensors based on the interaction of light with biomolecules. Recent advances in femtosecond lasers provide new tools for investigating microstructure and dynamic processes at the cellular and molecular levels, such as multiphoton confocal microscopy, time-resolved spectroscopy, and photochemical ablation. Tunable lasers have made possible high precision measurements of the spectroscopic structure even on single atoms and molecules, while pulsed lasers open a window to view the dynamics associated with transient states and molecular motors. With single frequency lasers we can cool ions to milli-degree temperatures, with femtosecond lasers we can possibly freeze the molecular rotation and vibration, getting insight into the most fundamental chemistry of life, such as the folding of protein molecules and the time evolution of photosynthesis.

In this talk, examples will be presented where single atoms, biomolecules, and intact subcellular units such as cardiac muscle sarcomeres (actin-myosin complexes) are studied with tailored laser radiation.

A connection to the study of tubulin and microtubules will be drawn and several new avenues of experimental research will be outlined.

Plenary Session 10
The Orchestrated Objective Reduction ("Orch OR") Model of Consciousness

Testing the physical basis of the Orch-OR model of consciousness. Roger Penrose (Mathematical Institute, University of Oxford, UK).

The Orch-OR model of consciousness, as put forward by Hameroff and Penrose, posits that conscious events arise as a feature of an objective reduction of the quantum state. The model has many attractive features, but it suffers from being dependent upon certain speculative ideas which have yet to be demonstrated. The two most important of these lie in the respective areas of biology and physics.

The main biological speculation lies in the possibility of maintaining large-scale quantum coherence in a living brain, for up to the order of a second, predominantly through the actions of microtubules. My main concern, in this talk, however, will be the key physical speculation, which is the very existence of an objective reduction of the quantum state (OR), at the appropriate scale. In a joint Oxford/Santa Barbara project, colleagues (Dik Bouwmeester, William Marshall, and Christoph Simon) are presently engaged in setting up an actual physical experiment involving a "Schrodinger's cat" (some 109 times more massive than the current record) consisting of a tiny miror---a 10 micron cube---to be put in a quantum superposition of two locations, displaced through a distance of about the diameter of a nucleus.

The gravitational OR scheme, on which Orch-OR depends, demands that spontaneous quantum state reduction will occur in the order of seconds. However, an improvement factor of some 104 over what is currently proposed will be needed in order to reach this level. There are various possibilities for achieving this.

Testing the biological basis of the Orch-OR model of consciousness. Stuart Hameroff <hameroff@u.arizona.edu>. (University of Arizona).

Microtubules (MTs) are cylindrical polymers of the protein tubulin, and are main components of the cell cytoskeleton. MTs provide not only "bone-like" structural support but, as shown in recent years, also convey signals and information within living cells, for example regulating synapses in brain neurons. Theoretical models through the 1980's suggested classical information processing in MTs with tubulin states functioning as interactive "bits". The Penrose-Hameroff model of orchestrated objective reduction (Orch OR) proposes that MTs act also as quantum computers, with superpositions of tubulin states acting as quantum bits, or "qubits". In Orch OR, entangled tubulin superpositions reach threshold for self-collapse via Penrose "objective reduction", a quantum gravity process in fundamental spacetime geometry at the Planck scale. The connection to spacetime geometry can account for consciousness based on a panprotopsychist philosophical stance.

Macroscopic/mesoscopic quantum states in the brain have been deemed unlikely due to thermal/environmental decoherence. However evolution may have solved the apparent problems. Specific predictions and experimental approaches to Orch OR include the following.

1) Quantum coherence in microtubules – Saint Hilaire and Bierman have suggested using quantum optical photon echo experiments for detection of quantum coherence. Such experiments at the level of tissue and cell culture and MT assemblies are in planning/preparation.

2) MT quantum decoherence times in the range of tens to hundreds of milliseconds have been predicted (Hagan et al) based on ordered water, actin gelation and a Debye ionic plasma layer due to charged C-termini surrounding microtubules. Work by GH Pollack predicts ordered water/actin gelation in neuronal cytoplasm, and simulations by Tuszynski and Sackett predict a C-termini plasma layer surrounding MTs. Experiments can verify these predicted conditions.

3) Orch OR suggests unified quantum coherent states among MTs in neurons throughout cortical regions interconnected by gap junctions (e.g. Woolf and Hameroff). Experiments have shown that coherent 40 Hz oscillations are mediated by gap junctions, and future experiments can determine whether neural correlates of consciousness (NCC) involve gap junction-connected neurons.

4) Decoherence may be avoided by topological quantum error correction using the specific MT lattice geometry based on the Fibonacci series. Experiments in nonliving systems and simulations can determine if MT topology is optimal for quantum error correction.

5) Experiments on MT preps or in cells can determine if MTs exhibit superconductivity as has been suggested for DNA.

6) Optical transmission studies can determine if NCC brain regions exhibit super-radiance (lossless optical transmission, as proposed by Jibu and Yasue). In awake monkeys Macknik and Haglund have shown that NCC brain tissue is more transparent to near infra-red photons than is non NCC brain tissue (irrespective of blood absorption).

7) Nanoprobes able to detect conformational, electronic, spin, dipole, ionic or other states of individual tubulins in MTs can test for EPR entanglement among tubulins in the same MT, different MTs in the same cell or prep, and different MTs in different gap junction-connected neurons.

8) Drugs which bind to MTs (e.g. general anesthetic gases. psychoactives) without affecting MT assembly and/or membrane/synaptic function will be shown to affect conscious processes.

Orch OR may be falsified by demonstration of consciousness (admittedly a difficult problem in itself) in the absence of functional MTs.

Plenary Session 11
Space-time and Consciousness 1

Nonlocal simultaneity from quantum mechanics or the other way around? Koichiro Matsuno <kmatsuno@vos.nagaokaut.ac.jp> (Nagaoka University of Technology).

Our mind as a language processor takes nonlocal simultaneity for granted. Every linguistic participant in a third person description in present tense shares the same present tense. Empirical upholding of nonlocal simultaneity of the linguistic origin should be sought in the material makeup of our mind because the language processor is installed in our physical body. At this point enters the significance of the energy quantum after Max Planck as a nonlocal physical unit of space-time configurations.

A thread connecting Planck•fs energy quanta to the biological language processor effecting a form of nonlocal simultaneity can be accessed in first and second person descriptions in the progressive tense, whereas in third person descriptions in the present tense the thread would inevitably end up with thermal decoherence resulting in failures in establishing the intended nonlocal coherence due to its queer descriptive stipulation. Nonetheless, the linguistic access to nonlocal simultaneity in first and second person descriptions is clumsy because of its internalist stipulation conditioned on the finiteness of descriptive horizon within which only those objects assuming the first and second person status can directly be focused, with no prior coordination with the outside of the current horizon. First and second person descriptions are constan24

tly tolerating those inconveniences originating in and coming from over the current horizon of description.

An empirical short-circuiting of the linguistic clumsiness associated with first and second person descriptions is to make an appeal to internal measurement as an elementary physical process of pointing to and being pointed out by others in the empirical domain. Internal measurement admitting the inevitable locality of directly measurable objects in a concurrent manner is constantly disturbed by the indirect influences coming from over the current finite horizon of measurement. What is unique to every material body processing internal measurement is its cohesiveness in tailoring those physical inconveniences coming from over the current horizon to its own suit.

An experimental example of demonstrating the nonlocal cohesiveness imputed to internal measurement is seen in magnetization of an actin filament contacting myosin molecules in the presence of ATP molecules to be hydrolyzed, that is, a prototype of muscle contraction that is ubiquitous in biology. We observed that the magnetization exhibited a nonlocal coherence over the entire actin filament at a mesoscopic scale in a simultaneous manner, even at the normal ambient temperature. The present magnetization remained robust to thermal agitations available from the surroundings.

Internal measurement processing those physical inconveniences ascribed to its locality can precipitate a form of nonlocal simultaneity and coherence in the perfect tense. That is a phenomenological reduction (e.g., the Penrose-Hameroff orchestrated reduction), which is hard to access in third person descriptions in the present tense alone. Precipitation of nonlocal simultaneity in the perfect tense on physical ground can be viewed as a necessary material precondition for how the language processor takes nonlocal simultaneity for granted linguistically.

In short, although classical mind has difficulty in overcoming thermal decoherence, quantum mind facing quantum phenomena can live with nonlocal coherence even at the elevated ambient temperature.

Space-time representation and information processing in the brain. Sisir Roy <sroy@scs.gmu.edu> (George Mason University), Menas Kafatos <mkafatos@gmu.edu> (George Mason University).

The possibility of constructing space-time representation in the brain has challenged numerous scinetists for several decades

in the 20th century. The recent interest in the role of quantum processes in brain function gives rise to new impetus to re-evaluate the above situation in the light of developments of our understanding of Planck scale physics, as well as networks of fuzzy lumps and generalized time in sheaf cohomology. Pellionisz and Llinas critically analyzed the possibility of constructing space-time representation for neuronal circuitry in the central nervous system(CNS) and arrived at negative conclusion. On the otherhand Pribram proposed a holographic model of brain and investigated the Hilbert structure of the receptive fields using the Gabor function. However, his work is built mainly on Fourier Harmonic analysis rather than Euclidean geometric appraoch.

The applicability of quantum processes to brain function raises fundamental question whether we can assign any kind of geomterical notion like the distance function or metric to the different cortical areas of the brain and hence Hilbert space structure. The developments of Planck scale physics and Menger's idea of hazzy lumps led the present authors to reformulate the age old problem of assigning geometric representation. This leads us to assign a kind of space-time geometry using the idea of probability over the cortical areas of the brain. This kind of space-time geometry is shwon to be useful for the description of Planck scale physics. Here, the notion of generalized time has been used to understand the space-time at Planck scale and the physical time around or above Planck scale can be derived by putting conditions on generalized time. This kind of generalized time seems to be very useful in understanding brain processes and cognitive activities. It should be noted that this kind of generalized time is well formulated in sheaf cohomology and brain modelling. Within the framework of sheaf cohomology, a type of communication or processing of information (with respect to generalized time) is possible which resembles the concept of non-local transmission in quantum mechanics.

In this paper we shall discuss the possibility of assigning statistical geometric structure to the cortical areas of the brain as well as the role of generlized time in brain function. This might shed new light on the existence of quantum-like processes in the brain. Ofcourse, this may be possible at more fundamental level than the usual neuronal level. It gives rise to new possibility to formulate the information processing in the brain and its relation to quantum-like processes in brain function.

Consciousness and the universe: Generalized principles of unification. Menas Kafatos <mkafatos@gmu.edu> ((1) School of Computational Sciences, and Center for Earth Observing and Space Research, George Mason University (2) Physics Department, George Mason University, Fairfax, VA), Sisir Roy <sroy@scs.gmu.edu> (School of Computational Sciences, and Center for Earth Observing and Space Research, George Mason University (3) Physics and Applied Mathematics Unit, Indian Statistical Institute, Calcutta, India).

Developments from quantum theory have made it plausible that certain principles cut across different fields of natural sciences and can be considered to hold universal validity. It is likely that quantum-like effects may be pervasive at all scales in the universe. What is meant here by quantum-like is phenomena that are more akin to the quantum description of nature, even though they may not occurring strictly in the microscopic realm or described by quantum physics. For example, complementarity, and non-locality are two principles that apply beyond quantum microphysical scales and as such may be considered to be universal foundational principles applying at all scales from the quantum to the cosmological realms. If true, these and other principles should be applicable to other fields such as brain dynamics and open new ways of study. In the same way, one can search for general universal principles that hold in realms even beyond the physical, namely mental, psychological, or informational. If consciousness is the foundational substratum of the universe, principles developed in perennial philosophical systems should be even more universally applicable and cut across all levels of the cosmos, "internal" (e.g. individual mental and psychic, etc.) as well as "external" (e.g. collective unconscious, physical, etc). We sketch here a possible new prescription for a unified "science" that will encompass ordinary natural science and extend it to realms where it has not been extended up to now. The prescription is simply, start from the larger whole and then study the particulars, a reversal of the way that ordinary science proceeds.

Plenary Session 12
The Cell Cytoskeleton

From tubulin to neurons: An overview of the physical properties of tubulin and their potential for affecting the functioning of neurons. Jack Tuszynski <jtus@phys.ualberta.ca> (Department of Physics, University of Alberta, Edmonton, AB, Canada).

Atomic resolution structure of tubulin revealed through the x-ray crystallography experiments of Downing and his collaborators has been the subject of our investigations for the past five years. In this talk, I will review our knowledge about the physical properties of tubulin including such properties as the net charge, the charge distribution, the dipole moment, the electrostatic potential and the conformational states. I will also present some recent result regarding the behavior of the tubulin's C-termini which, we believe, play a crucial role in the interactions of tubulin with its environment. There is a quantifiable effect of the states of the C- termini on the ionic environment as well as on nearby proteins such as kinesin and MAPs. I will present a physical model based on the hypothesis that the state of microtubules may affect the functioning of the neurons via electrostatic forces that may extend to the ion channels via ion gradient propagation along MAP's and possibly actin. This molecular model may have far-reaching repercussions for the biophysics of the brain.

Acknowledgements: This work has been supported by MITACS, NSERC (Canada) and the YeTaDel Foundation.

Fluorescent labeling of cytoskeletal proteins in PC12 cells grown in culture. Nancy Woolf <nwoolf@ucla.edu> (Department of Psychology UCLA).

Psychologists have pondered the material basis of mind since the inception of the field. Recently, Penrose and Hameroff have implicated brain microtubules in higher cognitive functions, a hypothesis that stands to revolutionize the fields of psychology and neuroscience. In order to more fully test this model, one needs a cell system that is easy to manipulate. Cells grown in culture represent one such system. Neurotransmitters, for example, can be directly added to the cell culture medium and the effects that these signaling molecules have on internal cytoskeletal proteins can be directly viewed by epi-fluorescence microscopy or by confocal fluorescence microscopy.

I will present microscopic analyses of microtubules, mi-

crofilaments, and microtubule-associated protein-2 (MAP-2) found in PC12 cells grown in culture in the presence of nerve growth factor (NGF). The neurotrophin, NGF, causes PC12 cells to extend expansive dendrite trees. These dendrites are enriched with microtubules, microfilaments, and MAP-2. The cytoskeletal linker, MAP-2, is of particular interest to psychologists and neuroscientists because it is degraded or proteolyzed with Pavlovian conditioning (Woolf et al., Brain Research, 821: 241-249, 1999). The breakdown of MAP-2 is likely to precede new MAP-2 linkages, many of which may be related to the newly formed memories.

The fluorescent method is highly applicable to the problem since multiple labeling is possible. In the studies I will present, microtubules are labeled with mouse monoclonal antibodies directed against tubulin, the major constituent of microtubules. These microtubules are visualized as red with Texas Red-conjugated secondary antibodies (anti-mouse IgG). The MAP-2 will be labeled as green with rabbit polyclonal antibodies to MAP-2 and fluorescein-conjugated secondary antibodies (anti-rabbit IgG). Actin is labeled as orange with rhodamine-phalloidin, the latter of which naturally binds to the native structure of F-actin. As a reference, the nucleus of the cell is labeled as blue with DAPI, which binds to DNA. Different combinations of the above are used to study the interactions between microtubules, microfilaments and MAP-2 in PC12 cells differentiated in the presence of NGF.

Future studies will assess the response of these cytoskeletal systems to neurotransmitters. Application of carbachol, an acetylcholine agonist, is known to cause alterations in the cytoskeletal systems outlined here. We plan to extend these findings in the literature and to further trace the cascade of effects through the evaluation of the receptors (muscarinic and nicotinic), protein kinases (protein kinase C, cAMP-dependent kinase, Ca2+/calmodulin-dependent kinase II) and phosphatases (e.g., calcineurin) involved. Other neurotransmitter systems will be assessed as well.

These kinds of studies should shed some light on how the cytoskeleton may participate in information processing in the living cell, with possible applications to neurons. Although PC12 cells are not neurons, in the presence of NGF, they acquire key similarities to neurons such elaborate dendritic trees, MAP-2 expression, and sensitivity to acetylcholine.

Cellular photon emission and cytoskeletal activity. Roeland Van Wijk <meluna.wijk@wxs.nl> (Utrecht University, Utrecht, The Netherlands).

There is a need for techniques that quantitate collective phenomena and internal dynamic organization of living organisms. In studies on collective phenomena in cell populations the attention has been focussed on the characteristics of spontaneous and light-induced photon emission (delayed luminescence) of organisms and cells. Two types of studies that suggest inter- and intracellular collective behavior in cell populations are discussed. The first type deals with the anomalic inter-cellular behavior of the concentration-dependency of delayed luminescence in normal and tumor mammalian cells populations. The second deals with the delayed luminescence of single cells of Acetabularia acetabulum. In these studies anaesthetics like chloroform, isoflurane and sevoflurane have been used to suppress intra-cellular motility. Long-term delayed photon storage can be related to intracellular motility.

Spontaneous photon emission has been studied less often, most likely because its intensity is extremely low. Recently, in studies on spontaneous emission the Fourier spectrum analysis has been introduced for analysing photon count data. The most important conclusion for mammalian fibroblastic cells was that they have no detectable photon emission above the photon emission of culture medium. However, they are able to modulate the frequency spectra of photon emission of culture medium. The use of specific cytoskeletal inhibitors shows that modulation is dependent on the intactness of the cytoskeleton. Fourier spectrum analysis of spontaneous photon emission of A. acetabulum cells has presented evidence for cell-specific high frequency oscillations (with periods in the second and minute range). The main oscillations are related to the endogenous activity of the cytoskeleton. The latter characteristics were studied for their response upon, weak magnetic fields and healing intention.

It is concluded that the technique of photon counting, when highly sensitive, is appropriate for dealing with the dynamics of internal organization, in particular with the functioning of processes regulated by the cytoskeleton.

Plenary Session 13
Space-time and consciousness 2

Qualia and quantum space-time. Paola Zizzi <zizzi @pd.astro.it> (Department of Astronomy, Padova University, Italy).

Which is the relation between the "occasions of experience" of Whitehead and the subjective aspects of conscious experience known as "qualia", a term coined by Lewis (Lewis, 1929)?

In fact, what is the wider, basic field of protoconsciousness Whitehead talked about?

We understand the occasion of experience as collapses, (OR events) occurring in quantum spacetime, the seed of qualia. This idea is based on the correlation of superposition with separation in underlying spacetime, and the OR collapses being a re-annelling, a reforming of the separation. Qualia are nonlocal patterns in Planck scale spacetime. Once the collapse occours, a set of qualia is selected, leading to a conscious experience. In mathematical terms, qualia can be interpreted as states of quantum information (for example a quale could be the 1-qubit state which is the superposition of the two bit states 0 and 1). A set of N qualia could be a N-qubit state. After the collapse, one is left with classical bits. In this scenario, a conscious experience is a flow of classical information, proto-consciousness (qualia) is given in terms of quantum information, and the occasions of experience are the collapses of the quantum information states.

It is very important to notice that in this picture, consciousness, as we know it, is classical information, although its origin (proto-consciousness) is quantum.

The fact that a conscious experience is a flow of classical information should not be too surprising. In fact, we are Boolean-minded, thus we would not be able to support a different kind of consciousness based on quantum information, as it would follow the rules of non-Boolean logic (quantum logic).

However, this approach is different from computationism. In our view, consciousness is not the result of classical computation in the brain. A conscious experience is a flow of classical information, but it relies on previous quantum computation at the stage of proto-consciousness. A classical computer would never be con-

scious but a (very big) decohered quantum computer might be.

Consciousness and our concept of reality. Paavo Pylkkanen <paavo@ihu.his.se> (University of Skovde)

Can conscious experience be understood as a natural phenomenon, and can there be a "science of consciousness" which can be coherently related to the other sciences? A great number of researchers in different fields (e.g. philosophy, psychology, neuroscience, cognitive science) have tackled this issue in recent years. Some have boldly tried to "explain consciousness" naturalistically while others have more cautiously suggested that such an explanation is beyond the reach of human cognitive capacities. But regardless of useful conceptual analysis and phenomenological description, and relevant empirical evidence about "neural correlates of consciousness", some central aspects of conscious experience remain mysterious and unnaturalized. One response to this frustrating situation has been to say that explaining consciousness naturalistically requires a fundamental change in our general concept of reality, and not just some new specific (e.g. neurophysiological or computational) model within the old mechanistic "paradigm".

It is well known that quantum and relativity physics also require a new concept of reality. Is it possible to develop a new overall world-view that can assimilate both conscious experience and quantum/relativistic phenomena, while containing the familiar, classical, mechanistic world as a special case? This was the long-term aim of the physicist David Bohm. This paper gives a brief overview of his research programme and uses some of the theoretical ideas to obtain a new way of looking at certain central problems in contemporary consciousness studies. The following aspects of his work will be distinguished:

1) Hidden variable / causal / ontological interpretation of quantum theory (1952), culminating in the book Undivided Universe (1993 with Basil Hiley). This interpretation is important because

a. It proved false wide-spread misunderstandings about quantum theory, such as that it is impossible to provide a hypothesis about how electrons (understood as little particles) move along trajectories and yet manage to collectively produce interference patterns (e.g. in the famous two-slit experiment).

b. More importantly for our understanding of living and mental phenomena, the ontological interpretation contains an entirely new type of energy (mathematically described by the quantum potential). The way this energy affects the particle can be understood via a new notion of active information. Bohm suggested that this kind of energy might be relevant to understanding features of living and especially mental phenomena, and explored the issue further with e.g. Hiley and Pylkkanen.

2) In the early sixties Bohm began to develop – often in discussions with Hiley - a more general conceptual framework which takes as constraints both the results of relativity and quantum theory. In particular he argued that both relativity and quantum theory challenge the "mechanistic order", but their basic concepts directly contradict each other. We need in physics a new theory that starts from what relativity and quantum theory have in common, namely undivided wholeness. The challenge then became to develop "new notions of order" that are appropriate to describe such undivided wholeness. The most important new concept was that of implicate order, which he illustrated with e.g. the hologram. The implicate order arises from considering the meaning of quantum theory and relativity, but he claimed that it applies even more obviously in other domains such as the biological domain, and especially in cognitive processes and conscious experience. This framework provides an entirely new "paradigm" in which to try to understand the nature of conscious experience, mental processes and their relation to the underlying neurophysiological and physical processes. He presented this framework in the book Wholeness and the Implicate Order (1980).

I will use some of the above theoretical ideas (which also differ from each other in some important ways) to look at the following problems:

1. The problem of mental causation, or the problem of how could mental states (as non-physical states) possibly influence the course of physical processes without, for example, violating the energy conservation laws. Bohm and Hiley's ontological interpretation of quantum theory suggests that an entirely new kind of energy operates in situations where quantum theory is required, an energy best understood as "active information". If mental states and their informational content can be understood as some higher-order organisation of this new "quantum potential energy" then an entirely new way of understanding mental causation, or how "mind" could affect "matter" (and vice versa) opens up.

2. The general mind-body problem. When discussing the implicate order, Bohm (1980) offers us a version of the idea that mind and body are aspects, related projections from a common ground beyond them both. He uses the well-known non-locality of quantum theory as an analogy to illustrate the "non-causal" nature of the relation of mind and body. Is there a way to reconcile this talk of "non-causal" relationship of mind and body with the apparently more causal relationship that is suggested by the active information picture? Can this view be the basis for a new, explanatorily powerful mind-body ontology?

3. The problem of time consciousness. The essence of the problem is to understand our experience of temporal objects as temporal. When I am listening to music, for example, how am I to understand the status of the sounds that I first heard a very short time ago? Bohm's idea is that when e.g. listening to music we are directly perceiving an implicate order. Is it possible to develop a satisfactory theory of time consciousness with the help of the concept of implicate order?

Concurrents

Concurrent Session 1
Quantum biology

Spin-mediated consciousness theory: Possible roles of oxygen unpaired electronic spins and neural membrane nuclear spin ensemble in memory and consciousness. Huping Hu <drhu@quantumbrain.org> (Biophysics Consulting Group), Maoxin Wu/Dept. of Pathology, Mount Sinai Medical Center, New York, NY.

A novel theory of consciousness is proposed. We postulate that consciousness is connected to quantum mechanical spin since said spin is embedded in the microscopic structure of spacetime and may be more fundamental than spacetime itself. Thus, we theorize that consciousness is connected with the fabric of spacetime through spin. That is, spin is the "pixel" and "antenna" of mind. The unity of mind is achieved by non-local means within the pre-spacetime domain interfaced with spacetime. Human mind is possible because of the particular structures and dynamics of

our brain postulated working as follows: The unpaired electronic spins of highly lipid-soluble and rapidly diffusing oxygen molecules extract information from the dynamical neural membranes and communicate said information through strong spin-spin couplings to the nuclear spin ensemble in the membranes for consciousness-related quantum statistical processing which survives decoherence. In turn, the dynamics of the nuclear spin ensemble has effects through spin chemistry on the classical neural activities such as action potentials and receptor functions thus connecting with the classical neural networks of the brain. Our proposal calls for associative encoding of neural memories in the dynamical structures of neural membranes. Thus, according to the present theory: (1)the dynamical nuclear spin ensemble is the "pixels" of mind; (2) the neural membranes are the pixel-embedding and associative memory storage matrices; and (3) the unpaired electrons of the rapidly diffusing oxygen molecules are the spin beam for information retrieval, communication and pixel-activation. Together, they form the interface (neural substrates) to consciousness. (Please visit http://www.arxiv.org/abs/quant-ph/0208068 to retrieve the archived paper. More information is also availiable at http://www.quantumbrain.org)

Looking for quantum processes in networks of human neurons on printed circuit board. Rita Pizzi <pizzi@dti.unimi.it>, A.G. Fantasia (Dept of Information Technologies - University of Milan), F. Gelain; D. Rossetti, F. Gregori, A Fiorentino, and A. Vescovi (Stem Cells Laboratory - DIBIT International Science Park Milano, Italy).

At the Stem Cells Laboratory of DIBIT-S. Raffaele, Milan, human neural cells have been grown on suitable printed circuit boards developed at the Dept of Information Technologies of the University of Milan. The lay-outs are designed with 100x100 micron gold pads connected by thin nickel/gold wires. Pads are connected to build known models of neural networks. The neurons are put and grown on the gold pads. In particular, simple and more complex connections have been implemented, as a Kohonen network and a holographic hopfield-like network. The input and output connections are directed to a multifunction I/O device connected to a personal computer. A specific hw/sw system schedules a series of input patterns and records the output sequences coming from the neurons. At the moment we are analyzing with classical techniques and chaotic analysis the results of our first measures. In addition to results useful to the improvement of knowledge in neurophysiology and in the research on brain/chip interfaces, we hope to obtain some hints of the quantum processes in brain. In particular, we are interested in testing possible effects of quantum non-locality by comparing the behavior of simple gates, also tested with a quantum emulator on PC. Besides, we are testing the measures on a holographic Hopfield-like network of real neurons, comparing it with its classical Hopfield model, AND with the corresponding quantum model simulated on PC.

The "biofield hypothesis". Beverly Rubik <beverly.rubik@tui.edu> (Institute for Frontier Science and Union Institute and University).

A systems view of life based on biophysics and quantum concepts, complementary to the molecular reductionistic view of life based on chemistry, is offered. At the holistic level, living systems are complex, nonlinear, dynamical, self-organizing systems according to principles of non-equilibrium thermodynamics of open systems. They constantly exchange energy-with-information at multiple levels of organization with their surroundings in order to maintain themselves. They also possess higher-order relationships dependent upon context and meaning that reflect a connection with universal consciousness. When perturbed by stress or disease, living systems do not return to their original state, but attain a new dynamical state that integrates the new information from the experience. This process is called homeodynamics.

We propose that bioregulation of homeodynamics is achieved by the biofield of the organism. The biofield is proposed as the complex organizing field of the organism that is comprised of well-known energy fields (electromagnetic and acoustical) and more subtle fields of information involving nonlocal or universal consciousness not yet elaborated by conventional science. The electromagnetic component of the biofield is hypothesized to be a complex dynamic standing wave produced by the superposition of all component waves of the electrically-charged oscillators of the organism, ranging from the atomic, molecular and cellular levels to that of whole organs and organ systems including the heart and the brain. The biofield is hypothesized to regulate the homeodynamics of the organism via bio-information contained in the field. This goes beyond the usual molecular concepts of bio-information, to include electromagnetic and acoustical bio-information as well as information conveyed by more subtle quantum fields (nonlocal consciousness).

The biofield as proposed here is a useful construct consistent with the physical theory, but it goes beyond conventional science in offering a holistic model of mind-body-spirit. Consider that the heart is the most powerful oscillator in the human body whose pulse is felt in every cell both acoustically and electromagnetically. According to Chinese medicine, the heart is also the seat of the shen (soul), or universal consciousness. These two categories of fields---physical and ultraphysical, or ego self and the higher self—also represent the most powerful forces that govern the life of a human being.

The biofield also offers a unifying hypothesis to explain many phenomena that presently challenge the dominant biomedical view of life based on molecular reductionism. For example, it provides the rudiments of a scientific foundation for certain types of complementary and alternative medical interventions that involve the transfer of bio-information carried by extremely small energy signals, such as acupuncture, biofield therapies, bioelectromagnetic therapies, and homeopathy. It is hypothesized that these interventions may work by interacting directly with the biofield and thus impacting directly the global regulatory processes of life, rather than impacting the physical structures of the body. Moreover, the rapid signal propagation of electromagnetic and other fields comprising the biofield as well as its holistic properties may account for the rapid, holistic effects of certain alternative and complementary medical interventions.

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Information processing in brain microtubules. Jean Faber Abreu[1] <faber@lncc.br>, Luiz Pinguelli Rosa[2] <lpr@adc.coppe.ufrj.br>, R. Portugal 1 (1). LNCC - National Laboratory of Scientific Computing, Quantum Computing Group, Petropolis RJ, Brazil, (2). Alberto Luiz coimbra Institute for Graduate Studies and Research in Engineering, CT, COPPE, University of Rio de Janeiro, RJ, Brazil,

In the last years, many papers have addressed the prob-

lem of developing a theory of mind [Penrose, 1989, 1993; Stapp, 1993, 1998; Eccles, 1994; Vitiello, 1995; Zohar, 1996; Wolf, 1996; Conrad, 1996; Jibu et al, 1993; Jibu, Hagan and Yasue, 1996; Jibu, Pribram and Yasue, 1996; Tollaksen, 1996; Insinna, 1996; Nunn, 1996; Hameroff and Penrose, 1996, 1998; Alfinito and Vitiello, 1999; Pessa and Vitiello, 1999; Alfinito, Manka and Vitiello, 2000;Hagan, Hameroff and Tuszynski, 2000]. R. Penrose and S. Hameroff developed a quantum model of the mind considering the cytoskeleton of neurons cells as the principal component that produces states of mind or consciousness. Their model uses the microtubule (MT) structure, the principal part of cytoskeleton, to produce a quantum computation through tubulins, as dimmers which would work as cellular automata in the walls of MTs, and a propagation of information by wave guides inside MTs of neurons.

The microtubule wall could work as cellular automata, able to store information and to make computation, by using combinations of the two possible states (? and ? states) of the tubulins that constitute these walls. The microtubule interior works as an electromagnetic wave guide, filled of water in an organized collective state, able to transmit information along the brain. A gelatinous state of water in brain cells, which was observed by [Watterson, 1996], could boost these communication effects.

Using a different approach, Tuszynski et al. are modeling the biophysical aspects of MTs, considering the following questions: What kind of computing does microtubule perform? Can microtubule store and process information? How does microtubule process the information? To analyze these questions they start from the classical level, studying the physical properties of MTs as electric dipoles interacting with each other and its medium and move to the quantum level.

According to [Tuszynski 1997, 1998, 2000] each tubulin has an electric dipole moment p due to an asymmetric charge distribution. The microtubule is thus a lattice of oriented dipoles that can be in a random phase, ferroelectric (parallel-aligned) and an intermediate weakly ferroelectric phase, like a Spin-Glass phase. It would be natural to consider the electric field of each tubulin as the information transporter medium.

Therefore, the dimers tubulin would be considered as the information unit in the brain and the MTs sub-processors of the neuron cells. How MT's process information and allow communication inside the brain is the fundamental question of the theory of mind-brain.

In this work we derive some results which was not explicitly obtained in [Tuszynski et al] and extend the ideas introduced by [Jiri Pokorny, Tsu-Ming Wu, 1998] using the point of view of the information theory. We analyze the problem of information transfer and storage in brain microtubules, considering them as a communication channel where the electric field is the mediator of each communicator entity. We discuss the implications in assuming that the consciousness is generated by the microtubules as a sub-neuronal processors.

Penrose-Hameroff quantum tubulin electrons, Chiao gravity antennas, and Mead resonance. Frank Smith <tsmith @innerx.net> (Cartersville).

Penrose and Hameroff have proposed that consciousness in the human brain may be based on gravitational interactions and quantum superposition states of electrons in tubulin cages in microtubules. Chiao has proposed experimental construction of a gravity antenna that might be analogous to tubulin caged electrons. Tegmark has criticized Penrose-Hameroff quantum consciousness, based on thermal decoherence of any such quantum superposition states. This paper briefly describes some experimental results and theoretical ideas that indicate to me that Tegmark's criticism may be invalid. Such theoretical ideas include Mead's quantum physics of resonance. This paper closes with brief summaries of relevant experiments of Grinberg-Zylberbaum, the quantum cosmology of Paula Zizzi, and 26-dimensional closed unoriented bosonic string theory interpreted as a many-worlds quantum theory in which strings correspond to world lines, with massless spin-2 gravitons in 26-dimensions corresponding to gravitational interaction among tubulin electrons in states with Penrose-Hameroff superposition separation.

Simplicity theory: Is the brain a catalyst and can enzyme catalysis shed light on consciousness? Christopher Davia <davia@andrew.cmu.edu> (Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, Pennsylvania 15213).

I propose that living processes, from the smallest to the largest (including the brain), are processes of catalysis. Biological processes persist, be they chemical, neural, perceptual or behavioral, as a direct consequence of the way that they mediate transitions in their local environments. I suggest that the process of catalysis provides energy at points or regions of symmetry or invariance. A consequence of the process of catalysis then, is to bridge the discontinuity between energy and structure by utilizing the 'order' in the relationship between the reagent(s) and products(s) such that energy and structure work together.

Catalysts are generally understood to accelerate rates of reactions by providing 'paths' to the transition state. The transition state can be thought of as state that is half way between the reagents and the products of a reaction. Recently it has been proposed that energy in the form of a vibrational mode of the enzyme, called a soliton wave, may be the principle agent of enzyme catalysis. The action of the soliton may be to provide sufficient energy via conformation changes in the enzyme/substrate complex to cause the wave functions of the substrate and products to overlap and thereby increase the likelihood of quantum tunneling at the 'transition state'. The important point is that the transition state occurs at the intersection between potential energy/ nuclear configuration surfaces of the substrate and product(s). Catalysis establishes transitions by providing a path through this point of symmetry or invariance. Furthermore, I suggest that this analysis of the critical features of catalysis applies to biological processes at higher levels or scale; the hypothesis is that life is 'scale invariant' process of catalysis.

Supporting evidence for this hypothesis can be found in many areas of research that implicate solitons in biological processes at multiple levels of scale. From protein folding (Ben-Jacob, E., Caspi, S., 2002), enzyme function (Satarik, M.V., Ivic, Z., Tuszynski, J. A., & Zakula, R., 1991) and muscle function (Davydov, 1980), to macroscopic processes including the action potential of neurons. Also, the plausibility of 'scale invariance' in general is supported by the existence of numerous biological relations (fractal scaling laws) that hold across biological levels from the microscopic to macroscopic (Brown & West, 2000).

I propose that all brain states, and hence conscious states, can be correlated with a continuous process of catalysis. Conse-

quently, consciousness is to be correlated with a continuous 'transition state' of macroscopic catalysis. The transition state associated with any single instance of enzyme catalysis may hold the key to understanding cognition and brain 'functions' generally.

Furthermore, given the central mechanism of catalysis, the soliton wave, there is a strong relationship between the scale invariant catalytic model and previous theories that implicate 'resonance' as a possible mechanism of brain function (Shepard, 1984; Roy, 2000).

Departing from popular lines of research that look towards 'emergent' processes to provide the key to complex mental states, I argue that complex dynamic processes in living systems give rise to macroscopic 'emergent' processes of the same type - catalysis. Thus, the interaction among enzyme mediated reactions at the sub-cellular level may give rise to macroscopic catalytic processes at the level of the cell. At the level of the enzyme we observe instances of highly specific catalysis; whereas, at the level of the cell, we observe a continuous and broader ranging catalytic process. Following on from this, it may be argued that the process of evolution is from catalytic specificity to catalytic non-specificity.

I shall offer a view of the living process as a unique synthesis between matter, energy and 'order' that is mediated by the action of soliton waves. So, for example, the structural and 'functional' development of the brain may be seen as consequent upon the persistence (or not) of soliton waves arising as a result of interacting neurons where the persistence (or not) of a soliton is dependent upon the 'order' or invariances in the environmental stimulus.

By concentrating upon living structures and processes in terms of their persistence or robustness I have been addressing the problem of life and consciousness from an ontological perspective. I will argue that the ontology of living processes shares fundamental similarities with quantum phenomena. In this respect, it may be more useful to ask 'How does a brain process persist within its particular context or within a particular set of boundary conditions?' than 'What 'function' does a brain process perform?' This is to say that the apparent functionality of a living process is, in fact, identical with how it persists. Thus, function = metabolism.

I believe that this approach constitutes a radical simplification of our understanding of life and may offer an insight into the interaction and persistence of the many complex systems that comprise an organism. If the common language of life is the language of catalysis in a fractal or scale invariant organization, then we can begin to understand that the persistence of any biological process is consequent upon its being a mediator of transitions, utilizing the same mechanism that the enzyme does -- the soliton.

Concurrent Session 2
Time

Temporal anomalies involving causality and free will. Stanley Klein <klein@spectacle.berkeley.edu> (University of California, Berkeley).

Temporal anomalies in human performance have led several physicists (Penrose being the most well known) to question whether classical physics can provide a satisfactory account of brain function. In my talk I will examine three categories of temporal anomalies that seem to violate classical physics: (a) superfast reaction times. (b) Libet's finding of backward referral, (c) Libet's findings regarding free will and brain waves.

The first category involves an analysis of the timing requirements for hitting a fast ball in cricket or baseball. I will present previously unpublished data on the reaction time for tracking a randomly moving dot. We found the relevant reaction time to be about 80 msec, rather than the commonly believed value of 200 msec. I will ask whether the sped up reaction time is compatible with what is known about human physiology based on classical physics. The consequences for classical vs. quantum explanations of hitting balls will be discussed.

My discussion of the second and third categories centers around new insights into Benjamin Libet's experiments. At the 1999 Flagstaff Quantum-Mind meeting Libet presented his data on backward referral and on volition. These data have been widely discussed in a number of books and meetings. Several new and surprising insights into this topic were recently presented in a special issue of Consciousness and Cognition (C&C, June 2002), (http://www.idealibrary.com/servlet/toc/ccog/latest) devoted to Libet's data and conclusions. That special issue contained six target articles, twelve commentaries on the target articles and six responses to the commentaries, several of which are worth reviewing for the Quantum-Mind 2003 conference.

An example of a fresh insight into Libet's backward referral experiment came from Gilberto Gomes who pointed out (C&C, 2002) a difference in stimulus duration between Libet's thalamic vs. his cortical brain stimulation experiments (the experiments that Penrose felt needed a quantum explanation). Gomes argued this difference eliminated the need for backward referral. I disagreed (C&C, 2002) and joined Penrose in defending Libet's concept of backward referral. However, the need for quantum mechanics in backward referral is still questionable.

Many articles in C&C (2002) discussed Libet's experiments that measured the physiological precursors of volition. Except for commentaries by Libet and me, all these articles accepted the position that free will is compatible with classical, deterministic physics. In my talk I will discuss this compatibilist position, defending its strengths but pointing out its weakness. I will argue that a quantum metaphysics similar to that of Stapp is needed to provide the underpinnings for a dualistic type of consciousness that gives us a special, responsible role in the universe, not possible under a classical metaphysics.

Dynamic spatial information and the subjective relativity of time perception. John Leach <leach@findlay.edu> (The University of Findlay).

It is well established that the subjective perception of time is relative. Anyone who has sat through a long boring lecture is keenly aware of the subjective feeling of time moving slowly. Theories of time perception that rely on the "clock in the head" metaphor fail to explain how a hypothetical neural meter can subjectively speed up and slow down. Variations of the metaphor based on probabilistic random neural firings also fail to deal with the subjective relativity of the perception time passage. An alternative theory of time perception is proposed. It is hypothesized that time perception is based on cognitive representations of dynamic spatial relationships. It is further hypothesized that in the absence of dynamic spatial information an organism will experience distortions in time perception. Dynamic spatial information can be perceived in auditory, visual, or tactile forms as well as mentally generated images. The theory predicts that subjects exposed to dynamic spatial information will estimate "objective" clock time

better than subjects who are prevented from perceiving such information. Three experiments were conducted to test the hypothesis that estimates of time depend on the perception of dynamic spatial events. In all three experiments, mean estimates of clock time by subjects exposed to dynamic spatial information were closer to the objective time interval than subjects not exposed to dynamic spatial information. Further, subjects in the "no information" conditions estimates of time were twice as variable as those in the dynamic spatial conditions. Theories of time perception based on the "clock in the head" metaphor would predict that under such conditions no differences in time perceptions would be evident. The results of these experiments suggest that traditional theories of time perception may need to be abandoned for theories that embrace the relationship between space and time, and the human capacity to exchange metric distance with time intervals given sufficient stimulation from a dynamic environment.

Time perception, cyclic groups and quantum computation. Michel Planat <planat@lpmo.edu> (Laboratoire de Physique et Métrologie des Oscillateurs du CNRS), Metod Saniga (Astronomical Institute, Slovak Academy of Sciences, SK-059 60 Tatranská Lomnica, Slovak Republic) <msaniga@ta3.sk>.

In the macroscopic realm, period measurements of a test oscillator against a reference one is performed close to baseband, thanks to a non linear mixer and a low pass filter. The set-up only preserves irreducible fractions p/q in the frequency ratio ? of input oscillators. They are f(q) allowed fractions (where f(q) is a quite irregular function bounded above by q-1, the value it takes when q equals a prime number). The resulting beat note in units of the frequency of the reference oscillator is the diophantine approximation q| ? -p/q|, and results from the continued fraction expansion of ?. The beat frequency exhibits variability, with 1/f power spectrum, that we explained from phase locking of the input oscillators. We could model the effect by considering a discrete coupling coefficient versus time, related to the logarithm of prime numbers and also to the Riemann zeta function and its critical zeros. The model could be justified from the hyperbolic geometry of the low pass filtering [Planat, Arxiv: hep-th/0209243].

Time evolution in human classical oscillators such as the circadian rhythm in plants, the heart rate or the one of melatonine secretion should obey the same rules, because they are slaved to the lightning environment or to internal pacemakers. But does time perception resort to the arithmetic above? Our postulate is that our mind still uses phase locking, but in a discrete algebraic way, from mental states related to the finite circle Zq = Z/qZ, the ring of integers modulo q, also related to Schor's model of quantum computation [Lomonaco & Kauffman, ArXiv: quant-ph/0201095]. In particular we claim the ability of our mind to lock to the period ?(q) = f(q) = q-1 of the largest cyclic subgroup of Zq*. This is a very irregular function, of which the mean value scales roughly as O(t 0.90) and which exhibits an error term with 1/f 0.70 power spectral density. A closely related view of time perception based on cyclic properties of Galois fields GF(pk) has been proposed [Saniga, Chaos, Solitons & Fractals, 9, 1071 (1998)]. This pencil model sheds new light on profoundly distorted perceptions of time characterizing a number of mental psychoses, drug-induced states, as well as many other "altered" states of consciousness.

The human ability to perceive the greatest common divisor in the frequencies of two sounds, instead of their beat frequency, is well known, as is the ability to implicitly manage with continued fraction expansions in the musical design of well tempered scales. In classical computers these tasks require a polynomial time. In contrast, finding the primitive roots g and the corresponding exponent r (the discrete logarithm) of the algebraic equation gr = 1 (mod q) requires exponential time. (We remind that g is a primitive root whenever the equation above is wrong for any 1= r< q-1, but is true for r = q-1. Primitive roots are used to discover if the group Zq* is cyclic. This happens for q equal to a prime number p, or of the form 2, 4, pk and 2pk, p>2; otherwise the group is not cyclic. By generalizing the notion of a primitive root to an element which generates a maximal cyclic subgroup, one gets the period ?(q) also called Carmichael lambda function). Thus our intuitive sense of time, of prime numbers, of primitive roots should result from the ability of our mind to perform quantum computation. Both hypotheses may be checked simultaneously from clever physiological experiments of time perception, in different stress contexts. The 1/f noise effects observed in human cognition and performance argues in favour of the theory.

Time and observation. John Sanfey <john.sanfey @btinternet.com> (unaffiliated).

Science is simply the process of agreement on invariance that has been experienced subjectively by generations of scientists. What if every occasion of experiencing invariance that has ever taken place, has required some essential component found only in consciousness? This would mean that all along, we have agreed to attribute some property to the external world that properly belongs to consciousness. Here I show that this is indeed the case. The properties of time in physics are a mirror image of subjective consciousness. Understanding this relationship is the key to solving the problems of both time and consciousness.

Einstein appreciated the seriousness of the problem of the subjective now and concluded that it was beyond the reach of science. It is not, however. The subjective now is simply any structure that allows the past and the future to have a relationship, and every theory in physics must invent some abstract framework that serves this purpose. It is simply not possible to describe an observable that is changing both constantly and causally without inventing some conceptual framework that remains constant in relation to the changing observable. These frameworks are conceptual and not empirical because they are unobservable in principle – being fixed. The only fixed empirical framework in nature, is the mechanism of consciousness. I outline a logical argument demonstrating that the properties of the abstract frameworks used in physics must assume the properties of subjective consciousness. In classical physics for example, making infinitesimal durations equal to zero is considered to have no important ontological significance, whereas in fact, this assumption creates an abstract fixed framework whose function is to hold the past and future together. Kant called this framework the noumenal, or unknowable properties, the "thing-in-itself", and it is considered constant in relation to change. It is needed because observers experience duration, and its properties reflect that unique capacity of observers to relate the past and the future. In quantum theory the abstract observer framework is more obvious since there is always an external time framework that allows constancy to exist in relation to change.

These abstract, physical frameworks reflecting the mechanism of subjective duration, have a common irreducible structure, which must be present in every consideration by a human mind

both classical and quantum. Within that structure there are two orthogonal time dimensions, one of which is informational and the other causally determined. Either of these dimensions can appear to be constant in relation to the other.

This model makes testable predictions about the structure of the brain, because it provides a strong, physical definition of subjective consciousness. In principle, it should also make testable predictions in physics.

Space-time-event-motion (STEM): A new metaphor for a new concept. Joseph Naimo <jnaimo@central.murdoch.edu.au> (Murdoch University Western Australia).

Have we got the concept of time right? In the context of relativity theory space and time are intimately connected and form a four-dimensional continuum – spacetime. Two observers will order events differently in time if they happen to be moving at differing velocities relative to observed events resulting in them the perception of different temporal sequences of those events. Relativity theory implies that perception cannot be uniform among perceivers. The past seems fixed and yet we intuitively know that the future is open to possibility. Strictly speaking, then, an open future cannot necessarily be determined by the past. Time appears to flow asymmetrically (fixed past – open future). In what way, then, is time linked to consciousness? Time, according to quantum physics, has directionality only in the conventional sense determined by the discourse of tensed language; its existence is asymmetric. For example, at the Planck length space and time lose their identity to what is known as the 'quantum foam' and there is no distinction between past and future. Yet, according to the physics of nonequilibrium processes, irreversibility leads to a host of novel phenomena (e.g. chemical oscillations, laser light, etc.) in which the arrow of time plays an essential and constructive role. Which theory is right? Can time be both linear and nonlinear? By employing a similar model extrapolated from Bohm's conception of the Implicate and Explicate Orders (Impression and Expression respectively) one can conceptually (at least) bridge the divide between the linear and nonlinear distinctions of time.

In this paper, I will argue that time can be both linear and nonlinear. In this modified worldview time is intimately linked to the 'Expression (materialized) Order' of existence. Time does not exist in the same sense on the 'Impression Order' (quantum vacuum) of existence, which needs to be thought about in terms of potential although an existent (as in a superimposed absolute realm) due to its time-independence. The Impression Order coexists with the Expression Order at the Planck scale, which occupies the interstices of all space yet is theoretically not space in the classical sense of the term. To understand these concepts requires the development of new concepts that incorporate the physical processes of energetic activity. The processes discussed involve the combined concepts of Space-Time-Event-Motion (STEM) to form a new concept. The acronym STEM is a new metaphor to describe both linear (causal) and nonlinear (simultaneous) processes related by the notion of energy corresponding to its frequency (Planck's constant) signature-energy-frequency (SEF). The implications of this model have far-reaching consequences for consciousness studies especially with respects to brain exploration concerned with occurrent events centered on the timing of processes. The measure of such events in terms of elapsed time are modeled against a background emerging from a historical dialectic based on the concept of causality and its hybridization, e.g. mental causation, causal theories of perception, etc. What is on offer in this paper is a process philosophy based on a holistic worldview.

Humean induction and tensed-time futurity. Ralph Hunt <hunt.6@osu.edu> (Ohio State Univ., Mansfield Campus).

Tenseless-time arguments against the reality of futurity and tensed time in general can be countered by a tensed-time appeal to Hume's Problem of Induction: future differs from past and present in the problem futurity raises for inductive processes.

Tenseless-time theorists take McTaggert's B-series as all of what time is: past, present and future are human-only perceptions, unreflective of scientific temporality that recognizes just earlier-than and later-than, past, present and future being ontologically identical. A-series advocates, construing the present as not only real but central to all change, counter with ways future events differ from past/present, to substantiate time's passing. Familiar arguments for a substantival futurity, supporting tensed A-time, are that (1) future events can (unlike most past or present events) lack truth or falsity conditions, and that (2) future events lack specificity. The suggestion I develop is that (3) future events exemplify Hume's Problem of Induction in a way most past/present events don't. Hume is further seen as countering the B-thesis because induction difficulty has continuously concerned scientists and philosophers of science.

The puzzle Hume raises for induction is the difficulty of projecting to future conclusions from present or past premises: supporting future induction by the success of past inductions is circular, verifying induction by induction. The future could still suddenly change, and this separates future events from past and present: future events are subject to Hume's Problem.

Hume notes:

As to past experience, it can be allowed to give direct and certain information of those precise objects only, and that precise period of time which fell under its cognizance: But why this experience should be extended to future times and to other objects which, for ought we know, may be only in appearance similar, this is the main question on which I would insist.

Whether induction actually fails is not at issue. The relevant core of Hume's logic is that future change is invulnerable to the "it's never happened before" attack: induction can't provide inductive support. So where induction gets into (possible) trouble is where safe past generalizations become riskier assessments of futurity.

All this runs counter to B-series claims that science is unconcerned with A-time. That scientific laws as such ignore time's passage has been shown false in some instances, but is no doubt largely true; physical laws are usually expressed mathematically in the timeless "is" copula. When we separate laws themselves from processes of science, however, we get a different picture: science utilizes induction, which utilizes prediction and prediction largely relies on futurity. Predicting the moment a Galilean moon will eclipse another means more than just that the eclipse event is timelessly subsequent to the prediction (in the sense that the Declaration of Independence is later than the Magna Carta): the eclipse hasn't happened yet.

My account includes postdiction—predicting what will be found to have already happened—as likewise requiring futurity: confirmation usually has to have been epistemically inaccessible

at the time of the prediction. Ultimately, science does not speak in one voice for B-series time.

Concurrent Session 3

Experimental approaches to nonlocality

Biological nonlocality: Problems and potential. Fred Thaheld <fthaheld@directcon.net>.

Several years ago I advanced the proposal that in the near future it would be possible to conduct experiments to simultaneously deal with several of the major problems in the field of consciousness studies based upon the concept of biological nonlocality to wit:

(i) Are there nonlocal correlations between human brains via the mind?

(ii) Can one transfer conscious subjective experience from one individual to another?

(iii) Whether mental events can influence, control and initiate neural events or what is known as the 'reverse direction problem'.

(iv) The 'measurement problem' or whether consciousness collapses the wave-function.

(v) The 'binding problem' or how it is that the brain can fuse together the many disparate features of a complex perception.

This proposal is based upon the original research of Grinberg-Zylberbaum which appeared to reveal EPR-style nonlocal correlations between the brains of 2 subjects.

Experiments which have been performed in the past and which are presently ongoing at Bastyr Univ.-Univ. of Washington and the Univ. of Freiburg replicating this earlier work, appear to indicate, in preliminary fashion, that one or more of the above items has been successfully dealt with or will be explored very shortly following specific experimental protocol. The fact that both subjects are in Faraday chambers appears to rule out any electromagnetic or neural energy mechanism, leaving a combination of entanglement, nonlocality and mental forces (as per Popper) as the possible solution to the above problems.

Resolution of one or more of the above problems should allow us to examine the question of the Neural Correlates of Consciousness (NCC), and leads me to postulate the existence of their equal and dual partner, which I have named the Mental Correlates of Consciousness (MCC). In addition, analysis of the ongoing experiments appears to reveal a possible solution to the conceptual tension which has existed between the spatial nonseparability of physical systems due to entangled states in QM and the spatial separability of physical systems in GR or, nonlocality vs locality. And, that what we call mental events or mental forces may be the same as the quantum mechanical forces of information or influence transfer which are involved when a measurement is made on 2 entangled particles.

While experimental efforts are beginning to catch up with and complement previous theoretical work in this field, we are now faced with the problem of accurately measuring and controlling the 'energy' of the anomaly which is involved. This will require us to go beyond the present use of Random Event Generators (REGs), which have been used for several decades to determine if mental events (operator intention or willful intent) can influence quantum random noise from semiconducting devices and radioactive decay events. The problem with REGs is that although very nice p values are generated, showing that the normal Gaussian output distribution is displaced towards higher or lower values than the baseline, as a result of operator intention, they are incapable of telling us when exactly this 'energy' appears, what its level might be or its consistency. One is certainly justified in thinking that this informational measure should be equivalent to so much 'energy' but, at the present time there exists no simple conversion metric and, it is impossible to derive one for the REGs as presently constructed. There may be several ways around this problem by utilizing the following:

(i) Beamsplitters where each time a photon goes to one of 2 detectors, we get a more measureable 1 or 0 digital output which can then be influenced by operator intention.

(ii) Superconductors where a current can persist for years without any decay and having an operator attempt to disrupt or alter it in some fashion.

(iii) Spontaneous fission rate of uranium-238, from each gm of which, one obtains a baseline of 25 spontaneous fission events per hour and, where the attempt can be made to alter this figure up or down.

(iv) The atomic resonance of Rubidium (6.8 GHZ) or Cesium (9.192 GHz) in which operator intention is used to try and increase or decrease the fundamental resonance rate of these atomic clocks i.e., to change time, if not space-time itself.

(v) The Casimir effect where zero-point energy is measured by 2 closely spaced conducting plates (0.6-6 micrometers) attached to a torsion pendulum, which are kept at a fixed separation by a minute current. Operator intention attempts to change the normal twisting of the pendulum or the amount of current needed to maintain the pendulum's position, with a sensitivity of around 100 microdynes or the weight of one red blood cell!

The advantage which these techniques would have over REGs is that one could get a real time readout between cause and effect.

Preliminary evidence of correlated functional MRI signals between physically and sensory isolated human subjects: Two case studies. Todd Richards <toddr@u.washington.edu> (University of Washington), Leila Kozak (Bastyr University Research Institute), L. Clark Johnson (University of Washington), Leanna J. Standish (Bastyr University Research Institute).

Previous visual evoked potential EEG experiments have suggested that neural signals may be transferred and detected between subjects who are physically and sensory isolated from each other. Functional magnetic resonance imaging (fMRI) methods were used in the present study as an attempt to replicate these findings using an independent measure of brain activity. Metabolic brain signals were measured using fMRI technology in four humans subjects using a sender/receiver paradigm previously designed for an EEG signal transfer experiment. During the fMRI experiment, the receiver subject was placed in the scanner with sensory isolating goggles covering the subject's eyes. The sender subject was placed 30 feet away in a chamber that was electrically and magnetically shielded from the scanner room. The sender sat in front of a video monitor that presented an alternating schedule of 6 stimulus on/stimulus off conditions. The stimulus on condition consisted of a black and white checkerboard pattern (that is known to generate visual evoked potentials in visual cortex.) The stimulus off condition consisted of a black and white checkerboard pattern that remained static (that does not trigger visual evoked potentials). Twelve static and flickering checkerboard stimulus intervals were presented in time blocks of random length

adding 150 sec over the 300 sec experimental session. Static checkerboards were presented for a total of 150 sec. Statistically significant activation ($p < 0.001$, corrected for multiple comparisons) was detected in brain voxels located in visual brain areas 18 and 19 (Brodmann areas) in three out of four of the receiver subjects using the GLM statistical model comparison of flicker versus static visual stimuli of the sender. For one of the subjects, significant brain activation was not observed anywhere in the brain. These preliminary data suggest that fMRI technology may be useful in the investigation of the controversial phenomenon of distant neural signal transfer. Non-local information models are proposed as a possible mechanism for this anomalous finding.

Experimental evidence of macroscopic nonlocality of the dissipative processes. Serguei Korotaev <serdyuk @izmiran.rssi.ru> (Geoelectromagnetic Research Institute, Russian Academy of Sciences), Vyacheslav Olegovich Serdyuk.

During the last decades in geophysics, astrophysics and biophysics number of facts on statistically reliable but classically impossible correlations between some processes were collected. Firstly, it was impossible to point out any local carriers of interaction.Secondly,except retarded correlations,unusial advanced correlations were observed.Thirdly,the only common property of such processes was their dissipativity.Unique not ad hoc concept explaining such correlations was causal mechanics suggested by N.Kozyrev,but it was weakly formalized and its experimental basis was insufficiently reliable.On the other hand,recently in some theoretical works(N.Mermin,D.Home and A.Majumdar)an idea on persisting of qantum nonlocality in the macro-limit was suggested. At last a new way of the entanglement formation through a common thermostate was suggested by A. Basharov and this way needs dissipativity of the quantum correlated processes. Macroscopic nonlocality might explain mentioned correlations of the dissipative processes.

We have formulated a heuristic equation of macroscopic nonlocality which is based on above ideas and action-at-a-distance electrodinamics.

This equation represents relation between the entropy production of the different processes not interacting locally. This equation admits experimental verification.

The idea of experiment consists in measurement of reaction of a probe insulated process on an external source-process. The theory of the detector based on some probe processes has to translate the entropy production into the measured signal. The construction of the detector has to supress and/or to control all possible local factors ifluencing on the probe-process. Our experimental setup includes three detectors of two types. The first type was based on the variations of weakly polarized electrodes in an electrolite, the second-on variations of dark current of the photomultiplier. Except data of own experiment we also used ones of independent experiment performed by A. Morozov with the detector based on variations of ions mobility.

We performed two kinds of the experiments-with non-controlled natural source-processes and with controlled lab ones. The first is more interesting, because according to principle of weak causality suggested by J. Cramer for quantum nonlocality, if a source-process is noncontrolled we can observe both retarded and advanced correlations. Moreover interpretation of nonlocality in the framework of action-at-a-distance electrodinamics predicts higher level namely of advansed correlations than retarded ones.

The detectors reaction on the following natural processes was studied: the meteorological, solar, geomagnetic and ionospheric activity. Total reaction of 4 detectors of 3 types (separated up to 40 km) on the large-scale processes proved to be rather high correlated, that is results are independent on type of the probe-process.

For the all source-processes existence of advanced correlation with the detector signals was reliable revealed. Level of advanced correlations proved to be really higher than retarded ones. The values of advancement are large (from hours to months) and likely depend on scale of the source-process. Combining measurements of some processes we revealed violation of Bell-type inequality for the advanced transaction.

On the contrary the second type of experiments (with controlled lab source-processes) has demonstrated only retarded correlations.

Effects of intention, musical sound and noise on the germination of seeds: Evidence of entanglement between human and plant systems. Katherine Creath <kcreath@ieee.org> (Center for Frontier Medicine in Biofield Science, University of Arizona), Gary E. Schwartz.

As a rule, scientists try not to affect the outcome of their experiments, whereas musicians with every performance have the intention of affecting the audience. Human consciousness and intention interacts with other living systems in ways that can sometimes be sensed but are not always tangible. A series of experiments was initiated to study the effects of music on a biological system. Seed germination was used as a model system to avoid human preferences for music and to create a replicable, easily quantifiable measure of the effects of musical sound. We found that a larger number of okra and zucchini seeds exposed to musical sound germinated than those exposed to no sound ($p<0.002$). When this same interaction was studied as a function of time the seeds exposed to musical sound germinated faster than those with no sound with highly statistically significant results ($p<0.000001$). These results were replicable across seed type, petri dish, temperature and assignment of condition to a particular growth chamber. A total of 4,600 seeds were studied over 14 runs encompassing five experiments. When musical sound was compared to "pink" noise to a control with no sound as a function of time, this interaction was also significant ($p<0.034$). Seeds exposed to musical sound sprouted faster than seeds exposed to noise and both sprouted faster than the control. The interaction between noise and control was not significant. As the experiments progressed, we wanted to see if human intention alone independent of musical sound could affect seed germination. For ten of the fourteen runs, a condition was added where an experimenter treated seeds for 15-20 minutes twice a day with a consciously focused intention that the treated seeds germinate faster. During a series of 6 runs utilizing similar treatment protocols, a greater number seeds exposed to human intention sprouted when compared to the control ($p<0.0006$) and they sprouted significantly faster than the controls ($p<0.0001$) with an effect size comparable to those exposed to musical sound. These results indicate that human conscious intention can have a replicable effect on the germination of seeds. This experimental evidence illuminates entanglement between macro systems where human intention can effect the growth of another biological sys-

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Further validation of the "one mind model" of quantum reality. Mark Germine <mgermine@hotmail.com> (Psychoscience).

According to the One Mind Model of quantum reality, Universal Mind is viewed as a single wave function that gives rise to individual branches or minds that remain entangled with Universal Mind and all other individual minds. We have previously reported experimental validation of a prediction of the One Mind Model using an EPR-type paradigm involving individual event-related potentials (ERPs) in the human brain (Quantum Mind Archives, 11/7/00).

In the experimental paradigm employed here, ERPs are generated using the standard "oddball" paradigm. The ERP is elicited in the brain of the observer when a random "rare" or less-common stimulus is substituted for a common stimulus. The common stimulus is delivered as a tone through headphones to the observer, who is in a separate room from the computer module that generates the tone and records the brain response for 750 msec. Stimuli are delivered every 1.5 seconds, with rare tones being randomly substituted for of an average of one in four stimuli based on a random number generator in the computer. The brain response of the observer is measured by EEG and averaged over numerous trials to yield a pattern of electrical potentials reflecting the brain response of the individual observer to the rare tone. The rare tone is selectively attended to by the individual observer, and the number of rare tones is counted silently in trials averaging 24 rare tones each.). Although we would have preferred to use a radioactive decay or similar microquantum event to generate the stimulus in our paradigm, as per our original design (see Dyamical Psychoogy, 1998), only electronically generated stimuli were available to us, and these are assumed to have some Heisenberg uncertainty in the Model itself.

Each wave form in the ERP reflects a cycle of electrical potential activity around the whole brain. Positive (P) potentials are traveling away from the vertex electrode. Negative (N) potentials are traveling towards the vertex electrode. All potentials were recorded at the vertex (Cz – A1). The oddball paradigm is designed to elicit the P300, or P3 wave form.

In our paradigm, an observer in another room randomly observes the condition of each stimulus on the computer module one second before the tones are generated in the headphones of the observer who's brain waves are being recorded. Approximately one half of the trials are observed based on the generation of odd or even random numbers, without the knowledge of the observer being recorded.

On the basis of the One Mind Model, the two observers are entangled in the event of generation of the random tone. Since the first observer or brain determines the status of this event, it was predicted that there would be asymmetry in the brain's response in the observed and unobserved conditions of the rare tone. This asymmetry was predicted to result in a difference in the ERP wave forms generated under the two conditions. It was predicted that this difference, derived by subtracting wave forms generated under the two conditions, would be statistically reproducible.

Using the standard oddball paradigm, two sets of ERPs were generated in each of the two conditions in two separate series averaging four trials each. Electrical potential was measured and averaged for each set of trials in each of the two conditions, and the unobserved profiles were subtracted form the observed profiles to produce a difference potential profile. The difference potential profiles were then measured at intervals of ten msec. from zero to 750 msec.

Data for the standard oddball paradigm yielded difference potentials that were highly significantly correlated in the positive direction on single factor ANOVA, based on the correlation of amplitude of wave forms at ten msec. intervals. The wave forms of these difference potentials had a strong periodicity of about 90 msec. or 11 Htz.

Another set of difference potentials was generated in which the decibel level of the rare tone was set at zero, yielding a random absent tone. These potentials were generated and analyzed in the same manner as the standard oddball potentials. Two sets of ERPs were generated in each of the two conditions in two separate trials averaging four trials each. The difference potentials of the two sets were highly significantly correlated in the positive direction on single factor ANOVA.. The waveforms of the difference potentials had a strong periodicity of about 90 msec or 11 Htz.

The data from the absence and rare tone and absence conditions were compared using single factor ANOVA. This was the most powerful statistic generated in the trials, and also minimized the autocorrelation factor between similar wave forms. Difference potentials under the absence and rare tone conditions were very highly correlated in the positive direction on single factor ANOVA ($F = 15.2$; $p = 0.00015$).

Examination of the data indicates that the difference potentials are interference patterns with a periodicity that is emergent form the individual profiles in the observed and unobserved conditions, probably due to alpha desynchronization in the unobserved condition. It is proposed that correlation of the difference potentials reflects EPR correlation of the brain electrical potentials in the observed and unobserved conditions. Further work is needed using ERPs in both EEG and fMRI paradigms.

Effects of participation in a prayer ceremony upon QEEG. Lewis Mehl-Madrona <mehlmadrona@aol.com> (University of Arizona Department of Psychology Center for Frontier Medicine in Biofield Science and Program in Integrative Medicine (Department of Medicine)), Daniel Lewis, Sabrina Lewis, Iris Bell, Gary Schwartz, Scott Ferrell.

Studies exist to document the effects of prayer upon the treatment of infertility, recovery from myocardial infarction, seed germination under adverse conditions, length of life among mice bred to develop cancer, and other conditions. A Quantitative Electroencephalographic (QEEG) literature also exists upon the QEEG characteristics of depression, and how depressed people respond to placebo treatment and medication treatment -- similar but different response sets. Psychological therapies have been shown via PET (positron emission tomography) scans to have consistent effects upon depressed patients. QEEG studies also exist to document reliable changes when shamans enter a state of possession in the Balinese trance possession ceremony. What these studies share are brain mechanisms involving theta rhythm, particularly in the frontal cortex, along with alpha rhythm in the occipital cortex. A QEEG measure that integrates relative and absolute power, called cordance, is also involved, especially with frontal theta. Cordance is the best EEG predictor of cerebral blood flow. Concordance refers to a state of brain characterized by cordance symmetry. We present pilot data showing that participation in prayer

ceremonies has similar effects as the successful treatment of depression, with changes in relative power in frontal theta, theta cordance in frontal lobes, increase in relative power in occipital alpha, and overall dampening of absolute brain wave power during the heighth of the ceremony. We suggest that depression and spiritual transformation exist on a continuum in the brain. We discuss changes in QEEG during different phases of the prayer ceremony, and wonder if QEEG may be a biofield marker to document the interaction of non-local quantum-level processes with the physical biological realm. We will discuss the evolution of control strategies for experiments such as these, and results accruing from different control strategies that also imply non-local effects.

Information transmission between killed and survivor individuals of the same population on several species. Aroutioun Agadjanian <arut@canada.com> (21st Century Information).

In order to establish experimentally the role of consciousness of single biological species during the evolution, it is necessary to understand first that the most important function of consciousness of the single living species by analogy with human consciousness is to provide conditions for the successful surviving of the species against new deadly killing factors by nonspecific and specific defense mechanisms.

Experimental project "Feedback" was accomplished form 1976 to 1989 in the former Soviet Union using as objects several biological species: mice, rats, aquarium fish, several species of insects. General design of experiments was following: two identical groups of individuals of the same species, control and experimental, were kept physically separated. Individuals in both of these groups were living together for some time to allow consciousness of the local population to be established. Specific number of individuals was removed from the control group alive and removed from further experiments. Simultaneously the same number of individuals with the same sex-ratio in the experimental group was killed by the specific killing agent (for example, in case of fish by physical destruction and in case of pest insects by one of commonly used against this species pesticides), left in the groups for a period of time and then removed too. This was accomplished in the way that would completely eliminate any direct exposure of the survivors to the killing agent. These manipulations were repeated periodically during some period of time. The reproduction rates were observed in the both of these groups. Also in experiments on several insect-pesticides combinations single individuals from both groups were checked periodically to compare the resistance to the pesticide used as a killing agent. The results of experiments on all studied species showed that after some time and number of above described manipulations the reproduction rate in the experimental group became considerably higher than in control groups. Also the results on insects established that individuals in the experimental groups gradually acquired resistance to the pesticide used as a killing factor, whereas resistance of individuals of control groups to this pesticide did not change.

The interpretation of experimental results was following. The killed violently individuals transmitted by signals of unknown nature the information about the fact of their violent death and specific information about nature of the deadly factor to the survivors of the same group. Based on this received information the consciousness of this population employed both nonspecific and specific defense mechanisms in order to survive the deadly factor. First, as a nonspecific defense the consciousness of the population increased the speed of reproduction. Second, as a specific defense, using the received specific information about the deadly agent, the consciousness of the population activated the specific resistance to this killing factor.

The conclusion of the project is that consciousness of the species is that long sought "intelligent" force that "consciously" defends species numbers and directs the emergence of specific new mutations to adapt to a new deadly factor during evolution.

Concurrent Session 4
Platonic realism

A quantum model of organizations: Formation, information processing and decision-making. William Lawless <lawlessw@mail.paine.edu> (Paine College).

To address how systems of computational agents, working alone, in teams, or with humans, can best cooperate to solve problems and advance technology more autonomously than the current generation of remotely controlled unmanned systems, it is increasingly clear that a revolution in computing foundations is necessary. Yet, the most fundamental revolution in computational agent systems, and the major unsolved problem in Social Psychology (Allport, 1962), is understanding and controlling group processes. By determining the optimum structure for decision-making or the formation of organizations, the group offers the greatest opportunity for advancements in military, computational, social, and industrial systems. On this question may well turn the future of U.S. and Western technological advances. However, this problem remains not only unsolved, but also virtually unstudied simply because social scientists have until now studied groups from the perspective of the individual (Levine & Moreland, 1998), notably game theory. As the first attempt to analyze social interdependence, game theory only produces static information, I (Von Neumann & Morgenstern, 1953, p. 45; similar to static snapshots of polls and repeated or "evolutionary" games). Luce and Raiffa (1967) concluded game theory could not rationally or mathematically determine the difference in value between a group and the aggregated value of individuals who comprise it, such as IBM versus the sum of its individual employees. After many years, group theorists now reluctantly agree that traditional approaches, reliant on survey and polling methods, do not measure "groupness"(Levine & Moreland, 1998).

The "groupness" problem arises by recognizing that once members have been surveyed with questionnaires or polls, summing individual data does not reconstitute the group (adapted from Zeilinger, 1999). Nash (1950) avoided this question in bargaining situations by assigning zero social value to groups with internal dissent, assuring that game theory only addressed a select number of groups whose values might be summed. But even for stable, homogeneous, dissent-free groups, Lewin (1951) famously recognized that a group is different from the sum of its parts. In contrast to logical positivist models, quantizing the pro-con positions in decision-making suggests that a robust model of argumentation increases in computational power with N, just as it does with humans. Previously, compared with consensus or command decision-making models, we have found that optimum solutions of ill-defined problems, idp's, occurred when incommensurable beliefs interacting before neutral decision makers generated suffi-

cient emotion to process information, I, but insufficient to impair the interaction, unexpectedly producing more trust compared to cooperation (Lawless & Castelao, 2001). Using the social quantum model, we extend this model to the first information density functional theory (IDFT) of groups, especially mergers between heterogenous organizations (Lawless & Chandrasekara, 2002).

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Paranoiac-criticism, Salvador Dalí, Arcimboldo and superposition in interpreting double images. Michael Betancourt (University of Miami).

This is an interdisciplinary paper exploring issues of perception in the realm of art history. Surrealist painter Salvador Dalí's early theorization of a painterly Surrealism was derived from his observations about paranoid schizophrenia. The articulation of this theory in his paintings both anticipates and demonstrates quantum superposition in everyday perception. This paper examines the form his theory takes and suggests an approach to this work that incorporates the historical precedents for the double images he makes while drawing parallels with optical illusions as demonstrations of quantum superposition in our perceptions.

Toward a theory of quantum aesthetics. Jonas Mureika <jmureika@jsd.claremont.edu> (W. M. Keck Science Center The Claremont Colleges).

The two physical revolutions of the early 20th century – Special Relativity and Quantum Mechanics -- showed us that the observer plays a crucial role in interpreting their surroundings. The notion of subjective realism is a radical departure from "classical" views of the universe and objective reality. In particular, it is an open question as to on which the nature of aesthetics is based. Our perceived likes and dislikes are certainly independent from those of others -- or are they? Is there a fundamental unit of aesthetic value which can be quantized, much like the physical quantities of classical physics which have discrete quantum observables? This talk will review the concepts of classical theories of aesthetics, human perception and discrimination methods, and will propose future directions to finding a method of aesthetic quantification which adheres to the postulates of quantum mechanics. Is there an observable for aesthetic appreciation? What are its eigenvalues? In short, is there a quantum theory of aesthetics?

Naturalistic, libertarian free will. Peter Ells <peells @brookes.ac.uk>.

In the 17th century, Descartes cleaved the cosmos into two parts: the subjective world of experience, and the objective physical world. Since then, science has enjoyed extraordinary success in explaining the physical world naturalistically, in terms of universal mathematical laws. These laws, in principle, give the fullest possible objective, causal explanation for all physical events. Many scientists and some philosophers have used these successes to assert that the objective worldview is the only valid way of judging what is real. Science has proven this viewpoint to be true, they claim, and the evidence of science contradicts all other viewpoints.

A few, however, argue that ordinary human experiences, while fallible, cannot be discounted entirely as experiences. Chalmers has summarized the strong case that our subjective experiences cannot be reduced to or identified with objective brain states. A smaller minority claim that human self-understanding implies that we possess free will that is causally effective: philosophers call this libertarian free will. In our private subjective world, we each have evidence that our free decisions cause our subsequent actions. Several workers have proposed that the incompleteness of quantum mechanics allows room for this second type of causality, but none has yet developed a naturalistic theory.

Although this minority have put forward cogent arguments, they have been less successful in fully integrating their ideas with current scientific understanding. Chalmers, by proposing psychophysical laws, achieves a large degree of integration, but he does this at the heavy cost of making consciousness an epiphenomenon in practical terms. Hodgson makes a case that consciousness and free will arise out of quantum events in the human brain, though as he admits, his account is unsatisfactory because it is not naturalistic. All theories that attempt to make consciousness causally effective, while restricting this faculty to highly evolved creatures, run into the difficulty that they inevitably contradict naturalism. Such theories imply that, once conscious creatures have evolved, a new causal influence emerges in the physics of the cosmos. Naturalism is perhaps the best-established characteristic of our current scientific understanding. Physical laws hold universally in all modern scientific theories, even though these theories have changed greatly, and currently appear to conflict with one another to a certain extent. Any account of consciousness and free will must be naturalistic if it is to be compatible with science.

Many others besides Hodgson have turned to quantum mechanics as holding the key to understanding consciousness and human freedom of action. Among them are Hameroff, Penrose, Seager, and Stapp, who have put forward their views in contributions to "Explaining consciousness, the 'Hard Problem'". Chalmers and Seager in particular have shown that panpsychism possesses many desirable explanatory properties, and is not contradicted by science. The philosopher Kane has made significant recent progress in understanding libertarian free will.

This paper is based on the plausible philosophical assumptions of rationalism, physicalism, naturalism, modulated common understanding, realism, the Copernican principle, Occam's razor, and monism. It attempts to show that libertarian free will is consistent with these principles, and with all of the current, standardly accepted laws and experimental findings of physics. The theory given here is a combination and refinement of the work of the authors so far mentioned, and of others; but it is novel in that it takes a bottom-up, evolutionary approach. It proposes that all elementary particles possess both an extremely primitive phenomenology, and some freedom of action based on this sentience, as fundamental, intrinsic properties. In addition to panpsychism, therefore, panfreedom (hinted at by Seager) reigns throughout the cosmos. A panfree cosmology, which is related to the ideas of Penrose and Hameroff, integrates panpsychism and panfreedom with general relativity and quantum mechanics. The paper goes on to show how human beings (and some other organisms) have evolved in accordance with natural selection to a degree of complexity where they could reasonably be said to possess both mind and free will. The objective (extrinsic) causality of physics, and the subjective (intrinsic) causality of panfreedom, mesh together precisely, to give a complete, well integrated causality for all events in the cosmos.

Quantum representation of idealism's view of consciousness. H. Froning, Jr. <froning@flagstaff.az.us> (Flight Unlimited), H.D. Froning, Jr.

The idealistic world view, first proposed by Plato, holds that the entirety of temporal ever-changing physical experience is the sum of the substance-less shadows cast upon the mass-less mental terrain of consciousness by the eternal solidity of ideal patterns, called ideas. And Plato endowed ideas—-now usually referred to as platonic forms—-with not only immortality and immutability, but with absolute goodness and perfect beauty, as well. Quantum Mechanics (QM) cannot, of course, prove the validity of such idealism. But some of its underlying formalisms are used as mathematical metaphors to attempt a better visualization of the non-physical being that idealistic theories of consciousness propose.

A classical view of platonic form immortality and immutability places them within a time-less x-ikz realm, that is orthogonal to the x-ct Minkowskian space of Special Relativity, and within which the "ideal patterns" of platonic forms are Lorentz-invariant. And since platonic form world lines and dynamical states are invariant with respect to Lorentz transformations, while those of material forms are not, spacetime and energy-momentum histories of material forms can be viewed as shadows, cast upon x-ct and p-E/c planes of existence by the higher order kine-matics and dynamics of platonic forms. The mental topology of consciousness, which is repre-sented by a 3-D surface of zero thickness, includes: horizontal x-ct and p-E/c components that display third person objective experience—-the spacetime and energy-momentum shadows cast by platonic forms. The topology also includes vertical x-ikz and q-iku components that display first person subjective experience—-our hopes/fears, exaltations/despairs, higher sentiments/lower tendencies, etc. And because the slopes, peaks, and valleys of such mental terrain determine the measure of platonic form-beauty and goodness that is seen and felt, the slopes, valleys, and peaks determine the richness or poverty of the human experience.

The quantum mechanical "heaven", in which platonic forms dwell, is symbolized by a Hilbert Space (a complex configuration space) that is orthogonal to that Hilbert Space of QM, in which quantum states of physical forms unfold. And, like the Hilbert Space of QM, the fabric of the platonic Hilbert realm is woven by the enumerable state vectors (wavefunctions) representing the enumerable combinations of goodness and beauty that platonic forms express. A Schroedinger equation equates the unitary evolution of physical states [H?] within QM Hilbert Space with the eternal being [hk/c ??/?z] occurring within the platonic Hilbert Space of platonic forms. Thus, the quantum states of physical forms are viewed as shadows cast upon the Hilbert realm by higher order platonic form activity. Platonic form effulgence and interconnectedness is symbolized by entangled superpositions of quantum states that, in the simplest approximation, can be visualized as a stupendous omni-directional emanation of rays from the South Pole of a Reiman Sphere region that contains their effulgence. And the material senses (like an obscuring, distorting transparency) perform the equivalent of wavefunction collapse that allows only a distorted and infinitesimal fraction of platonic form effulgence to pass through. And just as cancellations of enormous zero-point field energies continually occur within the quantum vacuum—-the most invisible component of physicality, so cancellations of platonic form effulgence may occur within the subconscious—-the most invisible component of the senses.

The paper concludes by examining possibilities for favorable re-sculpturing and re-aligning of the mental terrain of consciousness by making the senses/subconscious a clearer transparency for the glory and goodness of platonic form effulgence to shine through.

The biology of morality. Nancy Morrison <nmorrison @salud.unm.edu> (Department of Psychiatry, University of New Mexico Health Science Center), Sally K. Severino.

The morality of human beings, defined here as our ability to determine whether our actions are right or wrong, depends not just on following rules but also on understanding the impact of our actions on another person. How we understand the impact of our actions on another person depends on our state of consciousness, which is mediated by our brain and nervous system. We will describe how our morality flows naturally from the biological state we are living in. Our biology and our morality are mutually interactive; a change in one changes the other. Another way of saying this is that changing either our morality or our biology changes both and changes who we are and what we do.

Concurrent Session 5
Philosophy and Ontology

An integrated physical and informational ontology for conscious agents. Kathryn Laskey <klaskey@gmu.edu> (George Mason University).

Importation of methods from statistical physics into machine learning has led to rapid advances in learning methods for complex problems. This paper explores the potential for cross-fertilization in the other direction. The Stapp ontology for quantum dynamics can be coupled with the recent work in probabilistic knowledge representation to yield a unified ontology for physical and mental processes. Conscious experience and learning play a central and fundamental role in this ontology, as distinct from their epiphenomenal role in the classical ontology. The ontology

suggested here is fully consistent with our current knowledge of the workings of the physical universe. Moreover, it fills an acknowledged gap in currently popular ontologies for quantum theory and at the same time fills a complementary gap in current theories of neurobiology, psychology and artificial intelligence.

Classical mechanics is a dynamically complete theory with no role for conscious thought and efficacious deliberate action. It fails at precisely the place at which learning and artificial intelligence require an adequate theory. The attempt to found artificial intelligence and computational psychology on a deterministic computional dynamics with no role for consciousness and efficacious action has given rise to a number of difficulties. Physics also is plagued by difficulties associated with explaining the periodic "collapses" that interrupt deterministic Shhrödinger evolution. Coupling quantum dynamics with Bayesian probability and decision theory provides an ontologically complete non-dualistic theory that seamlessly fills both gaps.

No attempt to banish the observer from quantum theory has yet produced satisfactory results. Quantum systems evolve according to three distinct dynamic processes. In the absence of observations, the state of a quantum system evolves deterministically according to the Shrödinger equation. In a second process occurs not specified by the theory, an observer prepares an experimental set-up to measure some observable event. Finally, the event occurs, producing an outcome according to the statistical rules specified by the theory. Because evolution of the system depends on what question is asked at what time, there is an unsatisfactory gap in the theory. Von Neumann and Wigner suggested filling this explanatory gap by bringing the bodies and brains of the observers into the quantum state, and allowing an interaction between the informational structure represented by the quantum state and the informational structure of conscious experience. Stapp argues that such an interaction can fill a fundamental lacuna in the formulation of quantum theory, considered as a theory of reality, and that it allows consciousness to become efficacious without disturbing any of the precepts or rules of quantum theory.

Stapp suggests that the brain encodes a "body-world schema" to represent the body and its environment. More faithful representations evolve as information is gained via the measurement process. Bayesian sequential learning provides a natural framework, consistent with the probabilistic language of quantum physics, for dynamic evolution of body-world schemas given environmental feedback. Recent advances in probabilistic knowledge representation provide a language for expressing cognitive-level models and their relationship to the sub-symbolic events that occur in the physical substrate that supports cognition. The ontology presented here provides a unified account of the physical and mental aspects of the scientific description of the world. As such, it shows promise for a post-classical theory of computing founded on explicitly non-deterministic and irreversible quantum systems.

In closing, it is worth considering the sociological implications of the ontology proposed here, especially if it proves to be fruitful in generating engineering advances. If all quantum systems are in some sense conscious, then building a quantum computer would amount to creating an engineered proto-consciousness. Because all physical systems are quantum systems, this is true even of digital computers, although it would appear that the degree to which they exhibit the property we call consciousness at the human level is extremely limited. However, we may soon succeed in building adaptively intelligent quantum computers. It is worth pausing to give serious thought to how we wish to go about doing this. An important first step is to found both our theory of quantum computing and our economic and social theories of collective decision making on a scientific ontology that has an explicit place for free will and responsible choice. The ontology proposed here does this quite naturally and is fully consistent with known science.

Complex semiotic dynamics. Edwina Taborsky <taborsky @primus.ca> (Bishop's University, Lennoxville, Quebec, Canada).

This paper is focused around my research in Semiotic Realism, which refers to natural processes of measurement of energy/mass interactions found within all realms of our universe, the abiotic, biotic and conceptual. Our universe is composed of energy and mass; the one is a version of the other. Radiant energy is transformed into diverse densities of matter, by means of a complex architectural network of active measurements or codifications of mass/energy.

The measurement infrastructure for this dynamic process operates within four spatial dimensions and three temporal dimensions. When spatiotemporally linked at key nodal sites, these dimensions result in six predicate relations, which measure energy such that it is stabilized as 'informed mass'.

A vital measurement is the interface 'cut' that permits dissimilar densities of energy/matter such that matter can be divided into internal and external realms. Internal measurements are richer or more complex than external measurements. The three internal predicate measurements operate by quantum processes, while the two external predicates operate by classical processes. However, energy/matter does not exist within an either-or architecture, for our universe requires both the quantum and the classical measurements of energy/matter. What differentiates the two realms? It is not a micro/macro differentiation nor is it the existence of the 'observer'. The differentiation is due to the dissimilar spatial and temporal perimeters. I am suggesting that both the internal and external are objectively real measurement processes and that the 'same' matter is entangled within both quantum and classical measurement processes. If we take an internal/external entangled architecture as a basic requirement of energy/matter dynamics, then, consciousness arises within the modal typology of these interactions - whether they are iconic, indexical or symbolic.

A phenomenological approach to the measurement problem. Where do these ideas take us? Elizabeth Hill <lizhill @hotmail.com> (University of Leeds, England).

Recent exploration of phenomenology as a means of understanding/solving the measurement problem in Quantum Mechanics will be the subject of this paper. Here I shall examine the issues raised in Steven French's recent article 'A phenomenological solution to the measurement problem? Husserl and the foundations of Quantum Mechanics' in the journal 'Studies in History and Philosophy of Science' (Vol 33 2002), where French argues that London and Bauer's monograph 'The Theory of Observation in Quantum Mechanics' is heavily influenced by Husserlian phenomenology. French claims, reinterpretation of the measurement problem in this light leads to a dissolution of the problem of its 'collapse'as it is traditionally conceived. The theory he puts forward in this paper is that the 'collapse' of the wave function is not a physical process at all and the problem is dissolved through an explanation of the measurement process from a phenomenological perspective whereby 'we create for ourselves new

configurations of objects' and 'it is only in this creative act itself that the seperation between the I and the object occurs'.

However my paper will conclude that these phenomenological ideas do not go far enough towards solving the measurement problem, the major weak point of the arguement being the explanation as to why we have a collective scientific regard so that out of that scientific regard we all see the same thing.

This paper will present a solution to this problem by examining Schrodinger's philosophical ideas that there is a collective consciousness through which we view the world and furthermore it is a waste of time for us to pin down the place where the mind on matter or visa versa. We all belong to one consciousness and reality is not outside this consciousness in some way but is embodied within consciousness itself.

Phenomenology of scientific observation and paradoxes of measurement. Patrick Heelan <heelanp@georgetown.edu> (Georgetown University, Washington, DC 20057).

Husserl's Eidetic Phenomenology is used to analyse the perceptual 'constitution' of scientific data 'given' in measurement to a first-person individual observer (the experimenter, S1) and a related third-person individual observer (the observer of the measurement process, S3). A comparison of these outcomes leads to two paradoxical theses: I: Classical science necessarily entails 'complementarity' and 'uncertainty relations' between the observational outcomes of the two individual observers (S1 and S3) and the 'entanglement' of every datum with its observer, in ways formally identical with the structure of quantum physics. II: A quantum object is a physical object with footprints in the perceptual world, but lacks a space-time 'body' in the experimenter's space-time; it exists then ontologically prior to the 'constitution' of the experimenter's perceptual space-time.

The embedded molecule, self organization and quantum mechanics. Uziel Awret <awret@erols.com> (Science & Consciousness Review).

The emerging paradigm of 'embeddedness' claims that natural systems, especially organic ones cannot be separated from their immediate environment. The system and it's immediate environment co-evolve interactively. It is this compound system in which the relevant dynamic variables should be discerned (as in dynamic system theory.) An idealized analysis of the isolated system cannot explain it's properties.

In Consciousness studies we have Varela's "The embedded mind" or more recent work by Andy Clark on the embodied and environmentally embedded brain. In sociopolitical theories there is a shift from the mythical rational agent to the embedded agent.

Even in elementary particle physics something like en electron is really a collective excitation of the vacuum, a radical plurality that cannot be reduced or apprehended by a simple ontology.

We are witnessing a movement which can be called 'The denaturalization of the medium.' We cannot always treat the medium as the neutral and inert arena in which the theory unfolds.

Organic systems have always taken advantage of this principle and evolved in a way which took advantage of the latent predispositions of their immediate environment. As a matter of fact living systems will mold their environment in a way which improves their performance. Clark mentions experiments on Tuna fish which seem to suggest that the Tuna's fins store energy in its immediate surrounding in the form of vortices which it then utilizes to swim more efficiently than it should theoretically. (Based of course on a theory which considers the Tuna by itself.)

This paper will attempt to speculate on embedded molecules. For example, instead of simply considering a chunk of alpha helical protein by itself one considers it together with its immediate water environment and perhaps some other essential molecules like Ca++.

Such an approach raises an interesting question, suppose that we have a collection of self replicating molecules operating as dissipative, open systems far from thermodynamic equilibrium. What are the properties of the environment which such a collection would attempt to harness? We know that in a way it will do what it has to do to maximize its survival chances and that it exists in order to do just that. Can we circumvent this tautology and ask a more meaningful or useful question?

Well, there is a conjecture that we can make that is probably true at least for these early evolutionary stages. Those early systems evolved in such a way that they could absorb maximal amounts of useful, or low entropy, energy from distinct environmental sources (blue photons, hot geysers and what not) and transform this energy into useless high entropy energy better than the environment by itself. (According to the Virial theorem that energy will spread evenly over the available degrees of freedom of the system.)

What does Quantum Mechanics have to do with all this? If one follows Penrose "The Emperor's New Mind" one realizes that there is an important argument that can be used to bring Quantum Mechanics and Biology a little closer. if E=hv than a blue photon with frequency v can be converted almost instantly into a hundred near infra red photons with one hundredth of the frequency v. This means a sudden increase in the system's degrees of freedom and in its entropy. It is important because it suggests possibilities of self organization which are peculiar to QM. So perhaps instead of looking for systems with important information theoretic properties we should look for the mechanisms that could cause entropic cooling in biological systems since this is a prerequisite for self organization.

I will first mention thermalization in general (Fermi-Pastaulam) and than concentrate on a specific compound system - The Davidov Soliton + it's immediate water environment, and try to show that such an approach is essential for this type of problem.

I will also mention some recent results on the importance of hydrogen bonds to various properties of water (like phase transitions and the dissociation of salts in water) in general, to the embedded approach and to this specific model in particular.

Concurrent Session 6
Nonlocality

A quantum method to test the existence of consciousness. Shan Gao <gaoshan.iqm@263.net> (The Scientists Work Team of Electro-Magnetic Wave Velocity, Chinese Institute of Electronics).

As we know, "Who can be said to be a conscious being?" is one of the hard problems in present science, and no method has been found to strictly differentiate the conscious being from the being without consciousness or usual matter. In this short talk, we will present a strict physical method based on revised quantum dynamics to test the existence of consciousness, and the principle is to use the distinguishability of nonorthogonal single states (Gao,

1999b; Gao, 2000a; Gao, 2000b; Gao, 2001a).

According to revised quantum dynamics (Ghiradi et al, 1986; Pearle, 1989; Diosi, 1989; Ghiradi et al, 1990; Penrose, 1996; Gao, 1999a; Gao, 2000b; Gao, 2001b), the collapse process of wave function is one kind of dynamical process, and it will take a finite time interval to finish. We demonstrate that a conscious being may perceive the dynamical collapse time under the assumed QSC condition, thus can distinguish the nonorthogonal single states in the framework of revised quantum dynamics (The conclusion is irrelevant to the concrete perception of the observer in the superposed state). This in principle provides a quantum method to differentiate man and machine, or to test the existence of consciousness.

We further discuss the rationality of the assumed QSC condition, and denote that some experimental evidences have indicated that our human being can satisfy the condition (Duane et al, 1965; Grinberg-Zylberbaum et al, 1994). This not only provides some confirmation of our method, but also indicates that the method is a practical proposal, which can be implemented in the near future experiments.

Mindless sensationalism. Don Page <don@phys.ualberta.ca> (University of Alberta).

Mindless Sensationalism is a framework for laws of psychophysical parallelism connecting a quantum description of the physical world with the mental world of conscious experiences. It postulates that for each possible conscious experience or perception (or for each set of them if the set of all possible perceptions is a continuum, so that each individual experience has zero measure), there is a corresponding positive operator in the quantum theory. Then it further postulates that the measure for each perception (or for each set of them) is simply the expectation value of that operator in the quantum state of the physical world.

This framework is analogous to many-world quantum theory in that the quantum state is postulated to be fixed, never undergoing state reduction or "collapse of the wavefunction." However, instead of postulating many physical worlds, it postulates that what there are many of are conscious perceptions in a single quantum world, though the result is qualitatively similar to what would be the case if there were many different conscious perceptions in many different quasi-classical worlds. Nevertheless, there are no strictly defined sequences of perceptions in Mindless Sensationalism, so it is not a many-minds theory either.

In Mindless Sensationalism, there is nothing truly probabilistic about either the quantum physical world (which has a unique state and a determined set of operators) or the conscious perceptions, but of course one may consider the statistics of perceptions that are considered to be selected randomly from the set of all possible perceptions. It is proposed that one may in principle test any specific theory within this framework by considering the typicality of one's experienced perception in comparison with perceptions randomly chosen with the weighting given by the measure assigned by the specific theory to each set of perceptions.

On the nonlocal nature of the physical basis of consciousness. Ken Mogi <kenmogi@csl.sony.co.jp> (Sony Computer Science Laboratories).

One of the most puzzling features of the conscious experience is the apparent nonlocality of the neural correlates of percepts. Since every aspect of our subjective experience should be ultimately explained in terms of the mutual relationships between neural firings (Mach's principle), it logically follows that the elements of perception (a.k.a. qualia) are coded nonlocally in terms of the physical processes in the brain. The firing of a single neuron with a particular stimulus selectivity does not suffice. The neurophysiological data on the neural basis of color perception is compatible with the hypothesis that (e.g.) the quale of red is coded by the cluster of neural activity including those in V1 and V4. Despite this nonlocal nature of the neural correlate, we can subjectively perceive a red spot at a particular position in the visual field. This seemingly nonlocal to local mapping from the cortical activities to the percepts in subjective experience is one of the key features to be explained about consciousness.

One obvious way to account for the nonlocal nature of the neural correlates of conscious experience is to resort to the nonlocality in quantum mechanics. However, there are the obvious difficulties in spelling out how the quantum nonlocality can contribute. In addition to the decoherence problem due to high temperature, there is the essential problem of how one may make any quantum model of consciousness compatible with the wealth of experimental evidence on the correspondence between neural activities and conscious experience.

Here, I explore a possible account of the nonlocal feature of the conscious percepts based on a formulation similar to the "twistor" formalism developed by Roger Penrose. Specifically, it is assumed that the physical time required for the transmission between the neurons is neglected and mapped to a point in the psychological time (synaptic simultaneity). In addition, under certain conditions the physical distance between neurons are mapped to a point in psychological space, leading to a twistor-like geometry. These assumptions are shown to be compatible with the known experimental facts of neuropsychology.

A twistor-like geometrical mapping has the potential to explain some important aspects of the cognitive process, such as the binding of features (color, shape, motion etc.) within the framework of psychological space-time (the binding problem). This particular formalism can be formulated, on the surface, with or without quantum mechanical formalism. I discuss the relevance of the proposed formalism for the possible ultimate account (quantum or non-quantum) of the nonlocal physical basis of consciousness.

Do entangled systems share information non-locally? A key question for understanding the non-extended nature of qualia. Logan Trujillo <logant@u.arizona.edu> (Department of Psychology, University of Arizona).

Modern cognitive science conceives of the mind and brain as both energetic and informational processes. In the context of the "hard problem" of consciousness (Chalmers, 1996), information has been suggested as the ontological bridge between material processes and qualia. However recent arguments (Trujillo, 1999) questioning the relationship between information and energetic-material processes suggest that the spatiotemporal parameters governing informational dynamics need not be restricted to the ranges allowed for by energetic causation. This has significant implications for any theory of consciousness relating qualia and information because it suggests that qualia may be an entity quasi-localized in both space and time. The possibility of non-local information has well known consequences for key enigmatic features of consciousness such as the apparent spatial non-extension of the mind, phenomenal binding, and the possible existence of macro-

scopic non-local consciousness-related phenomena such as psi.

This presentation will examine the spatiotemporal (non-) locality of information from the context of the Einstein-Podolsky-Rosen Paradox and Bell's Theorem. Experimental investigations of these ideas have revealed that entangled quantum particles exhibit correlations violating the predictions of local hidden-variable theories. However it is generally believed that, at best, these correlations represent a non-causal "influence" between the particles, and that no information is shared or transmitted between them. This presentation will put forth a simple argument that an entangled EPR system does in fact carry information that is available to the particles for the governance of their behavior, but that the information is not available to observers outside the system at the time of external measurement. Using the mathematical concept of information-entropy, it will be shown that a measure of mutual information can be defined upon the entangled system, and that this measure is non-zero. Mutual information can be interpreted as a measure of informative interactions shared between the sub-components of a system, and as such does not depend upon reference to an external observer (Edelman, 2000). Hence the mutual information shared between the two particles may be considered as an objective, physically real property that is spread out across the system, analogous to the concept of potential energy in physics. The fact that the entangled system's mutual information is non-zero indicates that one may ascribe true physical presence of information sharing within the entangled system. Since comparison across particle measurements is necessary for any non-local correlations to be detected, the mutual information content of the system is not available to external observers at the time of measurement. However it will be suggested that this information is truly "global" in the sense that it is non-locally available to observers "within" the system (e.g., the particles), and as such may causally influence particle behavior in a limited manner.

This presentation will conclude with a brief discussion of the consequences of information non-locality for the key enigmatic features of consciousness mentioned above. In addition, this presentation will also present a simple mathematical model of a non-local information/qualia space. This model utilizes a functional metric based upon the concepts of information entrapment/amplification via autocatalytic closure (Gabora, 2002).

The use of probability fields in the defense of mind-body dualism against the critique of causal overdetermination. James van Pelt <james.vanpelt@yale.edu> (Yale University Divinity School).

The recent predominance of physicalism in consciousness studies can be traced in great measure to its efficacy in solving the problem of causal overdetermination emerging from the dualist model of the mental causation of physical interactions. In that sense, the strength of the case for physicalism results from its being the only plausible solution to that problem.

This paper explores the extent to which a prima facie case can be made for the plausibility of the intuitive understanding of the mind-body relationship--i.e. the commonplace experience of interacting causally as a mental being with the material world and with other persons, via the instrumentality of the physical body. Essentially this equates to the plausibility of interactionist dualism in regard to causality. Making this case depends upon the plausibility of an instrumentality of mental-neural interaction that avoids causal overdetermination by not resulting in the direct modification of the neural system by a non-material mental force, nor of the mental system by neurochemical activity. Instead, an intervening field must be identified capable of interfacing the two domains via a non-causal transmission medium. One candidate that has been proposed is the probability field of quantum mechanical physics. Another, derived from cybernetics, is the immaterial aspect of content expressed via physical media--a distinction related to the ancient discrimination of form from substance--encountered most vividly in the instrumentality of virtual reality.

The case is made first by considering dualism as it has appeared over the centuries and in the several recent varieties, focusing on the approach each version has taken to the question of psycho-physical interaction and the resulting problems concerning causality. Second, the major physicalist objections to dualism are considered, especially causal overdetermination, focusing on interactionist dualism as the most challenging case. Next, a set of basic guidelines is proposed for the development of a psychophysical functional model linking mind and body in a way that supports the plausibility of interactionist dualism in the modern context. Central to this model is the concept of the probability field, whose function in this regard was advanced by Sir John C. Eccles in 1988. The objective is not to present either a conclusive case for interactionist dualism or a detailed psychophysical mechanism for it. Instead, it is to make a case that interactionist dualism is a plausible alternative for explaining the mind-body relation, thereby contributing to the validation of the common-sense view of how persons experience the physical world and their own mental lives. In the course of making this case, simplistic notions of causality and materiality customarily implied by this stalemated debate are brought into question.

From quantum to complete consciousness. James Beichler <jebco1st@aol.com> (West Virginia University at Parkersburg).

The Orch OR model and other theories of quantum consciousness are not yet adequate to explain all the mysterious features that are usually associated with consciousness and could well prove inadequate to completely describe consciousness. The Orch OR model suffers the same fate as all quantum models of consciousness: Such models are, in principle like the quantum theory itself, incomplete, borrowing a term from Einstein. In particular, the quantum theories address only the individual local aspects of consciousness and not the more global and non-local aspects of consciousness. At best, they only explain how individual thoughts develop within the brain rather than the macroscopic aspects that many scientists associate with conscious thought. In other words, the present theories attempt to explain how consciousness interacts with the material brain at the quantum level on a molecular or even a neuron by neuron basis, but do not address the overall concept of consciousness as the complete collective product of a person's thoughts, dreams, memories and other "qualia" associated with mind. In their defense, scientists attempt to go beyond the inherent incompleteness of the quantum models by invoking the concept of entanglement, but entanglement is at the very least a misunderstood concept, if not completely undefined. There is no known mechanism for entanglement, so its application to the global problems of consciousness is no more than speculation at this point in time. Without a theoretical basis, entanglement is an unknown quantity within quantum theory. Outside the quantum domain it is known under its proper name of relativity, implying that science should turn to relativity

theory for a more complete understanding of consciousness than the quantum theory alone could ever provide. This is true even from the more philosophical perspective where consciousness either 'collapses the wave function' or otherwise chooses which single quantum state will manifest out of the infinite number of possible quantum states at any point in space-time. Therefore, whether consciousness creates physical reality itself or just the perception of reality in the brain, via quantum processes, it can be argued that consciousness must exist before and/or independent of the quantum process in the brain and any 'complete' theory of consciousness requires more than, or otherwise must go beyond, the quantum and the quantum view of physical reality alone. It is consciousness in this latter global respect that relates quantum consciousness to cosmology, and it is to this end that the other great modern theory of physical reality, relativity, enters the search for an explanation of the global features of consciousness. In particular, a single field theory of a type investigated by Einstein can be used to build a model of consciousness which is compatible with the Orch OR model, yet provides for quantum entanglement as well as the great complexity of global features of consciousness.

Concurrent Session 7
Experimental approaches

Photon emission studies in consciousness research. Eduard Van Wijk <meluna.wijk@wxs.nl> (Utrecht University, Utrecht, The Netherlands).

There is a need for techniques that quantitate collective phenomena and internal dynamic organization of living organisms. In studies on collective phenomena in cell populations the attention has been focussed on the characteristics of spontaneous and light-induced photon emission (delayed luminescence) of organisms and cells. Two types of studies that suggest inter- and intracellular collective behavior in cell populations are discussed. The first type deals with the anomalic inter-cellular behavior of the concentration-dependency of delayed luminescence in normal and tumor mammalian cells populations. The second deals with the delayed luminescence of single cells of Acetabularia acetabulum. In these studies anaesthetics like chloroform, isoflurane and sevoflurane have been used to suppress intra-cellular motility. Long-term delayed photon storage can be related to intracellular motility.

Spontaneous photon emission has been studied less often, most likely because its intensity is extremely low. Recently, in studies on spontaneous emission the Fourier spectrum analysis has been introduced for analysing photon count data. The most important conclusion for mammalian fibroblastic cells was that they have no detectable photon emission above the photon emission of culture medium. However, they are able to modulate the frequency spectra of photon emission of culture medium. The use of specific cytoskeletal inhibitors shows that modulation is dependent on the intactness of the cytoskeleton. Fourier spectrum analysis of spontaneous photon emission of A. acetabulum cells has presented evidence for cell-specific high frequency oscillations (with periods in the second and minute range). The main oscillations are related to the endogenous activity of the cytoskeleton. The latter characteristics were studied for their response upon, weak magnetic fields and healing intention.

It is concluded that the technique of photon counting, when highly sensitive, is appropriate for dealing with the dynamics of internal organization, in particular with the functioning of processes regulated by the cytoskeleton.

Delayed luminescence as a tool to investigate cell organization. Franco Musumeci <francesco.musumeci@dmfci.unict.it> (Dipartimento di Metodologie Fisiche e Chimiche per l'Ingegneria, Catania University), Agata Scordino, Antonio Triglia, Simona Carruba, Giuseppe Privitera, Maurizio Tedesco, Salvatore Tudisco.

In the last years a relevant experimental work conducted by researchers of different countries has outlined the possibility to connect phenomenologically changes in the physiological state of biological systems to the changes in the low-level luminescence they emit on being illuminated. This luminescence is known in Literature as Delayed Luminescence (DL), due to the long duration that typically occur after the stimulating light has been switched off. Moreover such results have produced notable interest for the application potentialities of DL measurements as technique for environmental control, food quality test and clinical diagnosis.

In order to give a deeper glance in the mechanism of DL phenomenon, the effects of reversible or irreversible disorganization of cytoplasm in unicellular alga, by using freezing-thawing procedure, anesthetic incubation and calcium influx change, have been studied.

Results of the tests showed that DL changes are closely connected to the highly organized and hierarchical arrangements of molecules in cells. In this respect DL results could be a possible evidence of the metabolically excited coherent excitations which H. Fröhlich hypothesized at the base of the functional order of active biosystems through the establishment of collective properties of the whole biological multi-components system.

The idea is that long time involved in DL measurements let to gather information about energy transfer pathway from more distant molecules, so taking into account for log-range interactions.

Moreover the similarity evidenced in the DL responses of biological and solid state systems related to the "grade of order" present in the structures, pointed at the idea that the phenomenon can be connected to the existence of collective electron states and challenged the authors in applying a Davydov's soliton model to explain DL results from a theoretical point of view.

In the end, experimental and theoretical results of DL show the possibility of using DL measurements in order to closely investigate the energy and information transfer mechanisms in biological systems letting to study the biophysics of a living organism as a whole complex system, and to prove that properties of living beings ultimately rely on and are determined by the law of physics.

Environmentally tuning molecular motors that replicate DNA. Anita Goel <goel@physics.harvard.edu> (Dept. of Physics, Harvard University and Harvard-MIT Joint Division of Health Sciences and Technology)

Recent developments in biophysics have made it possible to invesitgate the dynamics of molecular motors that replicate or trascribe DNA at the single molecule level. We will explore some the latest information being gained by such experiments. We will also propose some theoretical and conceptual frameworks that not only aid the interpretation of these experiments but may also add conceptual insight into how environmental parameter can influence this propagation of genetic information. Time permitting, we

hope to brainstorm with the multidiciplinary audience present how this experimentally grounded area might enable us to explore some of the underlying "deep" questions that that have inspired the emerging field of Biological Physics.

Toward testable hypotheses of neuro-dynamic and quantum field mechanisms underlying anomalous conscious states. James Lake <egret4@mindspring.com>.

Classical explanations based on strictly biophysical models, cannot potentially explain core features of anomalous conscious phenomena including shared information under conditions of sensory shielding, so-called "distant healing," and others. Several theories of anomalous conscious experience have emerged from different interpretations of the role of quantum mechanics, and especially quantum field theory, in brain functioning. It has been suggested that so-called "subtle energy" therapies, including QiGong, prayer, meditation and other forms of directed intention result in therapeutic changes in brain processes that are analogous to highly ordered neuro-dynamic changes induced by EEG-biofeedback or magnetic stimulation, and these "energy medicine" techniques operate at the level of complex interacting quantum fields. Recent brain imaging studies have shown that so-called "energy medicine" practices affect different functional brain parameters, including EEG frequency, power and phase coherence, and appear to be correlated with above-chance rates of biomagnetic regional and inter-regional coherence using fMRI or PET. These findings suggest a therapeutic mechanism analogous to induced electromagnetic changes in the brain achieved during EEG biofeedback. It follows that certain evoked physico-chemical or biomagnetic patterns of brain functioning, including sustained coherence in specific EEG parameters, are possibly correlated with, or "evoke," certain kinds of anomalous conscious phenomena at above-chance rates.

Until now direct effects of "subtle energy" healing methods have not been identified or measured and their underlying physical or physiological mechanisms have not been elucidated. Case reports suggest that anomalous conscious events are more often elicited during certain EEG biofeedback protocols, for example alpha-theta training. However, rigorous studies have not been conducted to determine whether reported anomalous experiences occur at above chance rates during or following EEG biofeedback sessions using specified protocols, or whether correlations exist between anomalous conscious states and specific EEG-biofeedback-induced features. Following the work of Zylberbaum, Walach et al, Thaheld, and others, this paper reviews evidence from both classical and quantum models pertaining to anomalous conscious experiences with the goal of advancing a testable hypothesis that certain anomalous features of consciousness, including telepathy, clairvoyance and the capacity to effect "distant healing," can be enhanced or reinforced using EEG biofeedback, and that these neuro-dynamic changes are verifiable using functional brain imaging technologies.

A survey of EEG-biofeedback practitioners and equipment manufacturers will be undertaken to demonstrate the frequency of reports of anomalous conscious experiences in the context of EEG biofeedback, and the strength of correspondences between specific kinds of anomalous effects and neuro-dynamic states achieved using specific protocols. Following analysis of survey data, testable candidate hypotheses will be advanced about causal relationships between specific induced neuro-dynamic states and specific anomalous conscious phenomena. Hypotheses will be constructed to be falsifiable with respect to experimental evidence using available validated technologies for measuring changes in brain function. The paper will conclude with specific suggestions for pilot studies and controlled clinical trials that will refute or confirm the hypotheses derived from survey results in the context of a focused review of the literature. The general goal of proposed studies will be the elucidation neurobiological or quantum mechanical mechanisms underlying anomalous conscious states associated with EEG biofeedback.

Quantum mechanistic event associated with electron flux migration through a semiconductor substrate and the conscious perception of reality. Charles Victor Davis <cdavi5@jpl.nasa.gov>.

In our quest to build the tool sets we need to achieve our technical goals, or at least further the functionality, and understand the subject matter of choice within the applicable fields of study. One has to appreciate the plethora of mechanisms all inclusive of trying to prove proof-of-principal concepts and the convincing of ones' self of determining the conscious reality of a particular event. It is this forum the intersection of disciplines crosses over to the subject matter hopefully is realized, and of course questioned.

The author wishes to present and qualify terms in conjunction with observations in order to establish conclusions associated with the data presented. The data presented is a representative model of the demonstrated laws* physical and quantum forms in nature. In the primary case RS170A video was captured as the main data set presented to demonstrate real time* electron flux migration through the substrate and surface structure of an interline transfer CCD (Charge Coupled Device). Two static bit mapped pictures, (Pic#1 and Pic#2) are included with this abstract.

The recorded event demonstrates a few representative mechanisms of quantum motion generated from electronic charge migration propagating through a substrate of silicon. A system of imaging a interline CCD "Hot Pixel", and reading out the video in real time creates a most intriguing dataset of images. Patterns that are fractal at first glance, but appears to be molecular in form, and possibly an ideal representation of "Real-Time" electron flow. As shown in Pic#1 a baseline position is determined from the odd to even raster noting that each state changing as a function of position and time with the Pic#2 being the next exact frame in the sequence of capture.

The history of the work was the culmination of a few projects and disciplines of study. One application was to create visual effects. Actual source footage of work was created for a special effect using RS170A for video mask mapping*. Using an unpredictable system, complex, and non-linear in nature, a custom imaging system was configured to record different conditions with the signal chain controlling feedback and control.

Time base errors and distortions were introduced to create resultant (if any) differences. Monochrome sources were needed to reduce the data sets and therefore have a higher resolvable throughput of data.

Of course, with the characteristic of unpredictability, the results have to be reversed engineered to clearly understand what is happening in the static and dynamic data. That is also the purpose of submitting this paper. Without unbiased (and biased), but purely subjective outside party interpretation, the facets of all what in involved may surface discontinuities, and therefore a higher

level of integrity is achieved to qualify reality in determining what actually is happening in the images.

Universal spintronic device for manipulating quantum information. Afzal Kamboh <m.afzal@ieee.org> (Spins Research Group, Department of Electronics and Tletcommunication Engineering, Mehran University of Engineering and Techonology, Jamshoro 76062, Sindh Pakistan.), B.S. Chowdhary, A.R. Memon.

The model of universal Spintronic device is proposed in our paper, which not only can manipulate quantum information but also can perform logic operation. The proposed model consists of three horizontal and three vertical layers of semiconductor and ferromagnetic semiconductor materials. Thus it forms a array (qunatum cube named as say [A]) of 3 by 3. Three different elctrons, all having different precessional characteristics thus possessing quantum information, are forced to enter the array elements labelled a11, a21, a31 (region 1) with the application of external electric field. The elements a11, a21, a31 consist of semiconductor material p-type (or n-type). The electrons then enter into region 2 (a12, a22, a32)where suppose any one of the electrons has lost its precessional characteristics depending on the strength of electric field that has pushed it into the region 1. If, for example, the electron which entered into the element a11 has lost its precessional characteristics (due to weak electric field) in its corresponding element a12 in region 2, the elctron will adapt the precession of any one of the two electrons say of electron in a21.

The region 2 consists of ferromagnetic semiconctor. Now is the job of region 3 which starts here. The region 3 is a ferromagnetic material which is separated from the region 2 by magnetic tunnel junction. It compares the spins in region 2 & 3 and will allow only those electrons whose spins are matched on both sides. Thus element a13 of region 3 does not get any electron, because its corresponding electron lost its precession in region 2. Hence two operations have been performed. First, a logic operation: an empty a13 element represents logic low '0' for the voltage that pushed the electron in the element a11 of region 1. Second, spin flow has been amplified in the element a23 because it gains the electron from a11. Thus amplification can be acheived by decreasing the electric field contrary to conventional transistor. We have also derived the equation for how to increase time for electrons to maintain their precessional characteristics in the region 2 to allow region 3 to compare spins.

Concurrent Session 8
Mathematical and physical approaches

Organised complexity and quantum mind. Brian Josephson <bdj10@cam.ac.uk> (Department of Physics, University of Cambridge).

Our understanding of nature has involved appreciation of its different levels of intractability, going from Newtonian (calculable) science, through chaos to complexity. Currently scientists are trying to tackle the problem of organisation in complex systems, including such aspects as functionality and cognitive processes. Hopefully, an understanding of quantum reality, the role of mind in nature, and paranormal phenomena, will emerge out of such considerations.

Chaos, quantum-transactions and consciousness: A biophysical model of the intentional mind. Chris King <king@math.auckland.ac.nz> (Mathematics Department, University of Auckland).

The nature of subjective conscious experience, and its consequences in intentionality, remain the central unsolved problem in science and one of critical importance to humanity's future as sentient observers and autonomous participants in a world history we are coming to have ever more pivotal influence upon. Each of us who read this paper are subjective conscious observers, making an autonomous decision to carry out a volitional action. All our knowledge of the physical universe is gained through the immediate conduit of our subjective experience and our intentionality in turn has major impacts on the physical world around us.

To understand how the subjective aspect arises requires both a radical investigation down to the foundations of physics and an understanding of how subjective awareness, as opposed to mere computational capacity, may have become elaborated by Darwinian natural selection. We thus have to find reasons why subjectivity itself, rather than computation alone, is of pivotal importance in organismic survival. The answer lies in its capacity to anticipate situations crucial to survival. For this to be possible, the foundations of physics must contain a principle of space-time anticipation not covered by any mechanism of computation alone, or subjectivity would become superfluous and would have never been selected for in evolution. This paper sets out to demonstrate how quantum transactions universal to all quantum phenomena may fulfil this pivotal role.

The role of dynamical chaos and bifurcation in neurodynamics has been the subject of an increasing volume of theoretical and experimental research in which transition from chaos to order may form a key process in perception and cognition. There has also been a continuing interest in the possible link between quantum non-locality and consciousness. This paper presents a two-part theory in which: (a) a fractal link between neurodynamical chaos and quantum non-locality; and (b) a complex system theory of the sub-quantum world; together provide a physical solution to the mind-brain paradoxes of subjective consciousness and free-will.

The fractal link between dynamical chaos and quantum uncertainty is proposed to be made through overlapping non-linearities capable of chaos, running from the neurosystems level down through the neuron, synapse, to the ion channel. Chaotic systems possess sensitive dependence, and brain states also contain features of self-organized criticality. In a critically poised brain state representing uncertainty of outcome, it is proposed that sensitive dependence opens the brain to quantum processes. In the transactional interpretation of quantum mechanics, future states form part of the boundary condition of reduction of the wave packet. Transactional supercausality may allow a form of prediction in the excitable cell which bypasses and complements formal computation. The selective advantage of such a process would explain the emergence of consciousness in organismic evolution.

This work continues that in the invited papers

King, C.C. (1996). Fractal neurodyamics and quantum chaos: Resolving the mind-brain paradox through novel biophysics. In E. Mac Cormac and M. Stamenov (Eds.) Fractals of brain, fractals of mind, Advances in Consciousness Research, 7: John Benjamin.

King, C.C. (1997) Quantum Mechanics, Chaos and the Conscious Brain, J. Mind and Behavior, 18 155-170.

Fractal compression algorithms: Implementation of brain and machine consciousness. Erhard Bieberich <ebieberich

@mail.mcg.edu> (Institute of Molecular Medicine and Genetics Medical College of Georgia).

Consciousness may be distributed throughout the brain or localized in single neurons. Localized consciousness requires a robust compression algorithm that feeds single neurons with globally processed information. Recently, I have reported a contraction mapping operation that emerges from recurrent fractal neural networks (RFNNs). In RFNNs, the local dendritic input pattern (active spines) of any single neuron contains the downscaled version of the global network output structure (active neurons) [1]. Fractal compression can map the dendritic input pattern onto a molecular substrate thereby linking the network output to molecular computation within single neurons. This includes quantum physical effects that are stabilized by the fractal structure of their biological substrate [2]. I will argue that the interaction of neural and molecular correlates of consciousness relies on fractal compression algorithms that emerge from RFNNs and biological substrates with intrinsic fractal structure (e.g., cell membrane, cytoskeleton). These biological substrates are unique in that they are not simply replaceable by any electronic device. Neurons that are connected to microelectrodes (neurochips) may thus be the first step toward the implementation of machine consciousness. I will discuss promising results from our laboratory that show the feasibility of the fractal neural network-to-neurochip approach for the generation of consciousness in bioelectronic hybrid structures [3].

1.Bieberich, E. (2002) Recurrent fractal neural networks: a strategy for the exchange of local and global information processing in the brain. Biosystems 66, 145-164.

2.Bieberich, E. (2000) Probing quantum coherence in a biological system by means of DNA amplification. Biosystems 57, 109-124.

3.Bieberich, E. and Guiseppi-Elie, A. (2003) Neuronal differentiation and synapse formation of PC12 and ES cells on interdigitated microelectrode arrays: Contact structures for neuron-to-electrode synaptic transmission (NEST). Biosensors and Bioelectronics, submitted.

The math over mind and matter. Douglas Matzke <matzke@IEEE.org> (Lawrence Technologies, LLC), Dr. P. N. Lawrence.

Large numbers of an emergent statistical data token object called a "corob" are now known to exist in both systems of living neurons and systems of non-entangled quantum states. Each corob has strong error-correcting properties. A corob retains its identity in the noisy environment of living neurons. It also retains its identity as it passes back and forth between classical and quantum domains. This robust identity allows each corob to be used as a unique "soft token" to represent information. Collections of corobs also form computing systems with unique, living-system-like characteristics.

The term "corob" stands for Correlithm Object, or Correlational-Algorithm Object and was coined to encourage people to think about neurological computing from a completely novel perspective. Comprehensive patents on these concepts are issued and pending, and Lawrence Technologies LLC is also developing a Corob Programming Language to facilitate corob modeling and applications development in both artificial intelligence and quantum computing. The US Air Force is funding a further exploration of quantum corobs.

We find it remarkable that the same statistical data token object, the corob, should emerge from two of the most mysterious things known, living neurons and quantum states. Even more remarkable is the fact that the corob can be employed to process information uniquely, effectively and in the same basic way in both systems. The three key properties that enable this are 1) the emergent yet intrinsic properties of very high-dimensional bounded spaces, 2) static yet "soft" data tokens (or corobs) statistically emerge from purely random processes as found in both neurological and quantum processes, and 3) corob soft tokens encoded in the quantum domain survive measurement. We therefore propose the corob as the mathematical "link" between Quantum Mind and Gray Matter.

The concept of irreducible field applied for consciousness understanding. Michael Lipkind <michaell@moag.gov.il (work); lipkind@macam.ac.il (home)> (1. Molecular Virology, Kimron Veterinary Institute, BEIT DAGAN, 50250 Israel; 2. International Institute of Biophysics, Neuss-Hombroich, D-41472, Germany).

Recently suggested theories of consciousness based on irreducible field principle ("Mental field" by Libet and "Unified conscious field" by Searle, together with "Morphic resonance" by Sheldrake,) have a claim on immediate connection with the main consciousness riddle – the psycho-physical gap – lately formulated as the 'Hard Problem' (Chalmers, 1995). Namely, the Chalmersian concept of 'extra ingredient', which, ac-cording to definition, is additional to the physical fundamentals, is compatible with the postulated field ir-reducibility in the above theories. Hence, it is tempting to analogize such still undefined 'extra ingredient' with the well-established and comprehensively defined field principle, which is the most universal notion involving the whole physical world from elementary particles till cosmic level, such profound generalization of physical reality being based on the strictest formalism (equations by Maxwell, Lorentz, Einstein, Lagrange, Schroedinger). The modern theoretical summits based on hyperdimensional spaces (Pagels, 1985, Kaku, 1994) including 'reflection space' and 'catastrophe structures' (Sirag, 1996) were terminated by the Ultimate Theory of Everything based on 'superstring revolution' that resulted in "a quantum-mechanically consistent description of all forces and all matter" (Greene, 1999). Naturally, such Theory may induce hope that this "Everything" must include Consciousness as well. However, since the Ultimate Theory a priori is based on physical fundamentals, it is questionable whether it has potentiality for deduction of such non-physical entities as various consciousness manifestations (experience, awareness, intention, volition, imagination, etc.). Therefore, namely an autonomous field theory of consciousness based on irreducible fundamental(s) is hoped to enter as an integral part into a comprehensive picture of 'The Elegant Universe' (Greene, 1999). However, in the above theories, the word 'field' has purely symbolic meaning emphasizing either non-locality of consciousness or its continuity, while declared irreduci-bility of a hypothetical field does not free it from subordinating to axiomatic postulates inherent to any field irrespective of its physical nature (e.g. action-at-a-distance, unboundedness, continuity, directionality, measurability). Such vague allegoric use of the great principle leads to its devaluation as ontological entity and explaining factor, that resulting in either esoteric speculation (Sheldrake), or purely tautological defini-tion (Libet), or vapid metaphoric description (Searle). The suggested positive alternative of using the irre-ducible field concept for explaining consciousness is based on the field theory elaborated by Alexander Gurwitsch (1944).

Here, the notion of the autonomous irreducible field is neither tautological, nor meta-phoric, being grounded on strictly defined postulates deeply rooted in biological reality. These postulates concern vectorial repulsive character of the field, field anisotropy, concept of elementary field "flash", field sources, mechanism of the field influence upon molecular substrate within living cell, formation of integral microfields and macrofields, dynamics of field tension. The field influence is realized at morphological, cellular, and molecular levels of living systems. Further development of Gurwitsch's field theory as applied to consciousness problem (Lipkind, 1996, 1998, 2000, 2003) has resulted in elaboration of the concept of 'geometrical feeling' as irreducible protophenomenal fundamental, which meets all the formal demands to physical fundamentals, being elementary (further unsplittable), axiomatic (further unquestionable), strictly and unequivocally defined, qualitatively uniform (homogeneous), and measurable.

Virtual stability and the quantum mind. Burton Voorhees <burt@athabascau.ca> (Athabasca University).

A system exhibits virtual stability when it utilizes self-monitoring and adaptive control to maintain itself in a state that would otherwise be unstable. The cost is a small but ongoing energy expenditure. The advantage gained from this is a significant increase in behavioral flexibility. Thus, to the extent that increased flexibility and the ability to quickly adapt to environmental contingencies is advantageous, there will be a selective bias in favor of the evolution of systems with the capacity to maintain virtually stable states. In this presentation we consider the possibility that certain quantum systems may utilize virtual stability by maintaining themselves in a superposition of states until an advantageous moment for collapse arises. We consider how the virtually stable state might be maintained in the face of decoherence effects, and how the nature of the collapse might be partially controlled. In both cases it is argued that the role of consciousness is essential.

Poster Sessions

1, Experimental approaches - Non-locality

Electromagnetic detection of non-local mind-energy interaction. Gabriel Aramburo <gabrielaramburo1@epm.net.co> (Inmente. Biocomp Research Institute, Minkind Research Foundation, Psychotronics Research, Alma-Ata University).

During 20 years we have been doing experimental research following after Cleve Backster's experiments with plants. We have been using extremely sensitive equipment manufactured by the Biocomp Research Institute of Los Angeles, hold a cordial friendship with Hershel Toomim and Bob Marsh (directors), and we believe we are now used to understanding their bio-feedback devices. Their equipment has been our technological basis to support our proposal.

As a matter of fact, we do believe Hershel does not pay attention to the fact of how far his machine can go beyond its main purpose of detecting very small physiological signals to perform clinical biofeedback tasks.

His equipment being extremely sensitive, we have adapted it to detect some other phenomena beyond the physiological. In other words, we have harnessed its sensitivity capacity to try to detect electromagnetic phenomena beyond the clinical environment.

Counting on this tool, then, many years ago we applied ourselves to the task of detecting some kind of computer-electromagnetic results that might be a consequence of mental or consciuos activity. Our hypothesis has been that consciousness activity somehow has to interact with some range of the electromagnetic spectrum. Also, that the electromagnetic means of information transportation could eventually carry mental signals.

Although that has been only a hypothesis, or an intuition, we have never stopped experimental sessions devoted to confirm that relations.

So far, we have conducted more than 2.000 measurements of this kind of interactions, and to date we are fully convinced that THERE IS A CLEAR INTER INFLUENCE RELATING MIND ACTIVITY and electromagnetic response of some kind, at least utilizing said Hershel's devices.

To our team, one conclusion is that IT HAS TO EXIST some conciouss way to communicate with electromagnetic devices. The responses our computers detect are clear enough to prove how individual and collective mental activity do affect electromagnetic devices.

Interestingly enough, we have always connected either a plant (following after Backster) or a human individual (following our own intuition) to the computerized electromagnetic arrangement. Watching the results have always been spooky and amazing. So far, we have it clear THAT THERE IS SOMETHING detectable, consistent, easily observable by means of current sensitive machines, that connects aspects of the mind with the electromagnetic field.

We find it interesting to report our data to the scientific community. We believe we understand the quantum nature of these phenomena, the strange reactions of the equipment and the clear responses it renders.

Our abstract, then, intends to report that the available electromagnetic computerized technology is able to contribute to the demonstration of interactions between the mind and the electromagnetic domain. This situation might eventually add evidence to the alleged theory of conscious/mental quantum influences over the energy/matter model of reality.

Trait absorption and treatment choices in fibromyalgia patients under double-blind conditions: Implications for Walach's entanglement model for homeopathic remedies and placebo. Iris Bell <irbellmd@aol.com> (Program in Integrative Medicine, The University of Arizona College of Medicine), Daniel A. Lewis II, Sabrina E. Lewis, Audrey J. Brooks, Carol M. Baldwin, Gary E. Schwartz.

From studies on the complementary and alternative medicine (CAM) modality of homeopathy, Walach observed that individuals assigned to placebo conditions under double-blinding may nonetheless experience effects unique to the active remedy chosen for them (intentionality), but not physically administered. Consequently, he proposed a nonlocal, acausal understanding of homeopathic remedy effects from the standpoint of macro-entanglement. The personality trait of absorption, i.e., the openness to shifting total attention into self-altering experiences, could contribute to experiencing intended homeopathic remedy effects in active and placebo conditions. Higher scores for absorption correlate with greater CAM utilization, intrinsic religiosity, hypnotizability, and experiences of psi phenomena.

The present study was a 6-month randomized, double-blind,

placebo-controlled feasibility trial of classical homeopathy in fibromyalgia (FM) patients (mean age 50+-11 yrs; 94% women; FM duration 13+-13 years). All patients were evaluated simultaneously by 2 experienced homeopaths. An individualized homeopathic remedy was chosen for 62 patients at a confidence level >7/10. The pharmacist dispensed number-coded bottles for either active or placebo LM daily doses using a randomization protocol. After 4 months, patients could choose optional crossover to the other group, under continued double-blind conditions. Forty-nine patients (79%) completed the study (15% dropped before and 6% after the switch decision; comparable between groups). Active and placebo groups did not differ in percentages electing to switch to the other group (overall rate=19/53 [36%] switched). The subset who stayed with active or placebo assignments were significantly higher in trait absorption than those who chose to switch groups (Staysame group: 20.97+-6.14; Switch: 16.33+-8.03; p=0.024). The Staysame and Switch groups did not differ significantly in age, sex, FM duration, Marlowe-Crowne Social Desirability, or Barsky Somatic Amplification. Covarying for absorption, education, and childhood emotional neglect, the Staysame group exhibited significantly greater improvements at 6 months than did the Switch group for McGill Affective and Sensory Pain ratings, Appraisal of FM for illness adjustment, Profile of Mood States Vigor, and global ratings of physical health, with similar trends at 3 months. Overall, absorption correlated significantly with the Limbic Symptom Checklist total score (a measure of temporal lobe symptomatology)(r=0.37, p=0.003) and JAREL Spirituality 'Faith' subscale (r=0.33, p=0.009). Absorption correlated with the change in global physical health at 6 months (r=0.41, p=0.005), but not with other improvements. The Staysame active remedy subgroup did significantly better than the Staysame placebo subgroup at 6 months for improvement in Affective Pain (p=0.029), Appraisal of FM (p=0.01), and global physical health (p=0.005). Taken together, the findings indicate that FM patients who choose to stay with randomly-assigned, blinded active or placebo treatment have increased scores on trait absorption and are clinical responders. Although absorption has some heritable features and may relate to limbic function associated with certain altered consciousness states and spiritual experiences, absorption does not appear to correlate with most clinical outcomes. For those staying with their randomized assignments, active remedy has an advantage over placebo. The data suggest a need to explore additional factors in positive responses to homeopathic remedies and placebo within the macro-entanglement model.

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Experimental program on mind-matter interrelationships. Edmond Chouinard <edmeasure@aol.com> (Measurements Research Inc).

A directing consciousness is seen to correlate with infinitesimal physical movements and amplitude changes among the random fluctuations of a flower. Mind-Matter Interrelationships between two conscious entities are seen to couple information and transfer energy, a dynamic and repeatable phenomena that ultimately needs some kind of a non-local quantum explanation. Such information and energy transfers are here considered to be the result of superposition of many distinct subtle states of consciousness arising from combinations of invocational soundings and various mental protocols involving visualization, imagination, contemplation, concentration, meditation, and transcendence.

An experimental program collects large amounts of real-time analog data from dozens of sensors to correlate external physical parameters relative to the affectations of one consciousness upon another consciousness, at a distance. The movement of flowers and the magnitudes of their random fluctuations are found to vary as a function of the nature of directed mental protocols. A perturbation in conscious intent or state of being is thus seen reflected through empirical measurement instruments. With focus directed toward energy transformations, Mind-Matter Interrelationships can thus become visible through the use of the tools of the physicist.

Micron size movements are monitored via precision laser-electro-optical systems to microinch resolutions. Instantaneous temperature fluctuations are monitored to milli-degrees. A variety of physical and physiological sensors at both source and target sites connect via redundant differential measurement and synchronous amplifier techniques to assure high quality experimental integrity with low level signals. Multi-computer automated measurement systems assure repeatability all the way from data retrieval, to data processing, to data presentation.

Distant intentionality on biological systems and healing at a distance (DH). James Hurtak <jjh@affs.org> (Academy For Future Science).

The topic of distant healing (DH) or healing intentionality through different states of consciousness brings some of the most controversial and central questions on the meaning of existence to the area of consciousness studies and the brain. Since the research of Andrija Puharich, M.D. and John Fuller in the 1970s the scientific community has largely ignored the subject or approached it through the perspectives of psychophysiology and psychoimmunology. The increasing disenchantment of many Westerners with prevailing materialist-reductionist philosophies, coupled with a growing interest in techniques for improving human life such as using meditation and prayer for healing has meant that many thinkers are seeking an understanding of mind, not as a by-product of bio-mechanistic processes, but mind as a product of consciousness itself.

The subject of distant healing (DH) will be examined through the pioneering efforts of Elisabeth Targ, M.D. and recent methodology studying distant healing in North America, Brazil and the Mauritius Islands. Here defining the intention will be analyzed by case studies recorded on film outlining a type of consciousness-mediated causality connected with positive affirmations.

EEG evidence of neural signal transfer between distant subjects who have undergone primordial sound meditation (PSM) training. Leila Kozak <leilak@bastyr.edu> (Bastyr University Research Institute), L. Clark Johnson (NeuroResearch Services), Todd Richards (NeuroResearch Services), Heather King (Bastyr University Research Institute), Leanna J. Standish (Bastyr University Research Institute), Marilyn Schlitz (Institute of Noetic Sciences), David Simon (Chopra Center for Well Being), Deepak Chopra (Chopra Center for Well Being).

Purpose: The purpose of this study was to determine whether brain activation triggered by a visual stimulus in one subject of a pair could be detected in the unstimulated member of the pair when subjects were physically and sensory isolated from each other.

Methods: Simultaneous digitized EEG were recorded from 8 pairs of healthy human adult subjects using a "sender/receiver" paradigm. All subjects had undergone training in Primordial Sound Meditation (PSM) and followed a meditation protocol for 30 days previous to the experimental sessions. Pairs were tested in three consecutive visits. Each of those visits included 2 sessions in which both members alternated roles as "sender" and "receiver." During each session, the sender was presented with a series of six alternating stimulus-on and stimulus-off conditions. The stimulus-on condition consisted of a flickering black and white checkerboard pattern presented at the rate of 1 per second. The stimulus-off condition consisted of a static checkerboard pattern. Receiver EEG data collected during the stimulus-off condition were used to construct a within-subject control statistic by which to compare EEG data collected from the receiver during the sender's flicker condition. Data were analyzed using three statistical techniques that were sensitive to three different activation measurements. An alpha spectrum test was used to identify changes in alpha power in the receiver's brain that may be correlated to the sender's flickering condition. A runs test was applied to compare EEG 'hits' in the receiver's EEG that would correlate to the sender's flicker condition. An amplitude/variance algorithm was applied to determine whether brain activation during the pre-selected 80-180 msec interval in the receiver was higher when the sender was visually stimulated compared to when he/she was not stimulated. Subjects whose test results reached p values < 0.01 in any of the three statistical tests were considered to provide evidence of a correlated brain signal associated with their sending partner's flicker condition.

Results: Results differed on all 3 statistical tests. Of the 16 subjects tested, 5 subjects showed significantly higher brain activation associated to the sender's flicker condition in the alpha spectrum test ($p < 0.01$) while 3 of those pairs were able to replicate the results. For the Runs test, 2 subjects showed significantly higher brain activation associated to the sender's flicker condition ($p < 0.01$) and only 1 subject showed significantly higher brain activation associated to the sender's flicker condition ($p < 0.01$) for the Amplitude/Variance test.

Discussion: These EEG results indicate that in some pairs of healthy subjects a signal can be detected in the brain of a physically and sensory isolated member of the pair when the other member is visually stimulated. The fact that correlated signals were found by all three statistical tests indicates that signal transfer phenomena may not strictly involve the transfer of visual evoked potentials (VEP's). Although these data represent a rigorous demonstration of correlated event related potentials between human brains at a distance, further replication is warranted to assert the nature and extent of these anomalous findings.

Effects of amethyst crystals upon QEEG. Lewis Mehl-Madrona <mehlmadrona@aol.com> (University of Arizona Department of Psychology Center for Frontier Medicine in Biofield Science and Program in Integrative Medicine (Department of Medicine)), Daniel Lewis, Sabrina Lewis, Iris Bell, Gary Schwartz, Scott Ferrell.

Since antiquity, crystals have been thought to be healing. In Native America, crystals were thought to store healing energy and then release that energy when worn or used in healing practices. The Cherokee were especially adept at the use of crystals for healing. Modern science has tended to discount the use of crystals as frivolous, superstitious, or New Age drivel. Methods now exist, however, to document the effect of crystals upon the brain -- that of Quantitative Electroencephalography. Studies show specific QEEG characteristics of depression and how depressed people respond to placebo treatment and medication treatment -- similar but different response sets. QEEG studies also exist to document reliable changes when shamans enter a state of possession in the Balinese trance possession ceremony. What these studies share are brain mechanisms involving theta rhythm, particularly in the frontal cortex. A QEEG measure that integrates relative and absolute power, called cordance, is also involved, especially with frontal theta. Cordance is the best EEG predictor of cerebral blood flow. Concordance refers to a state of brain characterized by cordance symmetry. We present pilot data showing that the use of an amethyst crystal during a healing ceremony has demonstrable effects on the QEEG, with changes in relative power in frontal theta, theta cordance in frontal lobes, and increases in occipital alpha. We suggest that crystals function in a similar manner to homeopathic remedies through storing information in their molecular structure and transmitting this information during use. We speculate that this information transfer represents a non-local, quantum process, with QEEG emerging as a potential biofield marker to document the interaction of non-local quantum-level processes with the physical biological realm.

Systems science, psychiatry, and non-locality. Lewis Mehl-Madrona <mehlmadrona@aol.com> (University of Arizona Department of Psychology Center for Frontier Medicine in Biofield Science and Program in Integrative Medicine (Department of Medicine)).

How would psychiatry be practiced in quantum mind is real? How would we reinterpret common psychiatric phenomenon in a quantum universe. Could schizophrenia be re-conceptualized as a non-local transfer of information without the usual filtering mechanisms of ordinary consciousness. Studies exist documenting unusual instances of information transfer. In this presentation, the author proposes a re-visioning of psychiatric science to match the concept of quantum mind. In this re-visioning, the thoughts and intent of the treating practitioners are as important as those of the recipient patient, since we must assume that all these factors are immediately available to the larger system in which treating physician and patient are both points in a curved topological space interacting where fields are defined that allow them to do so. Within this conception of treatment, we realize that the larger systems in which patient and physician are embedded and entangled must always be considered, and that, consistent with chaos theory, subtle interventions, can be magnified until systems are moved to far from equilibrium conditions. The transition into healing and the transition into sickness both represent such far from equilibrium conditions, with health and illness serving as attractor basins that may have large energetic separations. Within this framework, we can no longer perform linear science, since small interventions may have large effects and large interventions may dampen the system. Likewise, intervention on multiple levels may be required to achieve a synergy to overcome thresholds for energetic activation. The methods of quantum physics for measurement and consideration of measurement devices may need to be modified to psychiatry to serve as a philosophy of measurement that includes the persons performing assessments as part of an entangled system

with the persons or systems being measured. Implications for further research to document and substantiate these concepts are discussed.

Bioenergy detection and biofield entanglement: The role of awareness training and individual differences in absorption. Gary Schwartz <gschwart@u.arizona.edu> (Center for Frontier Medicine in Biofield Science, The University of Arizona), Summer Swanick, Willow Sibert, Daniel Lewis II, Sabrina Lewis, Lonnie Nelson, Shamini Jain, Laurel Mallory, Linda Foust, Kay Moore, Deboray Tussing, Iris R. Bell.

Can quantum particles such as photons and electrons become entangled through conscious intention and training? The present experiment provides observations consistent with the hypothesis that quantum entanglement, expressed between biological systems as biofield entanglement, may be inferred from behavioral measurements of bioenergy detection as a function of bioenergy awareness training and individual differences in conscious "absorption." Twenty-seven subjects between 36 and 66 years old received a five day intensive bioenergy healing training course with Roslyn Bruyere, a distinguished biofield therapist. Fifty-six percent of the subjects were physicians in the Associate Fellowship Program of the Program in Integrative Medicine at the University of Arizona's College of Medicine. The remaining subjects were nurses, psychologists, and other health-care professionals. Subjects were pre and post tested on a variety of subjective (questionnaires, including Tellegen's Absportion Scale), behavioral (e.g. bioenergy detection), physiological, and biofield measurements (e.g. high frequency X ray and gamma ray recordings). The bioenergy detection task required that the "receivers" sit blindfolded with their hands resting on their legs and with their palms facing upwards. The "senders" sat facing the receivers. Written sheets informed the senders on each trial whether they were take their dominant hand and place it a few inches above the receivers' left hand or right hand. The trial length was 30 seconds; the intertrial interval was approximately 90 seconds. At the end of each trial, the senders were to say "left" or "right." There were twenty-four trials, twelve left-and twelve-right. They were structured in blocks of four trials (two left and two right, order randomized from block to block). All subjects served as both receivers and senders. Chance detection, by definition, was 50%. We hypothesized that bioenergy detection would increase following bioenergy awareness training, especially in those subjects who scored high on Tellegen's Absorption Scale (a self-report measure of conscious immersion in sensory, cognitive, and emotional experience). A repeated measures analysis of variance revealed a significant increase in percent bioenergy detection from pre test to post test ($F=4.4247$, $p<.05$). The group average percent detection increased from 52% to 55.5%. There were substantial individual differences in degree of detection increase; as prediction, greater increases in energy detection was found to be correlated significantly with higher absorption scores ($r = .421$, $p<.05$). The question arises, are these bioenergy detection effects mediated by a quantum biofield entanglement process? Future research measuring biophotons between senders and receivers has the potential to examine this hypothesis. Supported in part by NIH P20 AT00774-01.

Anomalies and constraints - Psi within known physics? Richard Shoup <shoup@boundary.org> (Boundary Institute).

We consider the unnecessarily antagonistic relationship between anomalies such as psychic phenomena ('Psi') and theoretical physics. Characteristics of Psi are discussed with possible explanation and mechanism in terms of a new view of quantum physics. A hypothetical Psi experiment is used to explore the behavior of random processes where constraints are present, some of which may be due to future interactions. A simple rotation of the experiment diagram suggests nonlocality phenomena in quantum physics. A revision of our thinking about the concepts of time, causality, and randomness are argued as key to a deeper understanding of Psi and of the quantum realm in general.

Preliminary results on the effect of intentionality on ultra-weak photon (biophoton) emission from the human hand. Manish Vekaria <tolsetoy@yahoo.com> (California Institute for Human Science, 701, Gardenview Court, Encinitas, CA, 92024.), Cheatan Chevalier.

The role of intention in healing is becoming more recognized with the help of multidisciplinary approaches to understand a number of diseases. There are several evidences gathered in the field of psychophysics, psychophysiology and more recently psychoneuroimmunology about the positive reinforcement of the intention on health. This new concept of self-regulation sheds new light on mind and immunity, that what we think and feel and visualize have biological consequences that can promote healing. There is a consistent increase in the evidences of the efficacy of certain treatments piling up in the field of mind-body medicine. However, mind-body medicine pays relatively less attention to the possibility that people can consciously and deliberately use thoughts and images to influence their own and other's physiology and health. It pays much more attention to (seems almost preoccupied with) the neurochemical effects and biochemical basis of these emotions. Nevertheless, if a person can exert some control over physiology and health simply by telling the body what to do, then this act, – one might say role of mind/intention is theoretically and practically as important as the other arguments. How important is it to use the mindful intentionality to influence one's own health and influence the physiology and health of other people? Living systems continuously emit photons of ultraweak intensity within the optical range from 200 to 800 nm. These are called biophotons. Biophotons are characterized by their quantum character and are supposed to escape from coherent electromagnetic fields. Photon emission from living systems can be considered as stochastic point process. The 'point process' designates a sequence of time at which event occurs. In the Vitalistic approach to understanding living systems, biophotons are seen as coherent states of modern quantum optics. Even with low intensities biophoton emission provides an ideal non-invasive tool to explore living systems as a whole. In this respect it is interesting to observe photon emissions from the hand when a person is trying to influence it intentionally. Many 'hands on therapies' like Reiki, Qi-gong, Therapeutic touch, and Pranic Healing, etc. emphasize the beneficial effect of the 'intentional touch' on health. Despite the fact that the quantity of photon emission is considered negligible to attain biological relevance, any influence of intention on photon emission can be seen as a qualitative variation of photon emission that might account for such effects. Qualitative variations can be attributed towards quantum character of photon emissions. Preliminary results of ultraweak photon emission (biophoton) from the human hand are gathered from 10 subjects, who are intentionally trying to influence photon emission from

their right hand. Results indicate strong correlation between intention and photon emission.

Reference:

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2, Experimental approaches - Decoherence

Investigation of dephasing times in the human Rhodopsin complex by photon echo experiments. Pierre St. Hilaire <pierre@sainthilaire.com> (Allview Research, Belmont, USA), Dick Bierman (University of Amsterdam, The Netherlands).

That the brain or visual pathways can exhibit quantum coherence over macroscopic time intervals (say, milliseconds) is conceptually difficult to imagine since at room temperature typical decoherence times are measured in femtoseconds. However it has been speculated that structures in the human brain could, at some level, exist in a state of coherent superposition. In this poster we report some preliminary results of an experiment designed to assess decoherence times of quantum states in the human retina, an extended part of our brain, using the standard photon echo technique from quantum optics.

In our experiment a short green doubled-YAG laser pulse is initially sent to the subject's retina, followed by another pulse from the same source. If the time interval DT between the two pulses is less than the dephasing time T2* of the rhodopsin complex then a photodetector will detect an optical signal at a time DT after the second pulse: the photon echo. The photon echo intensity rapidly diminishes as DT becomes larger than the dephasing time of the rhodopsin complex. This property thus allows us to accurately measure the dephasing time of in vivo rhodopsin.

The measurement of photon echoes over intervals of nanoseconds or more would prove without ambiguity that the rhodopsin complex exhibits macroscopic quantum superpositions and could represent a fundamental advance in our study of vision and visual awareness. We will present an overview of the technique and preliminary measurements on a single human subject.

3, General models/Ontology/Foundations

Reality models in the human psyche. Wolfgang Baer <Baer@cs.nps.navy.mil> (Naval Postgraduate School, Monterey, California).

An explanation for our immediate sensory experiences cannot be derived from our understanding of classic physics and chemistry. Complex neurological systems built on classic physical principles will not generate awareness. The attempt to replace classic brain structures with quantum objects will not solve the problem because we are still missing a connection between wave packets and mental images. Rather than continue to search for an emergence of mental phenomena out of brains built either from classic or quantum objects this presentation turns the question around. We ask what is missing in our understanding of physical reality that would allow us to explain conscious experiences?

In order to carry out such an inquiry, we present a model of the thinking process and ask what physical principles are required for it to explain itself? This model uses graphic symbols of conscious sensations first introduced by Ernst Mach in order to represent the data items manipulated by the thinking mechanism. In the positivist tradition we will deal only with the flow of mental observables in order to avoid the trap of reverse engineering a brain using a priori assumptions about how the brain works in the first place.

Our model of the human psyche will define reality as those sensations, which explain immediate personal observations in terms of truths upon which we act. In our model the process of explaining sensations transforms symbols of sensations into symbols of reality. The collection of reality symbols is the reality model in the human psyche. Such a model is not a "take it or leave it" component of the thinking process but rather a necessary memory structure required to control profitable action. The question is not whether the human psyche has a reality model but rather what thoughts and ideas does this model hold. Our presentation will show the progress in human thinking as the evolution of the reality model from that of primitive man, through the reality of classic physics and on to the quantum mechanics.

Furthermore we will suggest that this evolution is by no means complete. We suggest a next step by presenting a macroscopic interpretation of quantum mechanics in which all parts of the material universe are treated as measuring instruments. We will argue that events, rather than particles, should be the fundamental building blocks of the universe and that consciousness is a property of existence events and therefore a property of all matter.

Pulsed-nonlocality: Towards a unification of approaches to consciousness. Donivan Bessinger <donibess@aol.com>.

Certain quantum theory concepts, especially nonlocality, probability, and entanglement with consciousness, mean that we cannot be satisfied with a theory of consciousness until we achieve a satisfactory theory of reality. Current approaches to a "final theory" of cosmos focus on the nature of the smallest objects in space. However, a theory of whole-cosmos Energy nonlocally pulsed (quantized and renormalized) in Planck time intervals, when taken in concert with quantum mind theory, yields a unification of physics and consciousness which intuitively describes physicality as we know it, and can account for "anomalous" nonlocal effects in psyche seen in various types of studies. Such a model points to consciousness as a "reading" of cosmic integration in nonlocality, providing a screen on which content is projected by processes at ordinary (local) neurological scale. Yet, since consciousness would be one aspect of the state of cosmos being integrated at each "pulse," it could (if only weakly) influence the probability wave equation for the next pulse. Having such a common working model would provide appropriate mapping of evidence to its proper level of description, would show where the gaps are, and would affirm the importance of all disciplines as work proceeds toward a final theory.

Quantum mechanics allows energy-less information and cause-transfer between mind and matter. Gerard Blommestijn <g.blommestijn@zonnet.nl>.

A concept of mind or 'I-ness' is proposed that is, materialistically seen, as little harmful as possible: it only exists, experiences and chooses. But it has no processes of its own: no time, no space, no qualities. All these things it obtains from matter in space-time.

The connection between this mind, this matter-less and space-time-less 'I-ness', and the material world may be formed by the quantum mechanical reduction process. It will be discussed how this might give a consistent model of reality involving quantum mechanics and this ontologically independent 'I-ness'.

Also the empirical testability of this theory will be discussed.

Toward a proof that awareness is not reducible and the limits of discovery in quantum conciousness. Steven Ericsson Zenith <steven@pearavenue.com> (Independent).

The mind we are familiar with is the product of a conspiracy between physiology and awareness. Our physiology is the emergent biomechanical organism of evolution. However, awareness is not reducible. There can be no awareness of the most primitive transduction before the organism is aware and we cannot experience awareness before it is so. What Damasio says (in "The Feeling of What Happens"), while making the most compelling rationale for emergence, is simply impossible, dependent on magical instantiation.

Awareness is therefore not emergent but necessarily first order, the equal of energy/matter.

By these same limits the search for consciousness in quantum observation cannot hope to find the physical mechanism of awareness but only to identify its presence and the mechanism of its interaction and development - it cannot produce a complete and internally consistent view of the universe that is purely physical.

A formal proof of the irreducibile nature of awareness should be possible and this paper discusses what such a proof will look like.

Metamatter and mind. Colin Hales <colin @versalog.com.au> (Versalog Systems P/L (Private Company).

This proposal, as a skeptical review of a quantum mechanical basis for consciousness, does away with the need for quantum mechanical explanations by supplying a detailed physical alternative based on non-quantum physics. Recent quantum mechanical solutions to the "hard problem" are microscale and mostly centered on quantum computing within the neural cytoskeletal volume. Using the principle of emergent phenomena, this new proposal looks outward at a possible physical solution at cellular/extra-cellular scales. An all-preconceptions-aside review of the nature of matter and reality is undertaken which results in one particular proposed new theorem. That Despite being just a new way of looking at existing matter, it delivers surprising predictive clarity in brain implementation. The process upgrades the existing computational model for low level brain function (it is more than just neurons) and removes subjective experience from the grip of mysterians, pan-psychists and representationalists, conferring on it the same mature epistemological status as "mass" and "charge". It provides a basic guide for the general selective control of the 'qualia' for a given 'sense'. It predicts current lowest level sensory cortex brain structure ('the little inhibitory loop'), provides some clues for neuroscientists to look for detailed supporting evidence and is also consistent with system-level brain pathology (blindsight, tinitus, depression etc). Implications for artificial intelligence and connectionists are also reviewed. As a complete model it based on one postulate it has no need of 'proto-consciousness', although it has identified a candidate for an equivalent, which is an interesting part of the model.

The most fundamental law of the ontology of consciousness. Jeremy Horne <jhorne18@cox.net> (RhinoCorps, Ltd.), Arianne Bahnson-Palmer.

Philosophers, especially those in science, attempt to discern the smallest in terms of an object, such as a subatomic particle. However, the process of repeated Cartesian subdivision takes us to a different and binary world. This is a world seen by philosophers like Hesiod to physicists (such as John A. Wheeler – "It from bit"). We enter a universe confined by a process boundary (as opposed to a physical boundary) that may allow a change of condition or exchange with another universe having other processes. Feynman might agree that this is a process boundary by virtue of the "Character of Physical Law" true for this dimension. The nature of process is expressed by the most fundamental law of all – that which is exists does so in terms of what it is not. Our dimension as object is in terms of what it is not – either other dimensions with different parameters or "nothingness". Process not only is the foundation for binary existence but also might be considered analogous to Aristotle's "substratum" underpinning all of what we think of as reality (e.g., Whitehead).

What we can understand, phenomenologically, is bounded by our capacity to measure. Our scientific understanding relies upon our ability to conceptualize and verify by observation. But the boundary parameter set by the character of process determines the ultimate measurement limit. We may be able some day to discern that smallest inflection of space-time, thus apprehending fundamental process. However, now we paradoxically are forced to discern its deductive nature by inductive reasoning, thus knowing something probabilistically. We may say, then, this indiscernible abstract is the Real, and what we take to be real revealed by our "contaminated" (Heisenberg) measurements is abstract. The Real consists of that which is and the underpinning of our dimension. The smallest entity, as the smallest inflection of space-time, forms the basis of that which is constructed and populates our dimension (quarks, atoms, molecules, you, me, and even ideas). Yet, that which is constructed may be altered. Whatever is alterable is abstract and "contaminated" by the means of constructing it. What is unchangeable is Real, and that Real is process operating on the dimensional boundary. Indeed, boundary proximity may generate new universes (e.g., Hawking, Steinhardt). More broadly put, process is responsible for that which is alterable, but Reality has its own will that may permeate us (e.g.: Kafatos). While the abstract has its locus, Reality governs the limits of our apprehending space-time and its loci.

The nature of this universe underpins the philosophy for scientific methods, i.e., uniformity, or the "Principle of Induction". That is, the future resembles the past. However, this approach, drawn in large part from philosophers such as William Whewell (1794-1866), is only an assumption. The methodology that discerns the smallest in terms of process may assist in providing a philosophy of uniformity, thus clarifying why scientific methods "work".

Consciousnees and origin of the principles of quantum theory. Zbigniew Jacyna-Onyszkiewicz <zbigonys@main.amu.edu.pl> (Faculty of Physics, A.Mickiewicz University).

A new interpretation of the quantum theory is proposed, allowing an explanation of the origins of the theory principles and its mathematical formalism. In contrast to the hitherto interpretations it is based on the objective idealistic ontology in the version

proposed by George Berkeley. According to Berkeley, the universe is only a dynamic, correlated and ordered sequence of ideas of a certain consiousness, showing the properties analogous to human conscionusness, communicated to the set of individual human consciousnesses. The image of the universe in Berkeley's ontology is confusing but simple, coherent and consequent. The interpretation proposed explains - in consistence with the relativity theory - the results of the correlation experiments implying that an unobserved elementary particle does not exist objectively (beyond our consiousness) or that a quantum system makes a nondivisive unity bound through non-spacetime interactions. According to this interpretation both these possibilities occur simultaneously.

Vibrational relativity theory: A third Einsteinian theory of relativity which integrates science and spirit. Kenneth Miller, MD <kmiller@vibrationalrelativity.org> (Forum Foundation Seattle, WA).

Is it possible to "spin" in an otherwise massless universe? Would you experience centrifugal forces in such a universe without an external frame of reference to "spin" relative to? What experiment could you perform to determine if you were spinning? As a physics major in college with a profound interest in Einsteinian physics and aspirations to become an astrophysicist (before other interests deterred him into medicine) the presenter formulated this question and pondered it for the next 20 years until, in an explosive moment of insight, the presenter not only answered his own question but discovered what he believes to be a third Einsteinian theory or relativity he calls "vibrational relativity theory (VRT)". VRT is a scientific theory with profound metaphysical implications, suggesting an integration of science and spirituality. VRT suggests a vibrational and relativistic continuum between the Newtonian (physical) and the quantum (spiritual) universes aligned along the 4-dimensional time axis of a thoroughly 4-dimensional Kosmos. It supports the epistemology and ontology of the Great Chain of Being wherein "matter", "body", "mind", "soul", and "spirit" exist along a continuum of "vibrational planes". VRT provides a literal science of the soul wherein "mind" does not strictly equate with brain, but supports a model wherein mind and soul ("psyche") may be located within the light/energy vibrations within the 4-dimensional atoms of our bodies which are in turn anchored within the nondual "quantum realm" (spirit). Vibrational relativity supports the perennial philosophy, the integral philosophy of the contemporary spiritual philosopher Ken Wilber, and the teachings of many mystics. VRT could be an important piece of a grand unified field theory of physics integrating gravitational theory and quantum physics, pointing toward a thoroughly 4-dimensional spiritual Kosmos as opposed to an essentially 3-dimensional strictly material (and reductionistic) "cosmos". The theory provides an explanation for many (if not all) "psi" phenomenon not explained by modern "orthodox" physics. The presenter's scientific and philosophical writings on vibrational relativity theory may be found at www.vibrationalrelativity.org.

Turning philosophies into hypothesis: Scrutinizing materialism vs. primacy of consciousness using diverse consciousness studies data sets and quantum mechanics. Nathan Munn, M.D. <NathanMT2@aol.com> (Munn Psychiatric Clinic).

Looming behind consciousness studies are tenacious philosophical quagmires. The author proposes considering two philosophical positions, materialism and consciousness as a primary aspect of the universe, as hypothesis. From this stance, diverse areas of consciousness studies are reviewed. Not dismissing data sets on philosophical grounds, the fields of Neuroscience, Mysticism, Parapsychology and Healing Techniques such as Cognitive-Behavioral Psychotherapy, Chi Kung and Distant Healing are included as initial fields for examination. In three of these data sets, a body of statistically significant literature exists. In Mysticism, common "findings" of mystics across cultures and epochs are considered. Quantum Mechanics (QM) are used as an explanatory system with which these data sets may be explained. Principles of QM such as superposition, nonlocality and entanglement are considered, as are coherence and decoherence, and the correspondence principle. In this analysis, a primacy of consciousness is supported by available data. A theory proposing a position of Primacy for Consciousness © with aspects of Meaning (m), Perception (p), and Intention (i) is applied to the quantum particle wave probability function per se and then expanded to quantum field and electromagnetic field theories of brain dynamics. The emergence of a subjective experience of a separate "self", a phenomena requiring explanation in any theory of consciousness, is explained by applying complexity theory and vector analysis to ©m,p,i states within the brain. Specific brain disorders such as Major Depression and Schizophrenia are also examined using this theory. The author concludes by calling for a rigorous study of consciousness sans pre-conceived philosophical parameters given the importance of the subject matter and the intractable nature of the philosophical arguments. The current theory is a step towards this goal.

System completion theory of consciousness. Anatoly Nichvoloda <otaman@hotmail.com> (Systems ThinkTank "Internatura"), Mr. Victor Tolkachev, Ms. Zlata Dikaya.

System Completion Theory is a metaphysical system organized around principle of the quantum supersymmetry. According to Supersymmetry, bosons/waves obey statistical rules permitting any number of identical bosons to occupy the same quantum state, while fermions/particles obey statistical rules requiring that not more than one in a set of identical particles may occupy a particular quantum state. Also, it establishes that every boson must have a fermionic counterpart and vice versa. System Completion Theory suggests that the Universe as a whole consists of two complimentary parts (Wave and Particle functions) represented by bosons and fermions that continuously and supersymmetrically collapse into and reproduce each other. Intersecting convergence of these two parts supersymmetrically organized in Time, Space, Information and Energy gives rise to Consciousness.

System Completion Theory identifies Energy, Information, Time and Space as four supersymmetrically organized components that characterize both the Wave and the Particle functions of the Universe. These four components cannot exist separately from each other and there is a very specific way of their coexistence: Space, Time and Information together constitute Energy. Therefore, any change in either Space, Time or Information of any object in the Universe, including the Universe itself, will necessarily lead to a change in Energy and vice versa.

Theory views Human Consciousness as a direct particle-based holographic reflection of simultaneous processes of collapse of the Wave function and reproduction of the Particle function of the Universe. Properties of Human Consciousness directly

correspond to the current stage of the Universe evolution characterized by the above two processes. Theory offers a solution to the hard problem of Human Consciousness by identifying Consciousness as the place and the means by which the Wave function of the Universe collapses and gets supersymmetrically reproduced into its Particle function. In other words, our Consciousness creates the Universe by transforming the Wave function into the Particle function.

Theory also offers a solution to the easy problems of Consciousness by identifying eight Sensory/Function organs within a human being. Sensory/Function organs are the mechanisms that connect Consciousness to the environment and form structural organization of the Consciousness. Each Sensory/Function organ is equipped with its own Bottom-Up/Top-Down information-processing paradigm that forms its own neurological/psychological vector. Neural networks of each Sensory/Function organ possess distinct information processing algorithms that correspond to the nature of the environmental stimuli (light, sound, etc) that each Sensory/Function organ evolved to process. Neural networks of all eight Sensory/Function organs form a flexible multilevel biochemical marketplace of Conscious, Subconscious and Unconscious drafts. These drafts dynamically reflect an individual's environment and compete for neural resources (attention, memory, etc) depending on the goals that this person pursues in this particular environment.

Is there space for non-locality in a causal world? Stefan Schmidt <sschmidt@ukl.uni-freiburg.de> (Institute of Environmental Medicine University Hospital Freiburg).

Until Einstein's, Podolosky's, and Rosen's paper on non-local correlations in 1935 and the empirical proof of these correlations in the early eighties causality was the only principle to describe change within nature. In a materialistic and mechanical world view the notion of causality leads to the principle of locality. Any change in nature is brought about by local impact of material parts; that is Aristotle's efficient causality. The introduction of the speed of light as a maximum speed for these local impacts assigned precise limits to the notion of locality.

Causality is the ubiquitous principle for any description of our world. Even experiments on non-local correlations or non-deterministic quantum events have their hypotheses formulated in terms of cause and event. The introduction of non-locality has limited causality to only one of at least two principles to describe change in nature but nevertheless it is completely predominant in our scientific and also daily approaches to the world. Many examples show that humans tend to see causal connections even if there are none. This predominance of causality in the world we experience has several reasons that will be outlined: (i) Our perception of ourselves as subjects with free will. As such we have intentions that lead to actions in the world, letting us experience a causal relationship. This experience can be traced back to its (ii) phylogenetic and (iii) ontogenetic origin. Examples from the process of evolutionary selection and development psychology are illustrating these origins.

On the basis of this analysis the notion of a non-local correlation will be revisited. Until today there is no proof for any macroscopic non-local correlation. But some experimental approaches are indicating that findings in parapsychology can be linked to the notion of non-local correlation. Thus the principle of non-local correlation might not only be of scientific importance but also for the world we experience. The possibilities and limits of this development beyond mere speculation and vague holistic thinking are outlined.

Probability and a five-dimensional model of experience. Amanda Seipel <ahseipel@yahoo.com> (University of Texas at Arlington).

Is it easier to understand human experience when one uses a model of reality with probability as a fifth dimension? When the uncollapsed state of matter is considered as a fifth dimension of reality, many aspects of human cognition take on a new role in defining experience, and the mechanism of the observer can finally be understood. This presentation will suggest ways in which neurological and psychological constructs facilitate movement of the observer through a reality where spacetime is tied to the quantum duality of matter.

The triadic mind. Inna Semetsky <irs5@columbia.edu> (Columbia University).

1.As a point of departure, this paper addresses a relationship between "three worlds" as posited by Rodger Penrose. The paper asserts that there is nothing mysterious in such a triadic relationship-- especially if one adopts a model of triadic semiotics as derived from the philosophy of American pragmatist Charles Sanders Peirce. According to Peirce, semiosis -- or the action of signs in mind and nature -- is constituted by the relationship between an object and a mind by virtue of a sign. A sign is both affected by the object and is capable of affecting the mind thus producing an effect (or meaning) called by Peirce the interpretant of the sign. The object to which a sign >refers may not have a solely physical existence, but may be a thought, a dream, or altogether "fictive", virtual and imaginary, yet meaningful, entity by virtue of its possible effects. The formal, albeit vague, rule of abduction, enable mind to reason from the premise to the conclusion thereby breaking the dyadic causal influence. The interference of a quasi-cause constitutes the tradic nature of signs-relations and extends the narrow idea of causality, as has been asserted first in 1952 by W. Pauli who posited the so-called "acausal connection principle" in collaboration with Jung.

2. The mental world in Penrose's scheme thereby (and in accord with Jung-Pauli synchronicity principle) is capable of both projection and introjection. It is possible to juxtapose a semiotic triadic relation between object-sign-interpretant onto the "three worlds" in Penrose's diagram thereby "objectifying" the subjective world of the mind. As Peirce was saying, it is not consciousness that is in us: rather we ourselves are in the field of consciousness. "Mind" therefore acquires a status of "objective psyche", as Jung called it. So first and foremost--and prior to appearing as mental representations in consciousness -- the objective mind (the collective, that is impersonal, unconscious that perhaps constitutes the "Platonic world" in Penrose's scheme) presents itself via signs, or potential tendencies that, DESPITE BEING OUT OF SUBJECTIVE CONSCIOUS AWARENESS, nevertheless possess an ontologocial status as patterns of UNCONSCIOUS HABITS (similar perhaps to Whitehead's occasions capable of prehensions).

3. To concluse my paper I will present a triadic vectorial model of the action of abduction, which is, for Peirce, an unconscious inference (quite a contradiction in terms, isn't it?). This model again may be superposed onto Penrose's scheme in order to demonstrate the absence of mystery in such a triadic relationship.

The purpose of the model is to show how the unconscious becomes available to consciousness. We earlier posited the action of signs as encompassing the realm of the imaginal. I am going to use a vector-field comprising imaginary and real numbers and to construct a model of consciousness on a complex plane. Consciousness by definition always already includes the unconscious in itself. Due to the projective and reciprocal function of Peircean abduction the meaningful relation between the unconscious and consciousness is established. Such indeed was the task of Jung's depth psychology that aimed towards integration of unconscious contents into conscious mind. I will address the possible ways of integration in brief for the purpose of practical application of this model.

Consciousness and complementarity. Mikhail Shatnev <mshatnev@yahoo.com> (Institute for Theoretical Physics, National Scientific Center " Kharkov Institute of Physics and Technology", Kharkov, Ukraine).

Following Niels Bohr, we first consider the observational problem in quantum mechanics and the notion of complementarity. Such consideration not only aim at making us familiar with the situation in physical science, but might on account of the comparatively simple character of atomic problems be helpful in clarifying the conditions for objective description in wider fields. Then we discuss the complementary approach to problems of biology, sociology, and psychology in more detail. In general philosophical perspective, it is very important that, as regards analysis and synthesis in these fields of knowledge, we are confronted with situations reminding us of the situation in quantum physics. Although, in the present case, we can be concerned only with more or less fitting analogies, yet we can hardly escape the conviction that in the facts which are revealed to us by the quantum theory and lie outside the domain of our ordinary forms of perception we have acquired a means of elucidating general philosophical problems. This allows us to use the complementary mode of description in the development and clarification of quantum approaches to understanding the mind. Next we try to show how consideration of the kind can help us to explain the enigmatic features of consciousness. Our starting-point is that any observation of atomic phenomena will involve an interaction with the agency of observation not to be neglected. Finally, we discuss briefly the old truth that we are both onlookers and actors in the great drama of existence.

Consciousness and the measurement problem of quantum mechanics. Michael Steiner <mjs@radar.nrl.navy.mil> (Naval Research Laboratory, Washington DC).

The interaction of two independent quantum systems A and B is treated quantum mechanically in terms of Schrödinger's equation. We assume that A is a large system of particles and that B is composed of a single particle or is otherwise small. The interaction is then considered with regard to conscious physical processes. When it is assumed that system A is a conscious process and becomes aware of system B through an interaction, it is proven that the mechanics that govern the interaction cannot generally have occurred according to Schrödinger's equation and hence a different process must be involved. Furthermore it is rigorously shown that under fairly general conditions, systems of particles that interact in agreement with Schrödinger's equation cannot be conscious. This effectively rules out single particle quantum systems exhibiting substantial consciousness. Consciousness apparently is at least a mesoscopic multi-particle phenomenon. Moreover, it is shown that consciousness either 1) contains a particular property or 2) is precisely that property, which is responsible for the measurement process. It is conjectured that consciousness contains a particular property as opposed to being that property. That is, consciousness is symptomatic of the property. The particular property of matter that may be responsible for the measurement process, and for which conscious systems contain this property, is discussed.

How delineating cosmological structure leads to an understanding of consciousness. Jerry Wheatley <jerrydwheatley @yahoo.com> (Independent).

R. Penrose has stated consciousness should be defined by the unification of quantum theory with relativity. H. Stapp has intimated that the fundamental processes of nature lie outside space and time; i.e., that it is nonlocal. M. Kafatos supposes the undivided wholeness of reality is a quantum system. He figures the ultimate principle will not be revealed via mathematical physics. He links the Big Bang singularity to the null set. L. Smolin mentions that the three contemporary approaches to quantum gravity should unify under a single principle. And, that the principle should ultimately define reality as a "hologram." A. Goswami has suggested reality is conceptually represented by monistic realism where consciousness collapses the wave function. Einstein thought the Ultimate Principle must be simple enough that a child could understand it.

Such questions are a lot to consider. Yet, the ultimate principle must address these ideas and more. The point is that the ultimate principle must either directly or indirectly define consciousness. So, what is a reasonable way to determine the nature of consciousness? History of studying the human body provides a clue. After determining body structure (anatomy), the focus shifts to understanding the functionality of its parts (physiology). Determine cosmological structure; determine the functionality of its parts. Therefore, all "lesser" questions must first be answered.

The grand idea of physics is to understand everything in one conceptual scheme called the "Theory of Everything" (TOE). Ideally, everything is explained as a reductive function of a single all-embracing principle. Contemporary physics sets the stage for realization of that goal.

The Structure of Reality has been delineated after 30 years of full-time research. It is now explainable how this structure leads to a clear understanding of the Ultimate Principle. The principle is represented by a compelling equation--one that defies all other possibilities.

An excellent candidate for the TOE has been found and tested by what it can explain. The final Test of the Ultimate Principle is Consciousness and the Big Bang Problem. The Big Bang seems paradoxical. How did it happen? How can it be explained as an expansion of space? How can it be explained as a function of consciousness?

Simply: How does space expand from the singularity? --OR--What is space expanding into--if not itself? If space is expanding into itself, then there is a difference between expanding space and the space into which it is expanding. A clear understanding of the Ultimate Principle explains the Big Bang and the nature of the singularity. It also defines the difference between space itself and extended spatiality. And, it explains why there was a Big Bang.

The Ultimate Principle not only explains cosmogenesis, but does so by explaining experience as a "projection" of consciousness. Moreover, there is a different but simple way to understand space and time that includes the idea of quantum nonseparability.

Presentation will briefly describe: methodology, hierarchical structure and functional levels of reality, derivation of Theory of Everything Equation, and how Ultimate Principle (TOE) explains and defines the nature of consciousness.

The localized quantum mind of classical particles and systems. L. Frederick Zaman III <Frederick.Zaman@hill.af.mil> (Neural Engineering Research & Development, OO-ALC/MASAD, Hill AFB, Utah).

An article in the issue of The Journal of Mind and Behavior just coming out, "Nature's psychogenic forces: localized quantum consciousness," proposes that the non-local consciousness of quantum systems is encapsulated within the localized particles of classical physics through the Ehrenfest theorem, which is the "classical approximation" in quantum mechanics for Newton's second law of motion - thereby creating a "localized quantum mind" (LQM) for each classical particle, or classical system composed thereof. The course of physical events in classical systems then is determined by the macroscopic dynamics of an LQM that's possessed by every particle or system in physics and biology (including microtubules and other intracellular systems, whole cells, cell assemblies, etc...). This dynamics clearly reveals an internal inconsistency within the mechanistic framework of classical physics today, whose resolution grounds brain-mind computations in consciousness acting at multiple levels.

Essence of the consciousness. Xin-Yan Zhang <inkk @hotmail.com>.

The energy of information that a mind gains from sense organs or from other external sources may trigger the production of consciousness but themselves may never appears as consciousness in the mind. The consciousness is an energy produced by the lives in the mind. Whenever consciousness occurs in a mind, the mind is not gaining or feeling the energy but is only producing it. Consciousness is produced in brain's hereditary parts. After being produced, the consciousness will flow further to the acquired parts of the brains and undergo life changes together with memory there.

The energy of consciousness is not the whole mind but only a component part of it, which is produced by the other parts of the mind that do not present as consciousness. The consciousness alone does not sense, does not remember or recollect, does not think, does not feel or will, does not move the limbs and trunk, does not speak or smile, and does not drive or rule the mind.

4, Time

Time perception in waking and hypnosis: Moderating influences of hypnotizability. Richard Atkinson <ratkinson3 @weber.edu> (Weber State University), Robert Hall Keri Wilde.

This study examined the moderating influences of hypnotic susceptibility on the estimation of time in waking and hypnosis. Participants were screen for hypnotizability on the Harvard Group Scale of Hypnotic Susceptibility, Form A and the Group Stanford Hypnotic Susceptibility Scale, Form C. Ten high (GSHSS:C 9-12) and 10 low (GSHSS:C 0-5) hypnotizables participated. Participants were exposed to an 18 minute guided meditation tape in waking on one day and a 16 minute guided meditation tape in hypnosis on a separate day. Waking and hypnosis sessions were counterbalanced within hypnotic groups. Participants' estimates of the elapsed time for each tape were obtained Time estimates were transformed into a percentage of the total time for each tape. A Conditions (Waking, Hypnosis) X Hypnotic Susceptibility (High, Low) analysis of variance (ANOVA) was performed on these data. A significant main effect for conditions was not obtained ($F(1,18)=1.01$), nor was a significant main effect for hypnotic susceptibility ($F(1,18)=.27$). A significant conditions X hypnotic susceptibility interaction effect was similarly not obtained ($F(1,18)=.25$). These results fail to support a body of literature suggesting a reliable underestimation of elapsed time in hypnosis.

Putting consciousness into the equations. Edward Close <eclose@closeenvironmental.com> (Anodyne, Inc.).

The branch of the physical sciences known as physical cosmology represents our best efforts to understand the large-scale aspects of the universe in terms of matter and energy evolving in time and space. The general theory of relativity plays a central role in explaining the red-shift expanding universe, and provides a reasonable, if somewhat abstruse, understanding of the physical processes involved. Quantum field theory, on the other hand, while being very successful in explaining atomic and sub-atomic phenomena, has not been as diligently applied to cosmology.

Because our view of the universe is limited to a small fraction of the total information spectrum, due to the physical limitations of the human sense organs and their extensions, our perspective is that of the nearly blind, groping in the dark; and current main-stream theories of the origin and evolution of the universe leave many questions to be answered. The standard "big bang" model has great difficulty addressing questions of initial or final conditions, and fails entirely to be able to shed any light on the mystery of the first cause. The role of consciousness, when considered at all, suffers from the lack of a concise, workable definition.

It is the thesis of this paper that the missing element in current physical theory is consciousness itself, and that quantum mechanics affords an avenue to rectify this error. The strengths and weaknesses of the standard cosmological model are discussed in light of relativity and the Copenhagen interpretation of quantum mechanics, and a new mathematical approach affording a means of including consciousness in the equations is proposed. A broad-based theory integrating consciousness and physical reality is offered, along with definitions of the primary and secondary functions of consciousness. Pursuit of this approach reveals the question of mind-matter interface to be the result of semantic confusion, and sheds new light on the nature of space and time. From this new perspective, many philosophical conundrums and metaphysical puzzles simply dissolve, and an optimistic view of the future of the scientific study of consciousness emerges.

Physics, consciousness and three-dimensional time. Edward Close <eclose@closeenvironmental.com> (Anodyne, Inc.).

The passage of time is an undeniably important aspect of experiences common to human beings, and in general, we human beings have an instinctive feeling that we know what time is. Classical physics defined time by formalizing this instinctive feeling: time was considered to be an objective, universal parameter, flowing uniformly from the past to the present, and from the present

to the future. Time, like space, was a fixed background against which events could be distinguished and measured. Of course, Albert Einstein changed that. Thanks to the theory of relativity, we now know that there is no universal time. Not only the perception of time, but even the measurement of time is observer dependent. Two events, for example, that are simultaneous for one observer, are not simultaneous for a second observer who is moving relative to the first observer. Furthermore, interpretations of quantum theory and experimental results from particle physics have raised questions suggesting that consciousness may be involved in phenomenal reality at the most basic level. Conventional mathematical and physical theories are not designed to include the functions of consciousness in the scientific description of reality. Including the involvement of consciousness in the basic processes of reality requires new mathematics and a new understanding of the nature of time and space. In this paper, a new mathematical approach is suggested. This approach leads to the concept of three-dimensional time. Formalization of the interaction of consciousness with matter and energy in three-dimensional space and three-dimensional time enables us to treat both perceived time and physical time within a logically consistent framework.

On the dynamic time scale of conscious experience? A novel neuromolecular approach. Danko Georgiev <dankomed @yahoo.com>.

Both in classical neuroscience and in the Hameroff-Penrose Orch OR model it is assumed that the dynamic timescale of conscious experience is intimately linked to the timescale of the traveling membrane potentials. This presentation discusses the basic framework in which quantum field theory is shown to be a reliable scientific approach for describing both processes in brain cortex and the conscious 'I'. The neuronal microtubules and the confined water molecules inside them interact with the local electric field generated by the membrane activity. This interaction results in spontaneous breaking of the vacuum symmetry generating Nambu-Goldstone boson condensates. Further Mavromatos et al. have proposed Rabi coupling between the tubulin subunits and the layer of water molecules near the microtubular wall and have modelled the processing of information by the tubulins using a string theory approach. The interaction of the tubulins directly with the electromagnetic field can be understood as a process of inputting information to the conscious 'I'. In brain cortex the coherent neuromolecular lattice composed by microtubules, neurofilaments and synaptic scaffold proteins causally affects not the presynaptic membrane activity but the neuromediator release. The neuromediator molecules modulate ligand-gated ion channels at the postsynaptic membrane thus outputting information from the conscious 'I'. The picosecond protein dynamics that drives exocytosis via quantum tunnelling and the cytoskeletal protein dynamics is comparable with the theoretic predictions for the time to decoherence of the quantum coherent protein lattice; a necessary condition that makes the quantum mind idea feasible. The proposed model works well even in such intense studied human pathologies like Alzheimer's disease. The quantum field theory interpretation of the molecular and clinical data reveals not only a novel mechanism of pathogenesis but also a possibility for experimental verification of the model.

Slowness: An economy of differential rates of being. Karen Gilbert <Wandsqueen@aol.com> (Wisdom Earth Democracy (WEDweave@yahoogroups.org)), Carriage House Talks (CHTalks@yahoogroups.org), Center for the Study of Culture, Work and Technology (Graduate Center of the City University of New York).

Models of the distribution and redistribution of goods throughout an entity are "economies." This paper deals with the economy of the body.

All matter exists at a rate of being. Between two things, or between two states, lies a temporal interval. This temporal interval is itself dynamic; that is, it resonates with the vibration of the difference between the rates of being of the two states of being. I believe that in this temporal interval lies the key to the dynamic coherence of the energy economy of the organic Being. This resonant interval exists on many levels of organized complexity, from the quantum coherence within the brain to the ability of creatures to mediate their environment.

I suggest that the economy of differential rates within living entities is a consequence of two complementary systems within them. The first is a step-by-step, rule-following unidirectional circuit subject to entropy that could be adequately described by 19th century thermodynamic metaphors. Contemporaneously and co-spatially, there exists a field of flows, (specifically electromagnetic, but as easily understood as intentions and desires) that predisposes and allows for rapid and global transition, in the form of phase shifting. This field is best understood in terms of quantum field theory with its vocabulary of non-locality, entanglement, holography, and virtuality. These two modes of being (that is ontic modes) exist in a relationship where self and other, same and different are superimposed.

These ontic modes differ in being continuous (that is to say, fields) and discrete (for example, molecules, cells, organs), and in that they call into being, and then exist in, different sorts of spaces. A metaphysics of biology in the 21st century will have to create a discourse that accounts for this dynamism.

What body is called forth in a far-from-equilibrium economy of turbulence and homeorrhesis? With what discourse can we discuss it? This paper aims to answer these questions based on theories of knowledge and ontology put forth by Michel Serres and Giles Deleuze writing with Felix Guattari. The specific notions of what constitutes a "body" and its component parts are take from Mae-Wan Ho's work on whole system bioenergetics, Gerald Pollack's work on the phase-state shifting of cells, and Lynn Margulis and Dorian Sagan's work of symbiogenesis.

Ho (1993) summarized the problem of finding a mechanism for dynamic coherence at metabolic temperatures. She reminds us that condensed matter physics is that study of "the collective behaviour . . . when molecular disorder – entropy – disappears and the systems no longer behave statistically but in accordance with dynamical laws" (87). Although typically true only of cold systems, biotic entities that were "nonequilibrium systems subject to energy flow can also undergo transitions to coherent, macroscopic activity¼" (89). Using a quantum model of the body, one where "exited molecules vibrate at various characteristic frequencies," Ho drew on Frolich's research that revealed "collective modes of both electromechanical oscillations (phonons, or sound waves) and electromagnetic radiations (photons)¼" (91). These "collective modes," called by Frolich "coherent excitations," could be synergistically linked. "[C]oherent excitations make the system sensitive to specific, weak signals . . . Whole populations of cells may be poised in critical states so that a small, specific signal

would set off a whole train of macroscopic, coherent reactions" (93) And, as in any other solid-state (condensed matter) system, move through the system as a standing wave (or, soliton). "[F]requencies are coupled together so that random energy fed into any specific frequency can be communicated to other[s]" (91).

Pollack (2001) documented the same sort of "cooperative" transition between condensed and expanded polymer states, in which, "once a critical point is reached (in triggering conditions) the transition is inevitable" (118). He suggested that, "inevitability presupposes some kind of cooperativity—a change that increases the propensity of additional change in the same direction," (118) and described the mechanism involved, which "arises out of competition between two or more forces," (118) in this case the equal tendency of polymer to bond with itself, or with water.

Cooperativity of fields is what enables them to be so fast; they create space. The link-by-link mechanism of neuronal and chemical networks is slower; it fills space.

Deep change and the origins of time. Scott Hitchcock <hitchco4@pilot.msu.edu>.

The connection between 'time' and consciousness is explored by introduction of the concept of a T-computer in the context of neural network information processing systems such as those involved in the brain. The 'problem of time' can be solved by this approach but leaves us with a deeper 'problem of change'.

This is an extension of my previous work at: http://www.msu.edu/~hitchco4/

Time is energy where consciousness is regarded as physical benchmark. Amarjeeth Pinnamaneni <jeeth_p@yahoo.com> (Andhra University, Visakhapatnam, India).

Matter which has a tendency to reach lowest energy levels is governed by laws of particular time frame consciousness has the capacity to transcend through different time frames. Because energy transfers from high energy level to low energy level we have to select more energy time line. This selection by consciousness itself makes low energy lines to move in the same direction of our line. This can be easily done by collective Consciousness with much discretion. So we have to move to be governed by laws or conditions from which universe(s) is emerged.

As energy is separated into different time lines, total energy is equal to no. of time frames, which will be decreased to only one the moment collective consciousness satisfies the conditions at the creation of universe (s).An ever expanding universe is the only solution for this. Thus indicating consciousness as physical benchmark.

Subject, object and time. Stephen Robbins <Stephen.Robbins@Metavante.com> (Metavante Corp.)

Bergson's framework for a theory of consciousness, laid out in 1896 in "Matter and Memory," anticipated the fall of classical mechanics, the birth of quantum wave mechanics (Gunter, 1969), and aspects of a holographic theory. Within it, he employed a model of the relationship of mind to time yet to be grasped, a relation summed in his statement: "Questions relating to subject and object, to their distinction and their union, must be put in terms of time rather than of space" (1896/1912, p. 77). This principle has been a missing key in discussions of consciousness, holography and the implications of modern physics.

At the base of this principle was a critique of "abstract" space and time, a conceptual framework originating in perception and the "objects" upon which it can act. It would lead Bergson to insist that motion must be treated as indivisible, or in the terms of Feynman (1965) and Nottale (1996) – non-differentiable. The "motions" of "objects" now become changes or transferences of state within a dynamically changing, and ultimately holographic, whole. Implicit in this field, due to its indivisible motion and holographic properties, when taken at the null scale of time, is an elementary form of perception.

The hierarchical dynamics of the brain imposes the scale of time on this field. Scale implies quality. The "buzzing" fly of our normal scale is a certain quality; a heron-like fly, barely flapping his wings, is another quality. The color red, a proportion over trillions of oscillations of a field for but a second, is a certain quality. At a higher degree of the velocity of processes underlying the brain's dynamics, where perception is closer to each developing oscillation, we have another, perhaps more vibrant quality of red. But equally, scale implies extent. The extent of the past specified for the heron-like fly is far less than in the "buzzing" fly. Supporting perception of these (past) extents, without invoking a memory that attempts to store "instants" or states of this field, is the non-differentiable motion of the universal field.

The mechanical essence of Bergson's model, in modern terms, is to conceive of the brain as a reconstructive wave within a holographic field (Robbins, 2002). This brain-supported wave is specific to the past, i.e., to a composite of past "states" of the field taken at a certain scale of time – the "buzzing" fly, or the "heron-like" fly. It is simultaneously a specification of the subset of the field relatable to the body's action. The information modulating this brain-supported reconstructive wave can be taken to be the invariance laws defining events described by Gibson (1979), required, as in the physical theory, by the fact that the brain's dynamics, in defining scale, determines variable space-time partitions on the field. There is no homunculus in this model viewing a projected wave front (or image). Body and field are undifferentiated at the null scale. Rather, the wave is specific to a time-scaled subset or form of the elementary perception defined over the entire field.

This is the essence of Bergson's framework. Within it is a radically different model of memory, for perception is not occurring solely within the brain. Also within is an intrinsic relativity principle, and many other implications yet to be explored.

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The system of time and its own worlds. Alexander Zaslavsky <am@oblik.dp.ua> (Oblik corp.).

In the report, a hypothesis of time system (construction) is put forward and analyzed. The essence of the hypothesis proposed is the statement that general time system is, from the point of view of an external observer, a linear order relation on an abstract set of

states displayed at some moments of his (the observer's) own time. For an internal observer of the time system this set is an indefinable set of events identified with the set of all the time moments in his system. The observer is considered as a subsystem of the time system, as a unidirectional automatic device with memory, similar to Tsetlin automatic devices. It is shown that such an automatic device, in order to optimize its behavior, should measure the states by the number of their repetitions in the circuit of events. On this basis, a new principle of measuring the extent of the own space of the time system by the number of repeating states is offered. The axioms of time system are formulated. The theorems of the order and the lemma of discreteness of time are proved. It is shown that these and some additional general reasons are enough to arrive at the basic laws of geometry, kinetics, thermodynamics, kinematics, dynamics and field theory of the own physical world of a time system. And moreover, these laws are similar to those known in our world. The results of research of mathematical transformations labeled as supervisionary, which are necessary for transition from the internal observer to the external one and from dynamic to kinetic description of a point movement (and vice versa), are given. Some ontological problems of a time system are put forward for a discussion, such as the problem of existence, inertia of existence, depth of the layer of actual reality, reality of a point as a subsystem of the time system, relativity of the notions of matter, field and substance, as well as the problem of consciousness as one of the kinds of interaction between the subsystems of a time system.

5, Physics/Cosmology

Quantum state engineering with the rf-SQUID. Christopher Altman <christaltman@yahoo.com>.

Quantum computers take advantage of the superpositional logic of quantum mechanics to allow for dramatic increases in computational efficiency. rf-SQUIDs show potential for quantum computing applications by forming the qubit component of a quantum computer, through simply treating the direction of its current - clockwise or counterclockwise - as the value of the bit. rf-SQUIDs present a major advantage over atomic-scale qubit systems: they are sensitive to parameters that can be engineered. The flux qubits are linked through controlled inductive coupling - the magnetic field of each junction affects the others. The strength of this coupling can be "tuned", allowing for refined control over the behaviour of the system. rf-SQUIDs can also be mass produced on-chip, making large-scale production feasible.

The conscious mind and the Schrödinger's cat. Giovanni Fantasia <fantasia@dsi.unimi.it> (University of Milan, Italy Dipartimento di Scienze dell' Informazione).

How comes existence? How can we develop a conceptual framework where our physical theories could be interpreted coherently? Trying to answer these questions John Archibald Wheeler (1,2) proposed an ontology based on elementary acts of observation. Similar ideas are explained in the work of Herny Stapp (3). In these works the world described classically in term of objects, space and time is a part of the picture emerging from a mosaic, where the single plugs are these elementary acts. Existence is the ensemble of transitions from possible to actual: possible and actual determines each others in a circular process. Developing this framework could also be a basis to build a theory of consciousness and self-consciousness and what kind of role consciousness has in actualization of being. In our work we make this further hypothesis: mind has the faculty to choose the set of possible directions of particular state reductions; these particular state reductions build the part of reality that mind is aware of. In this way we give a possible solution to the Schrödinger's cat paradox: the empirical fact that we don't observe Schrödinger's cats is the consequence of an asymmetry of mind in observing reality. Mind acts like a filter for some state reductions and these "forbidden" reductions may coincide with what we call non-local measurements. Example of these non-local measurements are the projectors on states that are linear superpositions of states describing a single particle at different locations. So Schrödinger's cats are excluded by a mind that gives a "localized" direction in the becoming of things. Finally we discuss some physical facts that could be searched to confirm this model.

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3) H. Stapp "Mind, Matter and Quantum Mechanics" Springer Verlag, 1993

From gravity to consciousness. Joel Fontes <mfvlabs@prodigy.net.mx> (MFV Labs Manifold Vectors Studies).

Gravity is the inverted, real image of electromagnetism. The force of gravity can be deduced from the ratio of relative strength between force of a distant electrically charged object and the force its inverted, real image exerts on an infinitesimal mass of given point size charge. The mass and electrical charge can be engineered so that strength of its inverted, real image is sufficient to vanish gravity effect at focal point relative to infinitesimal mass of point size charge. Though relative strength would have increased, ratio remains constant and equivalent to repulsion ratio between two electrons due to electricity and electrons' gravitational attraction due to their masses.

This observation comes from study of optics dealing with refraction and reflection from concave mirrors and lenses. The study is a radical departure from classical notion that light rays concave mirrors reflect produce inverted, real images resulting from light rays intersecting and convergence, and are devoid of physical properties.

Instead, concave mirrors displace space and time in the immediate path of reflection within the radius of original sphere from which concave mirrors derive. The displacement is a geometric exchange of curvature. The resultant curvature is a negative curvature manifold of hyperbolic paraboloid form. The hyperbolic paraboloid is a ruled surface. When reflected from concave mirrors, principal rays follow a ruled surface trajectory of a hyperbolic paraboloid to a focal point. The ruled surface nature of manifold limits degrees of freedom of reflected light from a concave mirror and confines positions of focal points.

The negative curvature requires light rays to move as vectors in opposite directions simultaneously; having equal magnitude, the resultant force is zero, hence, a real image. The focal point is the center of gravity of resultant negative curvature manifold. The curvature exchange transition induces a potential differ-

ence of space and time, thus, rotational motion, hence, inverted image.*

The inverted, real image produced by eyesight is similar to process above. Humanity and by default any bioptic** creature must perforce perceive incoming streams of photons, in waveform rather than particle nature. Incoming streams do not choose either one of two eye lenses by which to enter. Indeed, entry and passage through both eyes at once requires an undisturbed quantum state, akin to a double slit experiment.

This suggests natural state of photons is a quantum state.*** Tunneling photons, antedating reality perception, apparent timelessness, suggest reality inherent to this natural quantum state is four-dimensional. Four-dimensionality, however, composed of the three known spatial dimensions and time, but in a coherent state of equal identities having potential energy.

Decoherence of the natural quantum state in the mind begins with a curvature exchange resulting in an inverted real image; precisely here, four-dimensionality collapses to three spatial dimensions, releasing potential energy and transferring angular momentum to beholder who senses illusionary temporal flow.

Consciousness originates in the process of the quantum state collapse in keeping with the law of conservation of energy and momentum. Simultaneously, consciousness reduces the wave function, and consciousness originates as the result of the collapse.

What do you get when you build a tetrahedron out of magnets? (...Or, why unification is too big an attribute to be anything but a primary tenet.). Ralph Frost <ralph@refrost.com> (Frost Low Energy Physics).

What a thoughtful person gets when they answer the question posed above is a quick and dirty shortcut to quantum consciousness. A secret doorway opens as one notices that the five different ways to align four rod magnets along the radii of a tetrahedron have the same dualic look and *feel* as do the five possible representations of Debye electronegativity vectors in molecules involving tetravalent atoms. That is, these five patterns dominate in organic chemistry and thus, throughout all of the lithosphere and biosphere.

At first, such a fancifully, naive notion sounds like compound jargonic gibberish: an intriguing word salad trick perhaps, but inappropriate for the ears of more learned men and women of science. What? Structure duality in a tetrahedral manner and acquire a desktop model that directly imparts repeatable units of physical intuition on states, one-half spin, anharmonic motion, AND a *feel* for quantum consciousness, all in a few moments of just thinking? Preposterous!

Yet, a thoughtful person will soon notice that quantum consciousness is, in the main, carbon-based, thus these same five dualic structures resonate throughout all of quantum consciousness. We do share the pattern and the similar pattern recognition systems. The doorway opens wider.

Oddly enough, it turns out that abstract math symbols and expressions involve "store/hold/retrieve" morphisms that are not innate in the thing itself. Thus, abstract mathematical symbols and expressions are just not synchronous enough nor robust enough to convey enough information fast enough to spark and sustain a working awareness of quantum consciousness or any of the other emerging, more unified models. More robust symbols are required.

The remainder of this paper, that is, in this initial public presentation, using standard one- and two-frequency magnetic tetrahedra, the author introduces the new symbols and traces through the discoveries of (1) the underlying principle of structured duality, (2) the solar maximum cycle as one definite quantum gravitational wave in the local region, (3) why the analog mathematical approach is effective when modeling the emerging more unified models, (4) why one-half spin is important, and (5)how binary tetrahedral symbols go about generating internal sine and cosine tables with just a bit of torsion, therein relating energy to spin to vision to smell, to memory to angles to math to speech.

The author will also describe his view of the notions: (1) "experience exists; time does not" and (2) "all HEP results only show that the unified system breaks down in repeatable ways".

Lastly, some discussion will be added to show how the improved information compression ratio that is inherent in such a quick and dirty analog modeling approach fits in rather nicely in an introductory global science and mathematics educational effort.

Does the theory of psychiagenia (TOP) have experimental applications? Ivan Godfroid <ivan.godfroid@chu-charleroi.be> (CHU de Charleroi (Universite Libre de Bruxelles), Department of Psychiatry, Vincent van Gogh Hospital).

The theory of psychiagenia (TOP) was recently proposed as an alternative to dualism and materialism (Godfroid, 2002). It can be viewed as a double-aspect monism, where the mind and brain have a common root called 'psychiagenia' which is not directly assessable (Godfroid, in press). Brain mapping and subjective experience are thus considered as truncated representations of psychiagenia that cannot easily be 'correlated'. As the hard problem would then seem simply to have shifted, an analogy with quantum physics' superstring theory (see Randall, 2002) was used to explain why psychiagenia is not directly assessable. The idea was to show that a possible answer to the hard problem of consciousness might come out of the logic of a theory that has solved another difficult problem of science: the relation between gravity and quantum mechanics. In the string theory, the messenger particle is no longer a point but a string vibrating in space-time at different frequencies; these different harmonics correspond to the different elementary particles. The superstring theory only works if space has extra dimensions, but we are unable to discern these. In TOP, string physics is supposed to govern psychiagenia, and the mere nature of this common root (like its number of dimensions) is thought to render its assessment unachievable: medical imagery reduces it to a 4-dimensional brain map, and cognitive psychology to an 'n-dimensional' one.

The next step in developing TOP is to search for experimental possibilities. On the one hand, there are of course future experimentations that should take place in the field of quantum physics (and a first step towards this goal is the study of ordinary aspects of string physics that will start around 2007 at the European Laboratory for Particle Physics' Large Hadron Collider). On the other hand, TOP has to take up the challenge of the classical majors topics of consciousness studies (split brain, blindsight, etc.). But I would stress here that medicine could offer some other promising ways of investigation that have been largely neglected until now: pseudocyesis (a disease where the false conviction of pregnancy induces anatomical modifications), aphasia (where the preservation of thought after a stroke in the language area of the brain has been described), dementia (characterized by a backward erasing of all knowledge along with neuronal lesions), and most of all, the placebo effect. Placebo effect is certainly one of the most fascinating and controversial aspects of medicine. It can be

viewed as evidence that a mind state can be indirectly linked to a somatic effect through a far more complex mechanism than a neural correlate. In other words, the placebo effect seems the most promising way of assessing psychiagenia by new paradigms, and a first step towards experimentation of TOP.

Godfroid IO. Psychiagenia: mind and brain through superstrings. Int J Neuropsychophamacol 5 (Suppl 1): S195, 2002.

Godfroid IO. Psychiagenia: a gauge theory for the mind-brain problem. Neuroquantology, in press.

Randall L. Extra dimensions and warped geometries. Science 296: 1422-7, 2002.

No risk of a quantum decoherence in the brain according to the theory of psychiagenia (TOP). Ivan Godfroid <ivan.godfroid@chu-charleroi.be> (CHU de Charleroi (Universite Libre de Bruxelles), Department of Psychiatry, Vincent van Gogh Hospital).

Neuroquantology is a new field of research. It is based on the assumption that quantum physics and neuroscience can unite in the study of consciousness. Although new ideas, and especially integrating paradigms, are constantly encouraged in all the scientific journals, the least we can say is that physicalism is not always welcome. Scepticism is however fruitful when a real debate is possible. As it was stated in the first announcement of the Quantum Mind 2003 congress, critics mainly contend that "the brain is too warm for quantum computation which in the technological realm requires extreme cold to avoid 'decoherence', loss of seemingly delicate quantum state by interaction with the environment". Several authors have attempted to demonstrate that a quantum effect could nonetheless be possible in the brain (e.g., Donald, 1990, to see how a physicist deals with the difficulty; and Rocha et al., 2001, for a biological approach).

Tackling the problem from another point of view, I would like to stress that the theory of psychiagenia (TOP) clearly avoids this kind of inconsistency. TOP was recently proposed as an alternative to the usual answers to the mind-brain problem (Godfroid, 2002; Godfroid, in press). The world according to the TOP is ruled by string physics (see Antoniadis et al., 1998, and Randall & Sundrum, 1999, on string theory's relevance to macroscopic systems; and Flanagan, 2001, for an alternative application to consciousness). Psychiagenia is the name given to the part of this world corresponding to a common root for the mind and brain. Psychiagenia is currently not directly assessable. Indeed, only truncated images of it are obtainable: the brain is an "objective" one, and the mind a "subjective" one. If brain and mind are only indirect representations of psychiagenia, it is because the very tools we use for its assessment (medical imagery for the brain, or cognitive psychology for emotions and thoughts) lead to a kind of alteration in their common root. In other words, there is no risk of a quantum decoherence in the brain according to TOP, because the brain is already the result of a decoherence of psychiagenia. Now the real question is: which way forward to the direct assessment of psychiagenia?

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Unified model of bivacuum, wave-corpuscle duality, electromagnetism and gravitation. Nonlocality and quantum entalgement. Alex Kaivarainen <H2o@karelia.ru> (University of Turku).

The Bivacuum model is a consequence of new interpretation of Dirac's theory, pointing to equal probability of positive and negative energy. Unified Model (UM) represents our efforts for unification of vacuum, matter and fields from few ground postulates. New concept of Bivacuum is introduced, as a dynamic matrix of the Universe, composed from non mixing sub-quantum particles of the opposite energies, forming vortical structures. These structures, named Bivacuum fermions and antifermions, are presented by infinitive number of double cells-dipoles, each cell containing a pair of correlated rotors and antirotors: V(+) and V(-)of the opposite quantized energy, virtual mass, charge and magnetic moments.

The matter in form of sub-elementary fermions or antifermions is a result of double cells symmetry shift towards the positive or negative energy, correspondingly. Their triplets form elementary particles and antiparticles. The [corpuscle (C) - wave (W)] duality is a result of quantum beats between the 'actual' and 'complementary' states of sub-elementary fermions/antifermions. The [C] phase exists as a mass, electric and magnetic asymmetric dipoles. The [W] phase exists in form of Cumulative virtual cloud (CVC) of sub-quantum particles. It is shown, that Principle of least action is a consequence of introduced 'Harmonization force (HaF)' of asymmetric Bivacuum. The influence of HaF of Bivacuum oscillation on matter is a result of induced resonance between virtual pressure waves (VPW) of Bivacuum and [C - W] pulsation of sub-elementary particles and antiparticles, forming electrons, positrons, quarks of three generation (e, mu, tau). The system [Bivacuum + Matter] has a properties of the active medium, tending to Golden mean conditions under HaF influence. The mechanism of quantum entanglement is proposed also. The physical nature of electromagnetic and gravitational potentials of elementary particles can be related to non local equilibrium shift of infinitive number of Bivacuum fermions and Bivacuum antifermions, compensating the local symmetry shift, induced by zero-point longitudinal (z) and transversal (x) vibrations of uncompensated sub-elementary particles, as respect to (y) axe, coinciding with the axe of their rotation, responsible for the rest mass origination. The pace of time for any closed system is determined by pace of kinetic energy change of this system, related to in-phase change of electromagnetic and gravitational fields. The Unified Model is confirmed by logical coherence of many of its consequences and fairly close evaluated magnetic moment of the electron and experimental one. The full text of corresponding set of papers is on line: http://arXiv.org/find/physics/1/au:+Kaivarainen_A/0/1/0/all/0/1

Quantum consciousness and internal structure of elementary particle. Alexei Melkikh <mav@dpt.ustu.ru> (Ural State Technical University, Molecular physics chair).

An analysis of the processes of information reception, pattern recognition, and decision making by an information system have led to the following conclusions:

- Learning of an information system is impossible, because new (unrecognized) information received by the system is not valuable, while valuable information (that matches reference samples) is not new,

- Conditioned and unconditioned reflexes do not differ fundamentally. It is impossible to form a nonprogrammed conditioned reflex in an organism. The organism does not receive new valuable information in both cases,

- The behavior of man and animals is fully determinate. If a new signal appears in the environment, a priori programs are started (or not started) in the organism,

- In the presence of noise some programs may fail in the system. In this case the system will behave itself less adequately. New programs will not appear.

The deterministic model of organisms behavior was proposed. In this model organism described as adaptive automaton. Possible mechanisms of mind working are discussed:

À) Proteins and other macromolecules properties (including conformational changes) are determined by fine tuning of fundamental constants.

Á) Complex internal structure of an elementary particle. In this case a particle may represent a quantum computer with many degrees of freedom. If the internal structure of a particle is prepared such that internal degrees of freedom are excited only in the presence of a certain environment, the behavior of this particle will not contradict basic experiments of the quantum physics and can be described by a wave function. A Schrödinger equation (or an equivalent expression depending on the particle spin) can be written for this function. The equation will contain the particle mass as a whole, the particle charge, etc.

If assigned conditions are fulfilled, quite certain internal degrees of freedom of a particle are excited (this was prohibited by selection rules) and the particle starts functioning as a quantum computer: it recognizes patterns and makes decisions. Excitation of internal degrees of freedom may be viewed as a pulsed control of the particle motion, which can only be observed in special experiments.

In this case the Hamiltonian and the wave function (and, hence, all mean values) change in a preset manner during a short period of time. After a decision is made, the internal control system cease functioning and the particle again behaves itself according to the rules of quantum mechanics for a material point.

Thus proteins (and other macromolecules) cooperative behavior in the cell might result from the operation of this quantum computer. For example it is possible to control channels opening in biomembranes of neurons.

Numbers in Space 1. Transformation of four-dimensional space-time into quaternion time-space. 2. Rotation as a kind of motion, non-reduced to rectilinear one. 3. Non-interrupted continuum and varieties of numbers. Pavel V. Polyan <polyan2002@mail.ru> (Krasnoyarsk State Univerersity).

One of the Wolfgang Pauli's scientific texts begins with a remarkable phrase: "Let us introduce, as usual, material co-ordinates Xk for space and imaginary co-ordinate X4= iCt for time and consider Lawrence's transformations..." (W. Pauli. Works on Quantum Theory. M. "Nauka", 1977, see article "About Mathematical Matrix Theory Of Dirak", p. 5, "Lawrence's Transformations of Dirak's Wave Functions", p. 233). The phrase "as usual" can be considered here as a kind of a witty intellectual provocation, which means that the above-mentioned procedure can be performed not "as usual", but in "an unusual way". But how? It is not difficult to say: we try to maintain the material co-ordinate for time and consider 3 spatial co-ordinates imaginary. Then Minkowsky's four-dimensional pseudoeuclidean continuum will transform into some unusual variety, which we shall call "Quaternion time-space".

The appearance of the term "quaternion" here is evident: it is easier to present 4 numbers, expressing co-ordinates (one material, three – imaginary) as quaternion. But quaternion is algebraic numbers, and four-dimensional space-time is continuum. If it is so, are there enough reasoning to make them correspondent? We shall try to answer this question later and for the present we shall consider quaternion time-space as some pure logical construction, which can be seen as a whole and analyzed in particular. It is also important to mention that the term "space" in modern science is not connected any more with distance measuring, and nothing disturbs us to make a four-dimensional space, where a measure in [t] is put on the axis. But as time is of physical character, which reflects the important aspect of reality, not formal mathematical qualities of the made-up construction, but its physical interpretation will be of greatest interest to us in this article.

Thus we have a four-dimensional variety, where the material axis is pure time, and the rest three ones are spatial co-ordinates transformed into imaginary temporal axes. While building Minkowsky's four-dimensional pseudoeuclidean continuum, all the co-ordinates were measured in [x] as a result of multiplication of a temporal co-ordinate and co-efficient C which is velocity of light [m/s]. That is why in our quaternion time-space a 'one-measurement' is achieved in analogical way: Multiplication of imaginary spatial co-ordinates and some co-efficient S, measured in [s/m]. One can say that it is 'the reverse velocity of light', but it is not. The reverse velocity of light 1/c, as real physical quantity cannot be an unknown co-efficient, while the scale of reverse velocities is irregular. In classical notion velocity is a ratio, where the numerator is the distance segment, and the denominator is time period, time as independent variable quantity. Then dealing with 'reverse velocity', where the numerator and the denominator exchange their places, there appears not only new, but also irregular measuring scale: 1[m/s] = 1[s/m], 2[m/s] = 1/2 [s/m], 3 [m/s] = 1/3 [s/m], 4 [m/s] = 1/4 [s/m], etc. It seems that due to this reason quaternion time-space cannot be analogue of the four-dimensional continuum. But it easy to find the way out, if we do not consider S to be 'reverse velocity', but some co-efficient measured in [s/m].

Let us turn from mathematics to physics. If co-efficient C in Minkowsky's pseudoeuclidean continuum is a concrete physical quantity – velocity of light, which has in different measurement-system concrete numerical realization, in our quaternion time-space co-efficient S must be some physical constant quantity, different in itself from velocity of light, but having a measurement [s/m]- a reverse one to the measurement of velocity. We can offer a combination of constant h/e2 to suit this new constant, where h is Plank's constant, and e is the charge of an electron. It is well known that this combination as well as C is included in the expression of the non-measured constant of thin structure 1/a = hC/e2 = 137.

0306... (h is Plank's constant divided into 2 "p" – h/2p). I believe that is true, that quaternion time-space is a mathematical expression of the real aspect of microphysical reality, where the constant S = h/e2 measured in [s/m] is as important as velocity of light for Minkowsky's four-dimensional continuum.

Consciousness based solutions to mysteries and paradoxes of quantum mechanics. Avtar Singh <avsingh@epri.com>.

The observed spontaneity or consciousness in nature, specifically the spontaneous decay of particles, has been mathematically described in this work to formulate a Gravity Nullification model (GNM) that integrates a Modified Theory of Relativity, spontaneity that allows transformation of mass, energy, space and time to satisfy the laws of conservation and classical gravity into one simple model. Gravity Nullification Model (GNM) provides the missing physics in the theory of relativity to explain the fundamental relationship between space, time, mass and energy. Some fundamental assumptions in the Einstein's specific theory of relativity are reinterpreted or modified to provide answers or explanation to existing paradoxes of science including classical physics, quantum mechanics and cosmology. Using this model a mathematical relationship is derived relating the wavelength of a particle mass and velocity as a substitute for the famous de Broglie equation. Observed non-locality and effective speed of light are explained using GNM.

A physical understanding of the inner workings of Quantum Mechanics is developed using GNM. The Heisenberg's uncertainty is revisited and reformulated using relativistic formulations of the GNM. Paradoxes of quantum mechanics such as the observer paradox (the collapse of the wave-function, non-locality, quantum entanglement, formation and behavior of Bose-Einstein condensates, particle spin etc. are explained using the GNM physical models. The theory of parallel universes widely accepted by scientists to explain the inner workings of quantum mechanics is explained in terms of the relativistic parameters within the framework of the GNM.

Effects of gravity at quantum and classical scales have been evaluated using the GNM, which shows that the widely accepted and tested classical formulation of gravity can also explain the observed gravitational effects at or below quantum scales.

A dark matter model of consciousness. Richard Yannopoulos-Ruquist <yanniru@netscape.net> (Retired PhD from Harvard in Applied Physics 1966).

A model of consciousness may be based on the supposition that an axionic superfluid is the major component of Dark Matter. We assume that consciousness requires, as one of its components, a macroscopic quantum coherent medium, namely a Bose-Einstein Condensate (BEC). We also presume that BECs cannot exist at room temperature in the physical world of electrons and protons. Perhaps Dark Matter contains a BEC as one of its constituents. The cosmic axionic field, if it exists, is both a local and cosmic BEC.

Astronomical observations of other spiral galaxies indicate that dark matter permeates and extends well beyond the visible galaxy. The mass of the axion, thought to be 10^-5 eV or about 2x10^-38 grams, is about one trillionth the mass of a proton; but about 10 trillion axions exist for every proton and neutron. So axions are expected to be a major component of dark matter; and the huge number of them indicates that the superfluid is local as well as cosmic. However, there is still a serious problem.

Human consciousness is physical. For sure the visible component of human consciousness is physical and not a quantum consciousness. (The dreamstate could be otherwise). If quantum consciousness exists in the axion superfluid, it must be invisible. So we are faced with the problem of how the invisible axion consciousness couples with the visible physical consciousness.

This is an unsolved problem. But it reminds us of the fundamental wave/particle duality of quantum theory. In one interpretation, both waves and particles exist, but at different times, with the invisible waves collapsing or reducing into visible particles, so that particles of different kinds can exchange energy and information. For example, eyesight involves the reduction of electromagnetic fields into photons that can interact with electrons on the Planck scale (where all particles are alike).

The hypothesis is then that axion waves couple into physical processes when they collapse into axion particles. Penrose has already suggested that as a basis of consciousness in a slightly different context, and the Penrose hypothesis is consistent with Ohatim's measurements of microlepton half-life. Penrose and others have also suggested several physical processes that might be BEC capable at room temperature. We now presume that none are, but that some or one of these physical processes might be capable of coupling with axion particles. The Froehlich/Marshall hypothesis, where metabolic or electrical stimulation of membrane dipoles is required for physical consciousness, is preferred here, as it correlates with the human experience of going asleep and waking up.

6, Quantum Psychology/Biology/Neuroscience

Quantum theory and perception: Quantum state as "sense-data" and "emotion" as quantum measurement process. Balaraju Battu <bala@nbrc.ac.in> (National Brain Research Centre, Gurgaon, India.).

The objective world what we know is our perception, Perception involves, sense data and concepts. According to context, the emotional act of the brain / mind supplies concepts to sense data. The emotion brings up particular percept: Sense data + concepts (in the presence of emotion)----> percept. The percept is in our mind; it is our knowledge regarding an object that we perceive in the objective world. In quantum theory, the measurement processes brings particular observed state from all unobserved logical states (quantum superposed state). In the process of perception, the emotion selects particular percept from sense data, which is treated as all logical possible percepts (sense-data). The emotion seems like quantum measurement process, which brings particular percept from sense data [quantum state + measurement ----> particular classical state]. In modern economic theories, Daniel Kahneman and Amartya sen showed that decision-making is not preceded by minimizing or maximizing our comforts and loses. In quantum theory, wave function collapse does not depend on minimizing or maximizing certain parameter. Here, certain similarities are shown among the perceptual phenomena and quantum mechanical phenomena.

Quantum electrodynamics (QED) and unified synaptic channel (USC) in the identification of consciousness. Massimo Bondi' <masbond@libero.it> (Universita' "La Sapienza" di Roma), Manuele Bondi'.

The mysteries of Consciousness have gripped human imagi-

nation for over 5,000 years. At the dawn of the new millennium the international "debate over Consciousness" is largely being supported by two competing world-views: Dualism which splits the Universe into two fundamentally different mental and physical substances or properties; Material Reductionism, which claims consciousness to be nothing more than a state or function of the brain. Can consciousness be interpreted as a pile where both opinions are present? It is what the present effort endeavors to demonstrate. The aim of this paper is to show how the evolution of man is above all linked to the development of his own neurons, which during the milleniums acquire new information, increasing enormously in number and quality and assuming, so to speak, the features of the modern neurons. We have also tried to combine classical physics with quantic physics in the emersion and identification of consciousness represented as a "whole". Through a careful revision of the bibliography of QED (Quantum Electrodynamics) and its application to the biochemical structure of the USC (Unified Synaptic Channel), a model of consciousness identification is proposed. The model entails a channel running in loops all along the labyrinthic structure of the bi-emispheric cerebral cortex and constituting an anatomical-istological structure on its own along which the flow of molecular (and ionic) particles as neurotransmitters determines a sort of constant low-noise effect. According to this model the molecules would thus gain an additional informative value; for their presence in the synaptic fissure they would become relevant apart from their bonding reabsorption since by the process of diffusion they would induce concentration changes in other portions of the cortex, thus affecting the underlying mosaic of neuronal activity and inhibition. We are inclined to think that the process or the result of the awareness of the "Self" could be more clearly understood, considering it as a change of molecules-particles concentrations along the structure of the USC. This would determine a subtly regulated transmission of all the pre-synaptic inputs so starting a syncronic and synergic low-level activity in the "whole" neuronal web. Perception, memory and learning are the three physiological functions through which emerges the consciousness of the self, increasing from the constant low-noise effect of a quiescent state to particular map interconnection systems correlating selective events. Such moments would necessarily have to correspond to ionic-molecular codifications that coherently are accounted for by the QED mechanism. We also described how physiological, pharmacological and pathological moments through which consciousness disappears could confirm the global nature of consciousness which "lights up" and "turns off" when all the neuronal cytoskeletons and the USC loose their quantic/computational capacity.

Jung/Pauli dialogue: The influence of quantum consciousness on psychology. Gregory Brack <gbrack@gsu.edu> (Georgia State University), Michele B. Hill.

The concept of "quantum consciousness" has increasingly captured the attention of social scientists, but historically the dialogue of quantum physics and social science is old. One of the earliest and most significant continuing dialogues between physics and psychology was that between psychiatrist Carl Jung and Nobel Prize winning physicist Wolfgang Pauli. Among a select group of Jung's followers, the Jung/Pauli dialogue was followed closely, and influenced extensions of Jungian therapy, but until recently much of the psychological community was ignorant of the groundbreaking work between the two very different scientists. With the recent publication of several sources recording this dialogue, deeper insight into their thoughts are now available to a wider audience. In particular the publication in English of the Jung/Pauli letters titled "Atom and Archetype" records the decades long cross fertilization of ideas between the two thinkers. In addition the publication of Pauli's relevant collected work in "Writings on Physics and Philosophy" has provided Jungian scholars much more material about the deeper aspects of their ideas on quantum consciousness. This paper will discuss first the notorious background that led to Pauli entering the "Jungian circle." Next, the paper will discuss that as the two scholars became acquainted, there arose a mutual recognition of the similarity of their two apparently dissimilar fields. Their subsequent communications then affected Jung's view of "Synchronicity" and Pauli's view of quantum mechanics. This paper next assesses how that dialogue, and its subsequent effects upon Jung and Pauli, may inform contemporary discussions about quantum consciousness and the continued cross communication of the hard science of physics and the softer social science of psychology. Finally, the paper will look at the influence of William James upon both Jung and Pauli. Often in reviewing the Jung/Pauli dialogues, commentators have forgotten that one crucial aspect of James' theory of consciousness was the role of the "spiritual" on an unconsciousness level. James would suggest, and the writings of Jung and Pauli seem to support, that quantum effects likely influence consciousness via the unconsciousness. Such insight may lead to a revised formulation of "quantum consciousness."

Synchronous oscillations and phase encoding in the brain. Russell Ceballos <ucmenicu@msn.com> (School of Computational Sciences, George Mason University).

Recent neuroscientific evidence has called considerable attention to spontaneously active neurons synchronized as assemblies, within millisecond precision, over space-separated regions of the brain. This phenomenon has been related and extended into many areas of neuroscience, especially its significance to the distributed nature of brain processing, and even to requirements of conscious experience and psychopathology. Much of the earlier data emphasized zero-phase lag between synchronized signals, more often than not in terms of their relation to the perception of a percept/stimulus. However, accumulating evidence has been calling this straightforward approach to temporal binding into question, as transient phase locking and asynchronous inputs have been shown to be equally active mechanisms involved in this process. Attention is paid to the molecular, sub- and super-neuronal processes that provide insight into the pathways and possible mechanisms involved in "binding" distant spatio-temporally encoded processing in the brain. The phase relationships inherent in these processes, as well as other relevant data regarding non-local interactions/phenomenon in the brain are also discussed. It is emphasized that the resolution of time scales within which these synchronized processes occur need to be enhanced before any serious assessment can be made in terms of EPR-like correlations. It seems that such precise and delicate phase encoding between millimeters of space within the brain, working within the time scales evidenced so far in the data, would be best represented non-locally; in a Quantum-like way. That is, sub- and super-neuronal wave processes would provide a much more refined modulation of such oscillations, and a richer, albeit more comprehensive, understanding of the dynamics and information process-

ing involved. The problems posed in attempting to understand this phenomenon within the framework of classical neurophysiology and physics seem to evaporate when approached from a Quantum, or even Quantum-like, perspective. This paper, using the evidence presented and taking in hand the known structure and properties of receptive fields at the microdendritic processing level (which has already been established in Quantum holographic terms by Pribram), aims to elucidate some of the fundamental issues of distributed information processing in the brain and its relation to the conscious experience.

The role of hypnagogic state in the quantum brain model: A preliminary study on a mind model based on three values logic. Guido Del Prete <guidodelprete@interfree.it> (Progetto per lo sviluppo del potenziale umano "Shambhala" http://www.medicinaolistica.org).

According to the Stapp model, the mind is a quantum system, in which mental states are entangled with quantum events observed by consciousness. So, if a human subject observes an uncertain quantum event, the wave function of that event is collapsed through collapse of the mental state in that subject, which is manifested in recordings of electrical potentials; and then becomes determined for any subsequent subjects observing the same events. In literature, statistically significant data support the hypothesis that the collapse of the wave function is manifested on the ERP (recordings on EEG of event related potentials).

Event-related desynchronization of the alpha rhythm on the EEG is associated with conscious observation. In hypnagogic state, like during the meditation, instead, is present a well-synchronized EEG profile with priority of alpha and theta rhythms. In other experimental studies a few subjects in hypnagogic state, induced by hypnotic suggestion or deep meditation, are able to influence meaningfully a REG (Random Event Generator). This circumstance does not appear in the same subjects in wakefulness consciousness state. Further, always in literature, are present some experiments about transferred potentials between subjects during deep meditation; these experiments prove the nonlocality of the brain potential in particular conditions.

The authors suppose, on the basis of these remarks, that the hypnagogic state is a privileged mental state that is characterized by nonlocal effects, as transferred potentials and micro-PK, and is required to enable the mind working through a three values logic model, that is also the logic of quantum physics. The mind of the subject in hypnagogic state is trained by a particular procedure (based on mind-body techniques explained in this paper) to think according to this logical model. In this condition, after training, should to prove a higher duration of the superposition state on the ERP during the first observation of an event never observed before. This study offers valid indications to support this hypothesis.

Visual perception: A treatise to human consciousness. Constantinos Evripidou <revcon_au@yahoo.com>.

This paper investigates new relationships between visual attention and visual registration and perception. Further, theoretical relationships between attention and subjective consciousness are also presented. I suggest that this paper provides sufficient ground material, which proves the existence of human or subjective consciousness, and that human consciousness is intangible, separate and independent, yet existing or dwelling within the physical human body. (Additional research work including experiments is currently being undertaken to further qualify some of the findings and also practical experiments to measure response time of post attentive visual perception).

The efficacies of the findings are based to a degree on the study of a personal observation concerning my own eyes and the study of the "pendulum" which was used some years ago in earlier applications of hypnosis to induce a trance state.

If we invite the eyes to follow a moving object then it renders the natural visual properties of the eyes inactive, causing "conscious blindness". As there is no conscious registration, the mind automatically transcends into a trance or a level of unconsciousness, and hence the right side of the brain becomes more active in an attempt to create what the physical eyes do not see consciously.

Ultimately, the observation of my own eyes led me to specific discoveries which helped to qualify the concepts of visual attention, explain what I call complete visual perception, the dynamics of observing moving and stationary objects and how the process of observation altered the level of consciousness.

Gene expression to memory to consciousness. Robert Fujimura <kanjirob@bellsouth.net> (Department of Psychiatry and Behavioral Sciences, University of Miami School of Medicine, Miami, FL).

According to a book by JA Jungerman or by the present day process philosophy, a substance consists mostly of empty space filled with interactions of subatomic particles, photons, and gluons; a substance is a series of events. Each event is connected to earlier events. Each level of organization - atoms, cells, organs, organisms, and communities - affects all the other levels in a complex web of interactions or connections. Therefore, matter itself is at the microscopic level a dynamic sea of energy exchange in a vacuum. Everything we observe exists by interactions from fundamental particles to the universe. The universe and life are evolving toward complexity.

We have two extreme views on consciousness and many in between. One extreme end is that of Steve Sevush that a single neuron has the neurocore of consciousness. The other extreme is that of Gerald Edelman and Giulio Tononi, who wrote that the neurocore of consciousness is dynamic networks of neurons. Richard Sole and Brian Goodwin wrote that single neuron is like an ant in an ant colony, it does not by itself has consciousness. Such a complex system can not be understood by studying a neuron. Consciousness is based on series of interactions at increasing levels of complexity from gene products to signal transduction pathways to synaptic activities to memories and to consciousness. Each level depends on interactions at the previous level.

On the origin and function of biological synchronisation. Catarina Geoghan <c@geoghan.worldonline.co.uk> (Guest Researcher Philosophy of Cognitive Science Research Group Department of Humanities University of Skövde Sweden).

An overview of published evidence from biological synchronization research is presented, with the aim of establishing to what extent there is a correlation with the frequency harmonics of standing waves in the earth-ionosphere cavity. It will be shown that there are preliminary indications that there is a close correlation. However, since most research into synchronization of cortical and motor rhythms focus on fairly wide frequency bands, a clear view is not obtainable until data is available that has been analyzed in greater detail.

It is proposed that standing waves in the atmosphere provide a reference frequency for implicate order enfolding and unfolding of information (David Bohm, 1980).

Can anomalous brain function point to evidence of quantum amplification? Sheilla Jones <sheilla_jones@yahoo.com> (University of Alberta, Canada).

The astounding abilities of people who exhibit reduced fronto-temporal lobe activity, in particular prodigious mathematical savants, currently defy classical explanation. This raises the question of whether such abilities may be real world examples of quantum amplification. As a means of identifying abilities as classical or quantum computations, a boundary between the two is proposed, along with a means of testing this hypothesis if suitable candidates can be found.

Path integrals, Bohm theory and a model of the brain: A nonlocal, holistic, and contextual picture. Frank McLafferty <FMcLaffert@aol.com> (Long Island University Brooklyn, N.Y. 11201), Kathleen Loua Bohm.

We consider Triffet and Green's model of the brain. It is designed to mimic EEG results. We quantize it by the path integral form of Schweber. We consider the semiclassical limit which is a picture of competing programs in the quantum computer analogy. Collective Quantum jumps are possible and are interpreted as changes in perception. We then consider generalized Bohm theory. The picture is that of a stochastic computer. We then transform to the Wigner form and for the pure state formally solve the model. The result is nonlocal, holistic (the state of one neuron depends on all the rest) and contextual. The model predicts changes in the EEG if quantum effects are important.

Using the quantum mind theory for multidimensional visualization. Denis Perevalov <perevalovds@mail.ru> (Ural State University).

The classical psychological theory claims that human brain cannot directly perceive geometrical objects of four and more dimensions because our eyes deal with 3D structures only.

Using the quantum mind theory, it seems possible to create techniques for loading high-multidimensional objects into the brain. In work we study this possibility.

Within the quantum mind theory, one can imagine the process of visual perception like the hyperparallel processing on huge array of the visual images. The array is constructing during the perception phase inside the brain. The hypothesis: under special conditions, its possible to replace inner array to a set of images which we want. And more, the brain can process it and extract necessary information.

What happens if we push there the set of images which consists of the two-dimensional slices of given object, lying in n-dimensional euclidean space?

We believe that the brain will process it and extract geometrical information like connectedness, convexity, curvature, existence of holes in the object.

Its unknown, can the brain fuse slices into whole model of object, or just check some slices for getting answer. But we can prove, the set of slices is sufficient for both.

How one can push huge set of images into the brain? Obviously, special techniques of visualization is needed.

We had developed computer system for slices visualization. The system use speed, noncontinuous rendering and stroboscope effect for showing all the object's slices in short time.

Unfortunately, no positive results about "hyperperception" were obtained yet.

Despite negative results, the mentioned ideas seem well promised.

If our ideas will be realized, the system of multidimensional visualization will help to the topologists to see threedimensional manifolds (which mainly did not realizable in 3D space) and to solve famous Poincare's conjecture.

And of course this will give additional scores to the quantum mind theory.

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Paramecium-based cytoskeletal information processing model. Barry Ridge <nous@dna.ie> (Nous Research), Sean O Nuallain.

The paramecium, the most complex of all protists, has long been observed to exhibit intelligent behavior. Using the cilia on the surface of it's body to maneuver, it searches for food, it sexually reproduces, it avoids obstacles and it fires tiny darts at enemies, all without the benefit of a nervous system. However, like all eukaryotes, it does contain a cytoskeletal network which many believe to be the key to its curious behavior. It has been hypothesized that a pair of centrioles in the centrisome of protists such as the paramecium may act as a cellular 'eye', by which the organism would recognize infrared pulses from other protists. These pulses, which are thought to be generated by mitochondria, would be picked up by the two centrioles, which would use both their shape and relative positions, as well as the blind-like nature of their bunched microtubules to isolate the direction and possibly the distance of the signals. These signals would subsequently be relayed to the proposed cytoskeletal information-processing network, which would decide on the resultant action of the cell.

My future research will aim to create a model of cytoskeletal information processing based on the structure of the paramecium. In order to focus on the development of cytoskeletal functioning, the simulation of overall cell functionality would require significant simplification. This would entail omission of some or all of the following functionality, which might be considered to be non-critical to the processing system: respiration, metabolism, growth and genetic inheritance. The existence of such cell characteristics could still be implied in the model, but would not be simulated to any great level of detail. Ideally, the completed work would be a virtual adult paramecium cell that would respond to pseudo-infrared stimulation, and potentially other forms of stimulation, in a virtual environment. The primary goal, however, is to successfully emulate microtubule processing of generic stimulation which would form the basis for modeling of the entire cell. Major considerations for subsequent development would include cell motility, mitosis, reproduction and adherence to realistic physical laws.

In such a model, given the nature of present resources, it will not be feasible to extend past the tubulin detail level, but it is hoped that this will not be to the detriment of the overall goals.

If successful, the academic ramifications of this project would be two-fold. Firstly, neural models would be shown to be non-essential and potentially redundant in the development of non-symbolic artificial intelligence. Secondly, it would further ratify the Orch-OR model of quantum consciousness by showing that microtubules can indeed be used to process information, albeit without the quantum element. The project will be developed with extensibility in mind. The possibility of linking such software to future quantum computers is a long-term, esoteric objective, but certainly one worthy of consideration.

Does the brain produce binding by combining a correlated redundant neural network with a speed-of-light neural network? David Saunders <dsaunders42@yahoo.com>.

If the synaptic architecture of the classical neural network is altered slightly so that there are two discrete, correlated memories at every synapse, one of these memories being redundant from a preceding synapse, and then such a correlated redundant neural network is combined with a simultaneously functioning speed-of-light neural network, a rather straight forward solution to the brain binding problem suggests itself. The manner in which the above architecture would function is that when a synapse fires, both memories at that synapse are flashed across the brain at the speed-of-light. The only places where either memory will interact is when they encounter themselves at a synapse in some other brain center where of course each memory will be paired with a different correlated memory (the nature of these correlations will be determined by the main function of these other brain centers such as vision, hearing, faces, experiences, etc.). The interaction of a memory with itself in the various other brain centers triggers a process that leads to the firing of a synapse there and the resultant flashing of that same memory back across the brain to interact with itself at, among other places, the original synapse causing it to refire. And then the whole sequence starts over again. Such an architecture and function would in a very fast parallel manner allow the brain to process sensory input or to assemble thoughts by stringing together correlated memories from anywhere in the brain.

Is the above brain binding? Or, at minimum, is it an essential element of it? If it is, then into-the-bargain one can almost catch glimpses of: the "neural correlates of consciousness" (Crick and Koch 1990); the "global workspace" (Baars 1988); the "Neural Global Workspace" (Newman and Baars 1993); the generation of instinct and human nature (The question that begs itself is: if there are two correlated memories at every synapse, then what in the brain establishes these memory correlations and upon what values and priorities is this process based?); the replacement of neurons, no memory lost; dreaming; the push-pull ontogenetic and evolutionary development of the brain; the ability of the brain to recover or cope with some success after suffering trauma or lesions; the reason for some pathologies; ... and much more.

Virtual reality causing EEG-alterations. Hendrik Treugut <h.treugut@t-online.de> (Deutsche Gesellschaft für Energetische und Informationsmedizin e.V. energy medicine (DGEIM), G.Haffelder (Institut für Kommunikation u. Gehirnforschung, Stuttgart), A. Roessler (ICIDO GmbH, Stuttgart).

A combination of a special type of EEG (EEG-spectralanalysis) and CAVE, a special type of VR was used looking for possible interactions between mind and virtual reality (VR).

The Competence Center Virtual Reality at the Fraunhofer Institute for Industrial Engineering (IAO) in Stuttgart/Germany has created a combination of hard- and software for a 3D visualization system to be used as a 3D workplace (CAVE). The core of the 3D visualization is a virtual reality-software system which combines the relevant data with projection and interaction devices to a real time application. Digital mock-ups and processes present clear and vivid in a quasi holographic quality, thus avoiding the disadvantages of these systems, the lack of an object, and enable interactive and stereoscopic presentation.

In the Institut für Kommunikation und Gehirnforschung in Stuttgart/Germany activities of the brain are registered and measured by EEG-spectralanalysis: the frequencies of EEG-signals from different locations were analyzed by fast-Fourier-transformation (FFT) separating their partial portions and presented as a chronospectrogram. Thus very high time-related resolution is attained providing information about subconscious emotions and reactions.

In this CAVE 7 healthy persons have been monitored by EEG-spectralanalysis for evaluation of psychic effects of virtual 3D geometric structures on the brain. The chosen structure was a mathematically constructed pyramid, consisting of small light lines in front of a black background. Height and location of pyramid was changed by the software giving the impression of movement relative to the pyramid within the CAVE. We chose a pyramid about 6 meter high and movements up and down, ahead and back. The person was seated in the middle of the CAVE, connected to the EEG, the eyes completely covered by a mask and the pyramid moved. The setting in the CAVE was monitored from outside.

There were significant alterations in the EEG synchronous to the movement of the pyramid: while there was normal brain activity during steady movement a specific pattern appeared when the direction of the movement was changed or when it started or stopped. Similar alterations showed up in another very specific situation: when the head of the person penetrates the virtual surface of the pyramid.

EEG alterations consisted of very short interruptions of normal brain activity bihemispherically and the appearance of a new pattern during a few milliseconds (attention syndrome) with total decrease of alpha-activity, partial decrease of delta-activity and localized increase of specific frequencies in the theta-segment.

The observations demonstrate the ability of human brain to perceive events in a surrounding virtual reality without using physiological senses of the body. The mathematical-mental constructions of the VR seem to exist at a lower level of "reality", but within perception faculty of human brain. So the central observation of this study implies, that virtual reality (VR) shows interaction with the brain, part of "real" reality.

About modulation and demodulation in DNA molecule. S. Zdravkovic <szdravk@kondor.etf.bg.ac.yu> (University of Priština, Kosovska Mitrovica, F.R.Yugoslavia), M. V. Sataric (21000 Novi Sad, F.R.Yugoslavia).

In this article two types of solitonic waves, moving through DNA molecule, were studied. One can be recognized as modulated wave and the other as demodulated one. This demodulation is a result of viscosity effects and was compared with the same process in engineering. We state that demodulation plays a crucial role in the interaction of DNA molecule with m-RNA polymerize, i.e. in the formation of m-RNA molecule in cell nucleus.

7, Education

Quantum nonlocality, consciousness, and architecture. Tom Bender <tom@tombender.org>.

Modern physics posits the existence of only a material universe, and all properties in it inherent in the properties of its elemental particles. Yet we are faced today with significant limitations of that hypothesis as currently developed:

• the widespread experiencing and active work in our own culture with life-force energy (chi or prana) which our physics denies the existence of – in realms as different as healing, martial arts in the military, architecture, and CIA remote viewing. Any model of our universe today that ignores the phenomena of life-force energy has questionable credibility.

• the logical enigma of "fundamental particles" - particularly when they are large in number and with diverse properties: the inevitable questions "what are they made of, what brought them into existence, and what accounts for the variability of their properties"?

• the implications of nonlocality on the quantum level that everything in our universe is entangled, communicates, and is thus aware and conscious.

Virtually all historical cultures other than our own have acknowledged the existence of life-force energy and made it the basis of their cosmology, sciences, healing, and fine arts. As we understand life-force energy better, we are finding significant congruence in their explanations of the structure of our universe; coincidence with carefully documented experiences of consciousness researchers, as well as modern and ancient mystics; and effective conceptual and operational ability to embrace modern issues of consciousness and quantum physics.

We do not have conclusive evidence of whether life-force energy is a variation of conventional electromagnetic or gravitational energies, or a totally different realm of existence, though most traditional cultures posit the latter. It does appear to play a significant and demonstrable role in a wide variety of phenomena that have resisted conventional explanation; work non-locally and based in universal consciousness; and fit into coherent and effectual models of our cosmos that promise intriguing new avenues of exploration, verification, and application.

The map of the mind. Bill Potter <billpotter@uq.net.au> (Australian Centre for Consciousness).

The Map of The Mind is an integrative model of consciousness which provides insights into the concepts of self and physical and psychical awareness. The relational axes of the map are space, time, reason and emotion, the primary ordering principles of conscious experience. The self and the brain are at the origin of these axes, the ground reference point for individual consciousness.

The region between the space and time axes represents physical awareness, the extrinsic aspect of consciousness and that between reason and emotion represents psychical awareness, the intrinsic aspect of consciousness. The concepts of these regions grow out of our extrinsic and intrinsic perception respectively. Those furthest from the self are the most theory laden and most removed from our immediate perception.

Thus the notion of an object is that which has only spatial extension and of an event that which has only temporal extension. However the theory laden concepts of particle and wave are viewed in Quantum Physics as complementary aspects of physical phenomena, and space and time are viewed as a unified manifold in Relativity Theory.

Similarly facts are considered to have only rational significance and values are considered to have only emotional significance. However research in Neurophysiology and Anthropology is showing that thought and feeling are complementary aspects of psychical phenomena and reason and emotion constitute a unified framework in Information Theory.

The map reveals further insights into the nature of consciousness. For example, the focus of the left hand region of the map is static and characterized by structure. The focus of the right hand region is dynamic and characterized by process. The congruence and resonance between the upper and lower halves of the map suggest a transformal relationship between the intrinsic and extrinsic.

This transformal relationship is clearly evidenced in the concepts of entropy and information which were initially developed independently in physical and psychical contexts respectively. Subsequently, their mathematical definitions were shown to be identical save for a change of sign.

The ontological status of energy in scientific theory provides the conceptual basis for explaining this relationship between the intrinsic and the extrinsic. Energy is the link between the matter of physical awareness and the substance of psychical awareness. Hence The Map of The Mind supports the view that a theory unifying the psychical and the physical is possible with the concepts of energy and information playing central explanatory roles.

Modelling cognition using Schrodinger's cat. Walter Ratjen <wratjen@uni-bremen.de> (University of Bremen, Germany).

Two interpretations compete as to the philosophy of QM, namely, whether to take Psi to be an algorithm that has proven to hold sway under any condition of empirical testing, and nothing more, or, in addition, to describe physical reality.

What does this imply for the study of the mind? If the Schroedinger equation describes the basic rules according to which the universe functions then it must apply to the mind as well, as long as we consider the latter a part of the universe. Thinking historically, the Schroedinger equation is a product of the mind, not vice versa. On the other hand, the mind cannot reveal its own blueprint, because, if it could, it would be causal to itself, which is impossible, as long as we adhere to our traditional concept of causality, which is the only one we have. Thus, the Schroedinger equation does not causally apply to the mind, although it does apply to the universe, or the functioning of the mind.

What follows is that the concepts and algorithms of QM describe the mind, neither the brain nor physics - or, at least not necessarily so - where "describe" has to be understood as the process of attaching the best attribute possible to phenomenal reality. The process of attributing, and the forms of the attributes, i.e. the natural laws and constants, describe the mind, not Nature. Therefore a functional paradigm is needed that by itself comprises this functioning. It is to be valued by its capability to explain and predict the attributes or parameters the mind has tagged or will be tagging Nature with. The "deepest" or "highest" achievements or insights the mind has accomplished need to be part of the model. Therefore, the issue of creating this paradigm is equivalent to integrating the Schroedinger equation as the highest achievement the mind has mustered so far into one. Not before we succeed in

building a paradigm of cognition that functionally integrates the Schroedinger equation can we maintain to have reached the status of the scientific study of the mind.

The paradigm used by this author to get this accomplished is the one of the Schroedinger Cat as revised by Roger Penrose (in "Shadows", 1994). That paradigm of a Hermetic space that permits for uncertainty but excludes error is used to describe cognition mathematically, integrating the Schroedinger equation functionally, and applying this paradigm to cognition instead of physics.

This approach is a synopsis of the theories of Reinhard Olivier (Bonn, Germany, Dept. of Mathematics), Roger Penrose, and Otto E. Rossler (Tubingen, Germany, Dept. of Theoretical Chemistry), all three of which refer to gravity as their cornerstone, although in different ways. The synopsis is accomplished by transforming Penrose's Cat into a virtual reality. If the latter is found to correctly predict cognition, provided a mathematical form of gravity is inherent in the form it was constructed by, then we can say to have discovered this very form, and, by the way, to have eliminated time, or evolution, from the progress of science.

A student's map to quantum mechanics. Guy Vandegrift <gvandegrift@pnc.edu> (Purdue University North Central).

Beginning students of physics can explore quantum mechanics with a concept map that uses only the most elementary solutions to Schroedinger's equation. The content has been slightly modified from the traditional introduction to the subject because the issue of interpretation is postponed until Parseval's theorem is reached and used to postulate two fundamental equations of probability, simultaneously. A set of canonical but approximate equations can describe wavepacket motion for most linear waves.

8, Sacred Traditions

A model for the quantum mind. Diaa Ahmed <diahmed @yahoo.com> (ITP Utrecht).

A model for the "Quantum Mind" was introduced in conjunction with the study of the "Quantum Topology", the theory of the quantum space on the basis of set theory. Some new development are based on the logical structure of the "Yoga Sutras of Patanjali", the ancient text on Yoga Psychology that describe the development of Existential states of the mind; Ones that have the nature of existence itself.

Consciousness studying itelf. Stephen Bost <ancwisdom @earthlink.net> (The Center for Creative & Enlightened Education).

There is a dilemma with the study of consciousness, and that it is consciousness studying 'itself'. It is sort of like water trying to determine if it is wet. I also have found it interesting that this topic has been studied before. The Sages and Mystics of old did their own inquiries on this profound subject. The following writings talk about consciousness in such a unique way that I thought that I would present them here. These works give us a different view about the nature of consciousness.

From the "Shiva Sutras": "It is the primal limiting condition (called anava mala) which reduces the universal consciousness to that of an empirical being. It is a cosmic limiting condition over which the individual has no control. It is owing this that the jiva or individual soul considers itself apurna or imperfect, a separate entity cut off from the universal consciousness."

"Consciousness is the nature of Self which verily is the Divine Self freed of all limiting conditions."

"Every appearance owes it existence to the light of consciousness. Nothing can ever have its own being without the light of consciousness. Being experienced, it is of the nature of consciousness itself, because of its being identical with that light."

"When the mind is united to the core of consciousness, every observable phenomenon and even the void appear as a form of consciousness."

"The individual mind intently entering into the universal light of foundational consciousness sees the entire universe as saturated with that consciousness."

"That harmony, delight, bliss is the characteristic of consciousness which forms the warp and woof of the universe."

"Consciousness shines in various external and internal forms. There is no existence of objects apart from consciousness. Therefore, the world is simply a form of consciousness. Objects are not known by anybody without consciousness. It is consciousness that has assumed the forms of objects. It is through consciousness that objects are ascertained."

To sum up, I believe that these Sages and Mystics are saying that individual consciousness and Universal Consciousness are one and the same separated only by perception, and 'everything' that exists is a form of this One Consciousness.

The matter-mind continuum: Exploring the Sankhya paradigm in Indian philosophy. Meera Chakravorty <meera_c @vsnl.net> (Bangalore University, Dept. of Sanskrit, (Indian Philosophy)).

New findings in science provide us with amazing details about the structure of Matter. To come to this fascinating understanding it has taken a long time. Both the scientific experience and the perceptual experience are affected by the behavior of Matter, verifiable in details by experiments. Classical Physics has come to discover certain laws which can be formulated mathematically and are universal inasmuch as they are believed to apply to all Matter at all times. When we discover Matter that do not obey such laws, that would mean we are yet to understand about it more and more. For instance, the question of whether at it's most fundamental level, matter behaves in a wave like or particle like way or both, has been a source of continuing bewilderment. Our present understanding based on quantum theory, is that at sub-atomic level, Matter isn't either wave like or particle like in nature but both, depending on the circumstances and behave unpredictably in a manner quite unlike anything we are familiar with in everyday life.

In the Indian traditional schools of Sankhya, Nyaya and Vaisheshika, there have been attempts to grasp the far from obvious nature of the physical world at ever more fundamental levels and in doing so, to draw over understanding of phenomena that may appear to be disparate. These schools have made an effort to understand that complex objects are made from simpler components. As for instance, Nyaya says, Anu or atom is the simplest state, though not perceptible. While Sankhya emphasizes that everything around us, ourselves included, is composed of Prakriti or the Original Matter. Thus, underlying the immense complexity of life is a simplicity of composition.

Sankhya understanding of Matter or Prakriti is that of an invisible state of force at it's most fundamental level and therefore can't be located like objects with which we are used to in everyday

life. In particular, the question of whether it is a simple force unfolding a complex process or it is a complexity wandering away from minimal complexity is a puzzling phenomenon. How do we understand this in the modern sense? There have been a number of independent reflections on this concept. May be they suggest common factors, may be they do not. We still do not know what these factors are.

The idea that the Sankhya attempts to put forth strongly is that, Matter involves itself in combining the particles into objects as well as acts as a force, which is at the basis of all activity. Stranger is the fact which the Sankhya holds that Matter is pervaded by intelligence.

Also, the understanding of Forces in the context of New Physics, has undergone a dynamic change from being mediated by the effects of various "fields" pervading space and time, for e.g. the electromagnetic field and finally to being understood as involving the exchange of force carrying particles, photons incase of electromagnetism, gluons in case of strong nuclear force.

Realising this, an attempt is made to reflect on the Sankhya paradigm which has contributed for the evolution of myriad directions that might have all along perplexed it, yet made it greater inquisitive to explore the mysteries, nature has maintained so astutely.

Consciousness and the self: Reflections on quantum mind and Indian self psychology. Alfred Collins <acollins@gci.net> (Alaska Neuro/Therapy Center).

The Indian Sankhya-Yoga tradition of philosophy and psychology identifies consciousness with the knower or self (jnana and jna, in Sanskrit). Like the orch OR idea, Sankhya-Yoga embodies a fundamental split between levels, and attempts to show how the lower level (prakrti, or psychophysical "matter") functions in the light of the higher (the knower, jna or purusa).

The Penrose-Hameroff proposal does not explicitly consider selfhood in its understanding of consciousness, but does allude to a fundamental process that may be parallel to this major tenet of Sankhya-Yoga--the idea of purusartha (purusa artha), the insight that all action in the psychophysical world is done "for the sake of consciousness or the conscious self." In the context of "free will" (the area where a self would seem most central), Hameroff writes of a "hidden (Platonic) non-computable logic inherent in space-time geometry. The way in which this "logic" influences the quantum system's reduction might be understood, at least heuristically, as parallel to how purusartha describes prakriti acting in the interests of purusa. Sankhya-Yoga specifies this influence in ways that might be helpful to the Penrose-Hameroff model: prakrti's action is done "for the sake of" purusa's enjoyment (experience) and purusa's liberation (moksa).

Is the mandala mind a sign of string theory in action? John Gonsowski <jcgonsowski@yahoo.com>.

In April, 1999, a paper of mine (http://www.tap3x.net/EMBTI/j5gonsowski.html) appeared in the e-journal "The Enneagram and the MBTI". This paper unified existing circumplex models of personality into one of three types. Each circumplex type contained 12 two factor personality types in three Jungian personality dimensions. Why were there three circumplexes? Could the three be merged into one model? What about the fourth Jungian dimension, extraversion-introversion? These were questions left unanswered by my first paper. In July, 1999, John Fudjack, the editor for the e-journal with my paper, attended a "Theory of Everything" conference in the Smokey Mountains that was also attended by string physicist Brian Greene. Fudjack shared his view that the mandala, a symbol of a profound organizing principle, plays a vital role in personality typologies. The mandala, according to Fudjack, is structured in such a way that its 'outermost' rim must be conceived as identical to its 'innermost' center, and argues Fudjack, this is because consciousness is similarly structured. To Greene this sounded like the structure of string theory where infinitely large radii are physically equivalent to zero length radii. I decided to look to physics for help with my personality models. I ended up using Tony Smith's physics model rather than Brian Greene's. The reason for this is that Smith's model is based on the A-D-E series progression. D3, for example, has a root vector polytope with 12 bivectors in 3 dimensions. This was my circumplex model in a nutshell. For Smith, D3 created a "Segal Conformal Gravity". But why did I have three D3s? Well, when one goes up the food chain to D4-D5-E6, one finds a curious property known as triality supersymmetry. For Greene, triality creates a one to one correspondence between bosons and fermions while for Smith it creates a supersymmetry between spacetime and the matter-antimatter fermions. But why was I seeing this triality down at the D3 level? In a sci.physics.rese arch conversation (which is also now at Smith's website), Smith explained to me a way to see triality down at the D3 level. It was related to the process of why we perceive four and not more spacetime dimensions. Going to D4, Smith gets the negative and positive color/electroweak bosons while I get the introversion-extraversion Jungian fourth personality dimension. D5 gives Smith real plus imaginary spacetime dimensions while I get the first and second Jungian quaternities that were superimposed on my D3 Enneagram circumplex (I also get the fifth factor of the five factor model). E6 gives Smith matter and antimatter while I get the two non-Enneagram circumplexes. E7 and E8 give Smith bosonic strings while I get structures that map down to the recognizable personality dimensions. I detail these A-D-E series structures in a December, 2001 paper (http://www.tap3x.net/EMBTI/j5gonsowski.html).

Stability as a criterion to detect tachyons. The matter-mind continuum: Exploring the Sankhya paradigm in Indian philosophy. Syamala Hari <shymalahari@att.com> (Axis Staffing LLC).

Tachyons may not be hypothetical as they are often described. They may be ingredients of thought processes in the human brain although they violate causality or because they do so. If a theory which is trying to explain thought processes includes space-like states and if further, certain parameters associated with those states are observed repeatedly in experiments, then it is possible that the space-like states are indeed stable. They need not be dismissed as nonphysical because they are non-causal but may be regarded as evidence of involvement of tachyons in the observed process. Acausality of tachyons is interpreted by some researchers as the ability to convey information about the future to the objects they interact with. Interestingly, it is our experience that a person's present actions almost always, depend upon the "desire" to be in a certain future state and therefore on the information about the future state (unlike any lifeless physical system. So tachyons in the brain might be supplying this information about the future to brain cells.

EEG is a known mechanism, which provides data indicating

different psychological conditions of a human being. Interestingly, a recently developed theory relates EEG frequencies to space-like vacuum states of a Sine-Gordon equation (SG) in one dimension. In the neighborhood of space-like vacuum states, the SG approaches the Klein-Gordon equation for tachyons (KGT). This paper points out that the KGT does possess stable but non-causal solutions for small input perturbations. Therefore the observed EEG frequencies associated with the tachyonic states indeed correspond to stable solutions and may be considered as evidence of the occurence of these states in the brain.

Spiritual consciousness: Causality and reality. Paul Skinner <pskinner@u.arizona.edu> (University of Arizona).

Apparently the Quantum Wave Collapse emerges from fundamental (quantum) mind and consciousness, and probability, via "mind and matter" through observation and measurement. Such a "collapse" presumably precedes matter and brain to establish an "observer created reality." Is this science or is it magic? Is this reality or is it illusion? Critical examination of this process reveals that observation and measurement may actually "collapse" the Q Wave into illusions rather than reality. This conclusion can be tested directly and verified experientially. Thus one may ask, "Is locality or non-locality reality?" Which is illusion? Which is reality?

Post-Deadline Abstracts

Spontaneous state reduction revisited. Donald Bedford <don@tangentprojects.co.za> University of Natal, Durban, South Africa

In view of the renewed interest in objective state reduction, sparked by its possible relevance to consciousness in the Penrose-Hameroff theory of Orch OR in microtubules, an old, and possibly equivalent, criterion for spontaneous state reduction, derived using a simple double-slit gedanken experiment and the Heisenberg relations, is resurrected. A technically feasible experiment to test the criterion is proposed.

Quantum semiotics and quantum linguistics. Timen Timev <mtsad2@hotmail.com> G2 Institute for Integral Aesthetics, Sausolito, California

All languages have different "signifiers" and the same "signified". Different signifiers present the macroscopic world: Identical for all languages, signified is quantum possibilistic. Every word (sign) existing as unanalysed unity contains a local signifier and non-local possibilistic signified. As signifiers are ontologically non-transparent, signifieds are ontologically transparent.

Author's Index

PL 1-13: Plenary Sessions
C1-8: Concurrent Sessions
PO1-8: Poster Groups

Author	Page #
Agadjanian, A. • C3	32
Ahmed, D. • PO8	65
Altman, C. • PO5	55
Aramburo, G. • PO1	43
Atkinson, R. • PO4	52
Augustyn, K. • PL6	15
Awret, U. • C5	36
Baer, W. • PO3	47
Bahnson-Palmer. A. • PO3	48
Baldwin, C.M. • PO1	43
Battu, B. • PO6	59
Bedford, D. PO3	67
Beichler, J. • C6	38
Bell, I. • C3, PO1	31, 43
Bender, T. • PO7	63
Benioff, P. • PL6	15
Bernroider, G. • PL3	11
Bessinger, D. • PO3	47
Betancourt, M. • C4	33
Bieberich, E. • C8	41
Bierman, D. • PL8, PO2	17, 47
Blommestijn, G. • PO3	47
Bondi, Manuele • PO6	59
Bondi, Massimo • PO6	59
Bohm, K. • PO6	62
Bootzin, R. • PL7	17
Bost, S. • PO8	65
Brack, G. • PO6	60
Britton, W. • PL7	17
Brooks, A.J. • PO1	43
Carruba, S. • C7	39
Ceballos, R. • PO6	60
Chakravorty, M. • PO8	65
Chevalier, C. • PO1	46
Chopra, D. • PO1	44
Chouinard, E. • PO1	44
Chowdhary, B.S. • C7	41
Close, E. • PO4	52
Collins, A. • PO8	66
Creath, K. • C3	30
Davia, C. • C1	25
Davis, C.V. • C7	40
Del Prete, G. • PO6	61
Dikaya, Z. • PO3	49
Ells, P. • C4	33
Evripidou, C. • PO6	61
Faber Abreu, J. • C1	24
Fantasia, A.G. • C1, PO5	24, 55
Ferrell, S. • C3, PO1	31, 45
Fiorentino, A. • C1	24
Fontes, J. • PO5	55
Foust, L. • PO1	46
Froning, H. • C4	34
Frost, R. • PO5	56
Fujimura, R. • PO6	61
Gao, S. • C6	36
Gelain, F. • C1	24
Geoghan, C. • PO6	61
Georgiev, D. • PO4	53
Germine, M. • C3	31
Gilbert, K. • PO4	53
Godfroid, I. • PO5	56, 57
Goel, A. • C7	39
Gonsowski, J. • PO8	66
Gregori, F. • C1	24
Haffelder, G. • PO6	63
Hagan, S. • PL5	14

Hales, C. • PO3 48
Hall, R. • PO4 52
Hameroff, S. • PL10 19
Hari, S. • PO8 66
Heelan, P. • C5 36
Hill, E. • C5 35
Hill, M.B. • PO6 59
Hitchcock, S. • PO4 54
Ho, M-W. • PL9 19
Horne, J. • PO3 48
Hu, H. • C1 23
Hunt, R. • C2 28
Hurtak, J. • PO1 44
Jacyna-Onyszkiewicz, Z. • PO3 48
Jain, S. • PO1 46
John, E.R. • PL3 11
Johnson, L.C. • PL8, C3 18, 29
Johnson, L.C. • PO1 44
Jones, S. • PO6 62
Josephson, B. • C8 41
Kafatos, M. • PL11 21
Kaivarainen, A. • PO5 57
Kamboh, A. • C7 41
King, C. • C8 41
King, H. • PO1 44
Klein, S. • C2 26
Kolomenski, A. • PL5, PL9 14, 19
Korotaev, S. • C3 30
Kozak, L. • PL8, C3 18, 29
Kozak, L. • PO1 44
Kuttner, F. • PL2 10
Lake, J. • C7 40
Laskey, K. • C5 34
Lawless, W. • C4 32
Lawrence, P.N. • C8 42
Leach, J. • C2 26
Lewis, D. • C3, PO1 31, 43
Lewis, S. • C3, PO1 31, 43
Lipkind, M. • C8 42
Mahler, G. • PL1 10
Mallory, L. • PO1 46
Matsuno, K. • PL11 20
Matzke, D. • C8 42
McLafferty, F. • PO6 62
Mehl-Madrona, L. • C3 31
Mehl-Madrona, L. • PO1 45
Melkikh, A. • PO5 57
Memon, A.R. • C7 41
Mershin, A. • PL5, PL9 14,
Miller, K. • PO3 49
Mogi, K. • C6 37
Moore, K. • PO1 46
Morrison, N. • C4 34
Munn, N. • PO3 49
Mureika, J. • C4 33
Musumeci, F. • C7 39
Naimo, J. • C2 28
Nanopoulos, D.V. • PL9 19
Nelson, L. • PO1 46
Nichvoloda, A. • PO3 49
O Nuallain, S. • PO6 62
Page, D. • C6 37
Penrose, R. • PL10 19
Perevalov, D. • PO6 62
Pinnamaneni, A. • PO4 54
Pizzi, R. • C1 24
Planat, M. • C2 27
Pollack, G.H. • PL9 19
Polyan, P.V. • PO5 58
Porter, M. • PL6 15
Portugal, R. • C1 24
Potter, B. • PO7 64
Pribram, K. • PL3 12
Prichep, L.S. • PL3 11
Privitera, G. • C7 39
Pylkkanen, P. • PL13 23
Ratjen ,W. • PO7 64
Richards, T. • C3 29
Richards, T. • PL8, PO1 18, 44
Ridge, B. • PO6 62
Robbins, S. • PO4 54
Roessler, A. • PO6 63
Roemer, H. • PL2 10
Rosa, L.P. • C1 24
Rosenblum, B. • PL2 10
Rossetti, D. • C1 24
Roy, S. • PL11 20
Rubik, B. • C1 24
Sanfey, J. • C2 27
Saniga, M. • C2 27
Sataric, M.V. • PO6 63
Satinover, J. • PL5 14
Saunders, D. • PO6 63
Schlitz, M. • PO1 44
Schmidt, S. • PO3 50
Schuessler, H.A. • PL5, PL9 14, 19
Schwartz, G. • C3, PO1 31, 46
Scordino, A. • C7 39
Seipel, A. • PO3 50
Semetsky, I. • PO3 50
Serdyuk, V.O. • C3 30
Severino, S.K. • C4 34
Shatnev, M. • PO3 51
Shoup, R. • PO1 46
Sibert, W. • PO1 46
Simon, D. • PO1 44
Singh, A. • PO5 59
Skinner, P. • PO8 67
Smith, F. • C1 25
St. Hilaire, P. • PO2 47
Standish, L.J. • PL8, C3 18, 29
Standish, L.J. • PO1 44
Stapp, H. • PL1 10
Steiner, M. • PO3 51
Swanick, S. • PO1 46
Taborsky, E. • C5 35
Tedesco, M. • C7 39
Thaheld, F. • C3 29
Timev, T. • PO3 67
Tolkachev, V. • PO3 49
Treugut, H. • PO6 63
Triglia, A. • C7 39
Trujillo, L. • C6 37
Tudisco, S. • C7 39
Tussing, D. • PO1 46
Tuszynski, J. • PL12 21
van Lommel, P. • PL7 16
van Pelt, J. • C6 38
van Wijk, E. • C7 39
van Wijk, R. • PL12 22
Vandegrift, G. • PO7 65
Vekaria, M. • PO1 46
Vescovi, A. • C1 24
Voorhees, B. • C8 43
Wackermann, J. • PL8 18
Walach, H. • PL4 13
Wendt, A. • PL4 13
Wheatley, J. • PO3 51
Wilde, K. • PO4 52
Woolf, N.J. • PL12 21
Wu, M. • C1 23
Yannopoulos-Ruquist, R. • PO5 59
Zaman, L.F. • PO3 52
Zaslavsky, A. • PO4 54
Zdravkovic, S. • PO6 63
Zenith, S.E. • PO3 48
Zhang, X-Y. • PO3 52
Zizzi, P. • PL13 22

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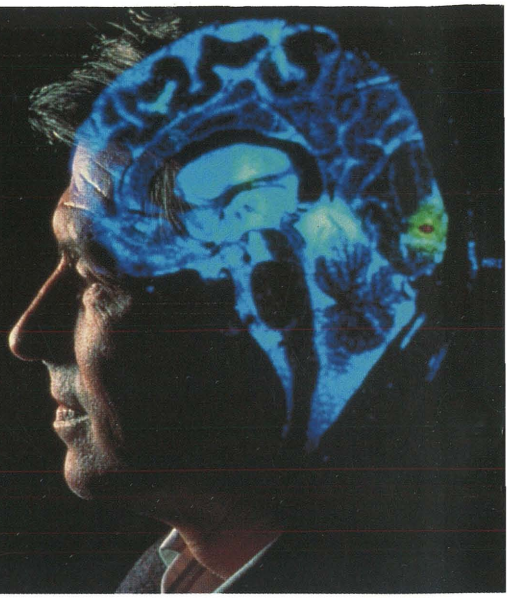

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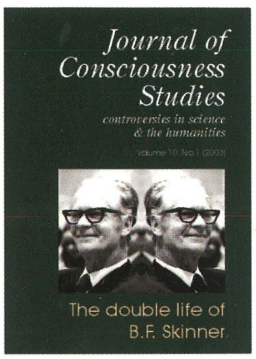

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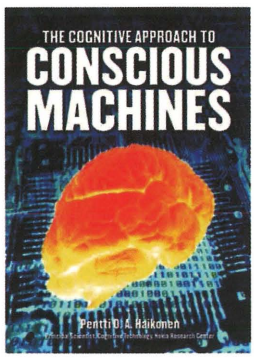

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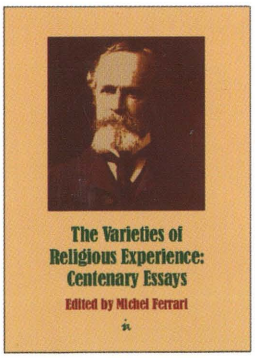

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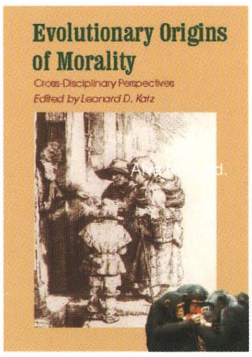

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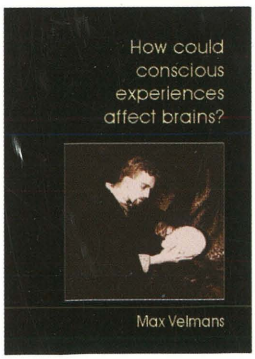

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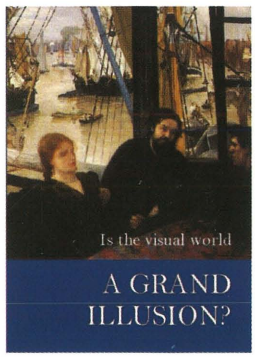

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