Comments about the representations in SSE-2016 conference about consciousness, biology, and paranormal phenomena

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Abstract

The article represents TGD based reaction to the representations in SSE-2016 conference held October 13-16 in Sigtuna, Sweden. The themes of conference were various approaches to consciousness, biology, and paranormal phenomena. From both the representations and personal discussions I learned about interesting new effects providing challenges for TGD based approach.

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1 Introduction

I had the opportunity to participate SSE-2016 conference (see http://tinyurl.com/jsha7ll) held October 13-16 in Sigtuna, Sweden. The atmosphere of conference was very friendly and inspiring and it was heartwarming to meet people familiar from past conferences and email contacts. I am

grateful for Tommi Ullgren for making the participation possible and taking care of all practicalities so that I had just to remember to take my passport with me and arrive to Helsinki at correct time!

The themes of conference were consciousness, biology, and paranormal phenomena (or more neutral "remote mental interactions" or even milder "non-locality" used in order to not induce so strong aggressions in skeptics). There were several notable speakers such as Stuart Hameroff talking about Orch-Or, microtubules and anesthetes as a Royal Road to the understanding of consciousness; Anirban Bandyonophyay talking about his ideas related to music, fractals, and ....; JohnJoe McFadden explaining his electromagnetic theory of consciousness and quantum biology; Rupert Sheldrake talking about morphogenetic fields; etc... Besides invited lectures and keynote talks many other very interesting talks we held. Panel discussions helped to see the differences between various approaches.

Personal face-to-face discussions were highly stimulating. I am rather passive socially thanks to certain rather traumatic experiences of past generating Pavlov dog like conditioning against anything associating with academic and a very severe phobia towards professors. Therefore I am grateful for Tommi for serving as a social midwife making possible also for me to get involved to these discussions.

Before leaving to Sigtuna I promised in Facebook to give some kind of report about the conference and now I must fill my promise. In the following I summarize some of my expressions about various talks. For a man of one theory like me the only manner that I can get view what was presented is by comparing it to my own theory - that is TGD. Why this strategy is so good is that only differences need to be detected in order to get a rough overall view. Therefore TGD has at least one purpose for its existence: to make easier for its developer to learn what others have done!

My perspective is rather narrow: I am a theoretical physicist interested in the quantum physical correlates of consciousness and life and also paranormal phenomena. Theoreticians are in general skeptics concerning the theories of others and I am not an exception. I am basically interested on new interesting phenomena providing challenges for TGD inspired theory of consciousness and quantum biology. About talks related to measurement technology or medicine I cannot say anything interesting.

Unfortunately, I lost some lectures and had to use abstracts to get idea about what the contents was. Almost as a rule, I comment only those lectures that I listened or which had obvious connection with my own work. I do not even try to be objective and report only my impressions about those talks that induced cognitive resonance.

The page providing the proceedings of SSE-2016 (see `http://tinyurl.com/zydoldy`) is under construction and will contain the abstracts of various talks.

Before continuing it is good to give some abbreviations. Electromagnetic (em), Exclusion Zone (EZ) are standard notions. At least for TGD inspired notions appear in the sequel: Topological Geometrodynamics (TGD), Strong form of Holography (SH), Zero Energy Ontology (ZEO), Causal Diamond (CD), Magnetic Body (MB), Biological Body (BB).

2 What TGD is?

Since the purpose is to see the representations through TGD lense it is polite to first to tell to the reader what TGD is. The reader interested in details can find them for instance in [K10].

2.1 Why TGD?

The first question is "Why TGD?". The attempt to answer this question requires overall view about the recent state of theoretical physics.

Obviously standard physics plagued by some problems. These problems are deeply rooted in basic philosophical - one might even say ideological - assumptions which boil down to -isms like reductionism, materialism, determinism, and locality.

Thermodynamics, special relativity, and general relativity involve also postulates, which can be questioned. In thermodynamics second law in its recent form and the assumption about fixed arrow of thermodynamical time can be questions since it is hard to understand biological evolution in this framework. Clearly, the relationship between the geometric time of physics and experienced time is poorly understood. In general relativity the beautiful symmetries of special relativity are in

principle lost and by Noether's theorem this means also the loss of classical conservation laws, even the definitions of energy and momentum are in principle lost. In quantum physics the basic problem is that the non-determinism of quantum measurement theory is in conflict with the determinism of Schrödinger equation.

Standard model is believed to summarize the recent understanding of physics. The attempts to extrapolate physics beyond standard model are based on naive length scale reductionism and have products Grand Unified Theories (GUTs), supersymmetric gauge theories (SUSYs). The attempts to include gravitation under same theoretical umbrella with electroweak and strong interactions has led to super-string models and M-theory. These programs have not been successful, and the recent dead end culminating in the landscape problem of super string theories and M-theory could have its origins in the basic ontological assumptions about the nature of space-time and quantum.

2.2 TGD and GRT

The new view about space-time as 4-D surface in certain fixed 8-D space-time is the starting point motivated by the above mentioned energy problem of general relativity and means in certain sense fusion of the basic ideas of special and general relativities.

The higher-dimensional space-time is 8-D $H = M^4 \times CP_2$: empty Minkowski space M^4 of special relativity with points replaced by 4-D CP_2 (complex projective space of 4 real dimensions). The symmetries of special relativity are preserved but lifted to the level of H so that classical conserved quantities like energy exist. CP_2 in turns codes in its geometry the standard model symmetries and quantum numbers and its spinor connection codes for classical electroweak gauge fields. Their projections to space-time surface are dynamical. Also classical color fields can be understood. These geometrized fields are expressible only in terms of four CP_2 coordinates and cannot as such directly correspond to those of standard model. How standard model emerges as a limit of TGD will discussed below.

Rather recently [K13] I have discussed twistor lift of TGD replacing space-times with the twistor spaces and H with the product of twistor spaces of M^4 and CP_2, which are unique as 4-D spaces in the sense that they have twistor spaces with Kähler structure making possible to lift the Kähler action to 6-D one. The theory dimensionally reduced to a 4-D theory containing cosmological constant and gravitational constant as additional constants besides CP_2 radius and Kähler coupling strength.

2.3 TGD and string models

TGD can be also seen as a generaralization of hadronic string model or of superstring models by replacing strings with 3-D surfaces and 10-D space-time with 8-D $M^4 \times CP_2$. 3-space as we experience it corresponds to a large 3-surface to which smaller 3-surfaces are glued by wormhole contacts. These smaller 3-surfaces we would interpret as physical objects with shape and size and when they are really small, we call them elementary particles. We would directly see this extremely complex space-time geometry. This geometry has fractal hierarchical structure: 3-surfaces glued to larger 3-surfaces glued to....

As a matter fact, string world sheets and what I call partonic 2-surfaces in 4-D space-time regarded as space-time surface turn out to be fundamental objects of also TGD forced by very general principles such as well-definedness of em charge and strong form of holography (SH) implied by strong form of general coordinate invariance [K5]. SH states that information given at these 2-surfaces allows to deduce information about quantum states and classical dynamics: effective 2-dimensionality in the sense of information theory would be in question.

2.4 TGD based ontology

TGD forces to dramatically generalize the ontology of standard model and GRT.

1. The new view about space-time differs radically from that of GRT. Space-time surfaces are topologically non-trivial in all scales. They have typically finite size and obey size scale hierarchy. One can glue space-time sheets to larger space-time sheets to get a fractal scale hierarchy with sheets glued to larger sheets by wormhole contacts and having interpretation as correates for physical objects.

Second key difference is that space-time surfaces can have also regions with Euclidian signature of the induced metric - time and space are geometrically in the same role. Wormhole contacts are this kind of regions and serve as building bricks of elementary particles and are identifiable as lines of generalized scattering diagrams.

2. A new view about classical fields emerges distinguishing TGD from Maxwell's theory. One can say that each physical object has field identity - field body consisting of space-time sheets. The notion of magnetic body (MB) turns out to be central in TGD inspired biology and adds to the pair organism-environment a third member: magnetic body (MB). The communications from biological body (BB) involve classical radiation fields: EEG is one example of this communication from the brain to the MB of brain. The size scale of MB is typically considerably larger than that of BB: even of order Earth size scale or even larger. MB makes possible remote mental interactions and could be behind the morphic fields of Sheldrake.

3. How TGD relates to GRT and standard model? The basic idea is that the sheets of many-sheeted space-time obeying extremely simple physics (only 4 analogs of field variables plus SH realized by preferred extremal property implying effective 2-dimensionality of dynamics) are lumped together and identified as GRT space-time differing slightly from flat M^4.

   The deviation comes in the following manner. The deviations of the induced metric for space-time sheets from M^4 metric (empty space metric) are summed up to give GRT gravitational field as deviation from M^4 metric. Induced gauge potentials known once space-time surface is known are summed up in the same manner to give the gauge potentials of standard model. This because test particle experiences the sums of various induced fields associated with space-time sheets. Ordinary linear superposition is replaced at fundamental level with the set theoretic union for space-time sheets.

4. The hierarchy of Planck constants $h_{eff} = n \times h$ was originally motivated by certain strange findings in neuroscience about effects of ELF em fields on vertebrate brain. First it was postulated that dark matter corresponds to phases of ordinary matter with $h_{eff} = n \times h$ having certain special kind of space-time surfaces (singular n-sheeted covering spaces) as correlates. Later it turned that these phases are actually predicted by basic TGD: in TGD framework Planck constants is for single space-time sheet h and only effectively $h_{eff} = n \times h$ but at QFT limit one can say that $h_{eff} = n \times h$ is strictly true.

   Later the view about dark matter as evolved and according to the recent view dark matter would emerge at quantum criticality (perhaps even at ordinary criticality) and would be a correlate for long range quantum fluctuations and long range quantum coherence. Various quantal length scales are indeed typically scaled up by n. This suggests that biosystems are quantum coherent and quantum critical because MB contains dark matter.

   MB containing dark matter would serve as intentional agent receiving sensory data from BB and controlling BB. EEG and its generalizations to various frequency ranges based on dark photons would be the tool for this. The dark cyclotron photons assignable to given charged particle would have very specific value of h_{eff} guaranteeing that cyclotron energy scale does not depend on particle mass and would be in the range of biophoton energies (visible and UV). Biophotons would result in the phase transition $h_{eff} \to h$. Also dark photons in IR range (Josephson photons assignable to cell membranes) are predicted.

   Biochemistry would not be enough to understand the biology. MB and its "motor actions" would be crucial for understandind bio-catalysis, in particular the miraculous property of biomolecules to find each other in the molecular crowd.

5. Zero energy ontology (ZEO) is a further new piece of TGD ontology. In standard ontology the state of system at fixed value of time characterize the time evolution of the system. Classically the state is typically characterized by particle positions and velocities and by values of say Maxwellian fields and their time derivatives. Field equations in principle allow to deduce the time evolution from these.

   In ZEO one introduces causal diamond (CD). CD is intersection of future and past directed light-cones (Penrose diagram) with points replaced by CP_2. CDs are assumed to form a

fractal scale hierarchy. CD has two light-like boundaries: "future" and "past" boundary. Light-likeness means that 3-D M^4 projection of given boundary correspond to a sphere expanding with light-velocity.

Physical states are replaced with zero energy states analogous to physical events consisting of initial and final states. Initial/final state can be assigned to 3-D intersections of space-time surfaces with the "future"/"past" boundary of CD. ZEO is consistent with the crossing symmetry of quantum field theories and with the conservation laws. It is however extremely flexible since any zero energy state is in principle achievable by a sequence of quantum jumps. The analog of ordinary positive energy can be assigned with either "future" or "past" boundary and the arrow of time is different for these states. ZEO leads to a quantum measurement theory allowing to circuvemtn the basic problem of standard quantum measurement theory due to the non-determinism of state function reduction contra determinism of unitary time evolution.

6. p-Adic and adelic physics are further new ontological elements of TGD. p-Adic numbers are generalizations of real numbers, and there are infinite number of p-adic number fields for each prime $p = 2, 3, 5, ...$ I ended up with p-adic physics almost accidently by playing with p-adic generalization of thermodynamics and finding that p-adic thermodynamics can reproduce elementary particle masses with minimal assumptions and thus replaced Higgs mechanism with more fundamental theory. The properties of p-adic number led soon to the proposal that p-adic number fields are correlates for cognition and imagination. Much later this led to the unification of real physics and various p-adic physics in terms of adelic physics fusing all these number fields to a bigger structure.

   Why p-adic physics is so nice that one can talk about p-adic imbedding space and space-time surfaces as kind of cognitive representations of real space-time surfaces. In particular, SH allows to assign p-adic space-time surface to given set of string world sheets and partonic 2-surfaces as preferred extremal but no necessary to real one. All imaginations cannot be realized!

   Also p-adic generalization of Shannon entropy makes sense but it can be negative. One can say that entanglement carries negative p-adic entropy - positive negentropy - although real entropy is non-negative. The interpretation is in terms of conscious information naturally assignable to cognition.

2.5 TGD, quantum measurement theory, and consciousness

TGD inspired theory of consciousness can be seen as quantum measurement theory in ZEO. Observer as an outsider becomes a part of physical system. Observer does not cause state function reductions but as a concious entity is a sequence of state functions on same boundary of CD - generalized Zeno effect.

1. The maximization of negentropy gain in state function reduction becomes the basic variational principle of consciousness theory consistent with second law which applies at the level of ensembles and is closely related to the growth of real entanglement entropy. I refer to this principle as Negentropy Maximization Principle (NMP).

2. In ZEO state function reduction can take place to either boundary of CD. In a sequence of reductions to a fixed boundary the boundary itself remains fixed as also the states at it - possibly entangled with those at the opposite boundary. This boundary is referred to as "passive". The second - "active" - boundary drifts farther away from the passive boundary and the states at it change. Each step can be regarded as time localization localizing the active boundary of CD.

   Self corresponds to this sequence of state function reductions. The permanent part of self - "soul" - corresponds to the unchanging part of self and changing part corresponds to consciousness determined byt sensory input. In particular, the experience about flow of time corresponds to the drift of the active boundary of CD farther away. Self is a generalized Zeno effect.

3. Eventually NMP forces the first reduction to the opposite boundary to occur. This is the counterpart of the usual large and non-deterministic quantum jump assignable to quantum measurement. Self dies and re-incarnates as time reversed self since the CD starts to increase in size in opposite time direction. This prediction has rather radical implications.

Some of the implications deserve to be noticed.

1. One ends up with a new view about time. Geometric time as fourth space-time coordinate (or time coordinate as distance between the tips of CD) is not same as subjective time defined by a sequence of state function reductions. The consciousness experience associated with each reduction has the changing components with contents coming from the active boundary so that subjective time is mapped to discrete clock time.

2. Selves having hierarchy of CDs as imbedding space correlate form a hierarchy. Subself is assumed to be experienced as mental image and subsubselves as kind of average sub-subself so that self is not drowned to microscopic information. Subconscious corresponds to conscious sub-sub-... -selves. We are ourselves mental images of some higher level self and the hierarchy continues ad infinitum with entire Universe at the top.

3 Comments on some talks and posters

The following represents my comments about some talks and posters related to consciousness, biology, and paranormal phenomena. I have commented only those representations, which I heard and provided stimuli for my own work.

3.1 Consciousness

Most consciousness theories discussed in the talks were identification theories with the theory of Alex Hankey forming an exception. Consciousness=X is the general formula for these theories. The general criticism against identification theories is that they start from something already known rather than asking what we know about consciousness and trying to develop a conceptual framework reproducing this knowledge.

The standard argument against identification of consciousness as classical fields or something else physical in standard sense is that consciousness is about something - as is also information. Matter or fields, or quantum fields, whatever physical, is not about anything, it just is. This criticism applies also to theories identifying consciousness as classical computation. The assignment of conscious to something analogous to quantum computation (as in TGD) is not an identification theory anymore since the outcome resulting in halting is probabilities and one has hopes about understanding free will and intentionality.

3.1.1 JohnJoe McFadden: *Electromagnetic field theory of consciousness* and *Quantum Biology*

McFadden's theory is physicalistic identity theory. Consciousness is electromagnetic (em) field, or more precisely, classical radiation field as I gathered from the lecture. Quantum effects would not be involved at all: the justification is that macroscopic quantum coherence is not possible in long scales. This might well be true in standard quantum theory. Assuming consciousness to be purely classical phenomenon looks rather weird and unrealistic. On the other hand, McFadden takes quantum biology seriously and had even talk about it.

Even if one one skips over these objections, quite serious critical counter arguments remain.

1. McFadden considers only classical radiation fields. One can wonder what might be the role of static or slowly varying em fields, such as magnetic fields known to have effects on brain and biomatter.

2. The radiation fields must have an effect at neuronal level. In accordance with standard neuroscience view neurons are assumed to generate EEG and the EEG is assumed to interact with neurons and generate the conscious experience. Brain would generates em field which

then interacts with brain giving rise to conscious experience. One can of course ask whether it would be more precise to say that neurons and consciousness together do the job or that only the active aspect of consciousness is generated in this manner. The inclusion of the interaction with neurons allows to circumvent the objection that artificial em field would be also conscious.

The motivation for this identification is that radiation fields indeed carry information in the sense that in proper receiver they can generate conscious experience. My cat does not however understand the text that I have printed (nor most of my colleagues, to be honest!). Here however both sender, receiver, and em field are involved. Em radiation alone cannot be said to carry absolute information nor consciousness. Conscious information involves always a relationship between two systems.

3. One can wonder why the em fields generated by other brains are not consciously experienced by me. Here one might argue that some kind of electromagnetic immune system has evolved preventing becoming possessed and that in some situation this kind of action is indeed possible and could explain remote mental interactions when target is living system. For instance, argue that the information is coded by certain resonance frequencies like in radio transmission and these frequency spectra differ slightly for different brains.

4. Neuronal synchrony is essential for binding but it is difficult to understand purely classically how disjoint regions of brain can be synchronous. In particular brain hemispheres can be in synchrony although corpus callosum is missing [J3]. Quantum entanglement and/or the existence of some kind of "boss" (magnetic body (MB) in TGD) suggests strongly itself [K6].

McFadden defends his hypothesis with several arguments.

1. Binding of the basic building bricks of percept to single coherent percept is central problem in neuroscience based consciousness theory. How the features resulting in the analysis of sensory input yield a single coherent unity? McFadden suggests that the em field is automatically a coherent entity making this possible. The em fields associated with features would integrate to conscious experience.

2. Gamma synchrony around 40 Hz is known to correlate with attention or - as the work of Revonsuo [J1] suggests - with the emergence of directed attention to new pattern recognized from the sensory data, kind of eureka experience in the experiments of Revonsuo [K4].

3. The coherence of percept correlates with the synchrony of EEG radiation (temporal and spatial coherence). For instance, in odour perception artificial desynchronization destroys the percept.

McFadden talked also about quantum biology about which he has written two books. In light of his purely classical physicalistic theory of consciousness I find it somewhat surprising that he takes quantum biology seriously. On the other hand, the basic quantum experimental findings of quantum biology are still marginally consistent with standard quantum theory. If quantum effects are important in biology, it is difficult to see how they could be irrelevant for consciousness: after all, the known conscious systems (in sense that we define consciousness) are living.

Consider now McFadden's talk from TGD perspective.

1. The basic objection against quantum theories of consciousness is that macroscopic quantum coherences is not possible. In TGD framework the hierarchy of Planck constants $h_{eff} = n \times h$ [K11, K12] changes the situation completely and dark photons in EEG range (in particular) having classical EEG fields as correlates are responsible to communications to and control by MB [K6, K1].

   In TGD framework MB is the seat for the macroscopic quantum phases of dark variants of various charges particles, and one can regard EEG as classical communication from brain to MB and vice versa. Also quantum teleportation of maximal or even more general negentropic entanglement is highly suggestive [L9]. For instance, cyclotron Bose-Einstein condensates fo bosonic ions or Cooper pairs of fermionic ions could be involved.

2. The lecture inspired an interesting question in TGD framework. Pyramidal neurons forming the layer V layer from top in 6-layered cortex generate EEG - a fact that has escaped my attention. At least the part of consciousness of vertebrates associated with EEG would be associated with this layer. In TGD framework dark photons with $h_{eff} = n \times h$ have classical em fields as correlates and communicate classically information to the MB of brain. Also communication of quantum entanglement could be teleported and maximal entanglement can be even cloned (maybe negentropic entanglement, which is maximal in p-adic sense, too). In TGD context one cannot say that this layer is conscious as a physical system: rather this layer provides the mental images integrating to coherent conscious experience at MB.

3. The interesting question concerns other layers. TGD picture would suggest that they have smaller value of h_{eff} and correspond to analogs of EEG at higher frequencies ranges generated by neuronal membranes acting as Josephson junctions creating Josephson radiation. Can one assign to these layers a fractal hierarchy of Planck constants so that the Josephson frequencies $f_c = ZeV/h_{eff}$ corresponds to say the hierarchy of frequency scales suggested by Bandyonophyay coming as powers of 10^3: 2^{10k}, $k = 0, 1, 2, 3, 4, 5$ beginning from 1 Hz and ending to 10^{15} Hz corresponding to UV radiation.

   Alpha frequency 10 Hz would have counterparts at 10 kHz, 10 MHz, 10 GHz, 10 THz (frequency $f = ZeV/h$ assignable to Cooper pairs in Josephson junction possibly defined by neuronal membrane) and 10 PHz (in UV). This hierarchy would also conform with the vision that that biophotons correspond to dark photons with energies in UV and visible range. The prediction would be five more analogs of EEG.

3.1.2 Stuart Hameroff: *The 'Meyer-Overton correlation' explains quantum biology and the origin of consciousness*

Hameroff talked about Orch-OR, microtubules, and Meyer-Overton correlation stating that the solubility of anesthetes to lipid layer of neuronal membrane correlates with the effectiveness of the anesthete. Hameroff argues that the effects of anesthetes occur at the level of microtubules as action on the aromatic rings of two amino-acids trp and tyr so that the solubility to lipid membrane could possibly make it easier for the anesthete to find their way inside the microtubules. Hameroff did not represent a detailed view for how the consciousness would be lost. In [L3] I have discussed Bandyonophyay's work about microtubules and ended up with the hypothesis that AC voltage at certain frequencies can transform microtubules of type B to type A: the latter ones are assumed in Hameroff-Penrose model but are not realized in Nature. The situation would be quantum critical at these preferred frequencies.

Hameroff makes also other proposals.

1. Hameroff proposes that EEG corresponds to interference peaks of em fields assignable to microtubuli in kHz, MHz, GHz and THz frequency ranges. TGD proposal is that EEG corresponds to cyclotron frequencies in the magnetic fields of magnetic flux tubes and Josephson frequencies for cell membranes identifiable as Josephson junctions. The spectrum of Planck constants gives a spectrum of frequencies in this case although the energy is fixed.

2. Hameroff also suggests that feelings drive evolution. Systems want pleasure: how to reduce this to deterministic Orch-OR is difficult to comprehend. In TGD framework Negentropy Maximization Principle [K2] is somewhat analogous to this. Quantum jumps would increase the negentropy of the universe assignable to negentropic entanglement, which indeed involves positively emotional coloring. To realize this framework mathematically one must generalize the real number based physics to adelic physics.

3. Orch-OR is the proposal of Penrose. The suggestion is that state function reduction would be objective - that is deterministic process. The splitting of state to a superposition of two states would correspond to a classical evolution of gravitational field, which splits into two analogs of localized wave packets. Eventually the analog of state function reduction would occur: the packets would fuse to form a single packet. I must say that I cannot make any sense of this. State function reduction involves the measuring system and entanglement with it: this is not the case now. Orch-OR says nothing about the strict rules involved with

the state function reduction. It seems to me that Orch-OR does not have much to do with ordinary state function reduction.

It is interesting to compare this Hameroff's vision with TGD view about the roles of microtubules and cell membrane already discussed in [L5]. The new elements are cell membrane as self-loading battery based on the TGD based model for the exclusion zones (EZ) of Pollack [L4] in terms of $h_{eff}/h = n$ phases.

First however a philosophical remark.

1. According to the behavioristic definition of consciousness, the ability to respond to sensory input and perform motor actions are essential aspects of consciousness. To my opinion these abilities correspond to only particular type of consciousness and consciousness might be possible even without neural activities (OBEs and NDEs). In any case, the inability to generate nerve pulse patterns would be an essential aspect for what we call loss of consciousness. This happens if there is hyperpolarization of neuronal membrane.

2. Hyperpolarization means reduced rate of spontaneous nerve pulse generation. This would be achieved if microtubules gain additional negatively charge so that the radial component of microtubule electric field increases. Hence the interaction of anesthetes with the microtubuli should generate this negative charge. One possibility is that Pollack effect [L4] generates in the presence of anesthete negatively charged exclusion zone (EZs) [L4]. The TGD based model assumes that the protons are transferred to the magnetic flux tubes as dark protons and perhaps end up to the exterior of cell membrane and transform to ordinary protons. This would induce hyperpolarization. The neutral anesthete atoms or molecules in turn could be transferred to the microtubules along flux tubes.

Consider next a model for the cell membrane.

1. In TGD Universe cell membranes could be generalized Josephson junctions. The energy of generalized Josephson photons (dark with energies in bio-photon range) would be the difference of cyclotron energies for flux tubes at the two sides of the membrane plus the ordinary Josephson energy. Generalized Josephson photons would take care of communications of sensory data to MB.

   Unless the cyclotron energies at the two sides of the membrane are same, the new contribution would dominate in the communications to MB for large values of h_{eff} since cyclotron energy is proportional to h_{eff}, and neuronal contribution would represent frequency modulation allowing to code nerve pulse patterns to kind of "whale's song". For smaller value of h_{eff} ordinary Josephson energy would dominate.

   There is a temptation to assume that the value of h_{eff} serves as a kind of intelligence quotient of cell. Frequency scale and energy scale for the analog of EEG would serve for the same purpose. For instance, pyramidal neurons responsible for EEG would represent the intellectual elite of brain and ordinary cells could have much smaller value of h_{eff} being say by factor 2^{-10} smaller than for pyramidal cells so that generalized Josephson energy would be of the same order of magnitude as ordinary Josephsone energy and in IR range.

2. Generalized Josephson photons with biophoton energies would also generate Pollack's EZs [L4] by ionizing one proton from hydrogen bonded pair of water molecules. The reduction of the membrane potential below the threshold for nerve pulse generation could reduce the energy of Josephson photons below threshold for generating Pollack's EZs and neuronal membrane would cease to be self-loading battery: this would replace ionic Josephson currents with ohmic currents through cell membrane and generate nerve pulse.

   The objection is that for low values of h_{eff} generalized Josephson energy reduces to ordinary one in IR range and for high values to cyclotron energy in visible-UV range. It is known that IR photons generate EZs in the experiments of Pollack. The process could occur in two steps involving cyclotron radiation - perhaps from MB - kicking of hydrogen bonded water molecules to a state, where proton is almost ionized so that the IR radiation would take care of the ionization. The mechanism generating EZs cannot be different for ordinary cells and

neurons. Either the notion of generalized Josephson junction must be given up or in the case of neurons glial cells accompanying also axons generate the IR radiation giving rise to EZs inside axons.

3. It is also attractive to see at least ordinary cell membrane as a self-loading battery [L7]. The generation of Pollack's EZs with negative charge and dark proton charge at magnetic flux tubes of the associated MB could make cell a self-loading battery [L7].

   Generalized Josephson photons from cell membrane or cyclotron photons could generate EZs by kicking protons to dark protons at flux tubes of MB of the cell. The energy must be in some critical range in order that this can happen. For too small energies the process stops. Besides ionic charge distributions EZs and the delocalized dark proton charges and the flux tubes extending beyond cell interior would be responsible for the resting potential.

   EZs are not expected to be completely stable. The $h_{eff} \to h$ phase transition would bring dark protons back as ordinary protons and destroy EZs and reduce the magnitude of membrane potential. There could be a competition between the generation and destruction of EZs by $h_{eff} \to h$ phase transition.

4. This picture is enough to explain the effect of anesthetes. Anesthetes at microtubules would generate a negative charge assignable to additional EZs thus increasing the magnitude of the membrane potential. This would imply stable hyperpolarization preventing the generation of nerve pulses.

What about generation of nerve pulses in this framework? I have suggested a TGD based model for nerve pulse [K3] relying on the idea about cell membrane as array of Josephson junctions consisting of membrane proteins (channel and pump proteins) but the model leaves open what exactly generates the nerve pulse. The expectation has however been that microtubules play a key role in the generation of nerve pulse. A charge wave with positive charge propagating along microtubule could induce the reduction of the membrane potential and lead to a generation of nerve pulse as a secondary wave.

1. The propagation of $h_{eff} \to h$ phase transition followed by its reversal along axon interior could serve as a weak control signal inducing the nerve pulse propagation at quantum criticality. This phase transition could be assignable to microtubules. Battery would temporarily discharge during the nerve pulse. If glial cells generate the EZs making axons glial-cell loaded batteries then the return back to the normal state after nerve pulse would be possible by the presence glial cells.

2. During nerve pulse either the generation of EZs ceases and/or the existing EZs suffer an h_{eff} reducing phase transition so that flux tubes are shortened and the positive dark charge returns to EZs and cell membrane potential is reduced. The generation of nerve pulse is usually modelled using ohmic ionic currents, which suggests that quantum coherence is lost by a reduction of h_{eff}, which is predicted to be proportional to ion mass so that cyclotron energy spectrum is universal and in visible-UV range for bio-photons.

3. Nerve pulse could be a "secondary wave" induced by a wave of positive charge propagating along microtubule. This wave of positive charge would rather naturally result from the reduction $h_{eff} \to h$ and return back to h_{eff}. A pair of phase transitions dark-ordinary-dark would propagate along the microtubule. The unidirectionality of the propagation direction would be forced by the fact that it can begin only from axonal hillock. Axonal hillock contains a large number of voltage gated ion channels, which would serve as generalized Josephson junctions in TGD framework.

4. What one can one conclude about the development of total charge during the time development of membrane potential $V(t)$? Nerve pulse corresponds to certain segment of axon and lasts for few milliseconds. The cell membrane voltage goes from resting potential $V(t = 0) = V_{rest}$ to approximately $V(t = T) = -V_{rest}$ and returns back. The total charge in cell interior defines the value of electric field E at the interior side of cell membrane and approximation interior as conductor, the value of Ein good approximation one has

$V = Ed = Q_{cell}d/4\pi R^2$ in spherical geometry and $V = Ed = dQ_{tot}/dld/2\pi R$ in cylindrical geometry of axon. Here Q_{tot} is the charge of the piece of axons at which nerve pulse is located. Total charge is sum of microtubular charge Q_{mt} serving as a control parameter and the total ionic charge Q_I changing due to the presence of ohmic ionic currents during the pulse (ionic currents are Josephson currents except during nerve pulse).

To get some quantitative grasp, let us idealize the situation by assuming that during nerve pulse the negative microtubular charge $Q_{mt}(0) < 0$ goes to $Q_{mt}(T) = 0$ for $V(T) = -V_{rest}$ (EZs disappear totally) and returns back to its original value as the phase transition returning the value of h_{eff} occurs.

One has $Q_{tot}(0) = Q_{mt}(0) + Q_I(0)$ before the nerve pulse. At $V = -V_{rest}$ one has $Q_{tot}(T) = -Q_{tot}(0)$, which gives $-Q_{tot}(0) = Q_I(T)$. This gives $Q_{mt}(0) = Q_I(T) - Q_I(0)$.

What can one say about the magnitude of Q_{mt}? If this charge serves control purpose and if the system is kicked off from quantum criticality, the change of Q_{mt} need not be large so that no large modifications of the ordinary model of nerve pulses are needed. The negative microtubular charge is partially due to the GTPs along microtubular to which EZs are associated. The value of resting potential of order .06 eV at threshold for nerve pulse generation and estimates for linear ionic charge densities $dQ_I(0)/dl$ and $dQ_I(T)/dl$ and $Q_{mt}(0)/dt$ would allow to test the model. The $h_{eff} \to h$ phase transition outside quantum criticality would take place in millisecond time scale.

The distinctions between neurons and ordinary cells allow to invent objections against the proposed scenario.

1. Ordinary cell membrane should act as a self-loading battery with Josephson radiation generating Pollack's EZs. Axonal microtubules are missing but the cytoskeleton consisting also of microtubules is present. Inside the cell soma the microtubules meet the cell membrane transversally. There is also T-shaped antenna like structure involving microtubules whereas ordinary neurons have axonal microtubules. Also now a microtubular positive charge generated by $h_{eff} \to h$ phase transition could induce the reduction of membrane potential.

2. Why the analog of nerve pulse does not take place also now? In the case of cancer cells membrane potential is reduced and can become even vanishing, and one might think that the lack of recovery is due to the absence of glial cells taking care that EZs are generated. For too low Josephson energies the self-loading would stop and due to the spontaneously occurring $h_{eff} \to h$ phase transitions, the membrane potential would be gradually reduced.

   In the case of neurons the $h_{eff} \to h$ phase transition would occur fast. The transition away from quantum criticality could cause this since long range quantum fluctuations would disappear. The value of membrane potential or the difference between neuronal and glial membrane potentials could serve as a critical parameter changing as the membrane potential is reduced. The quantum criticality of ordinary cell membrane would be analogous to self-organized quantum criticality. That of neuronal axon to quantum criticality induced by glial cells.

3.1.3 Riccardo Manzotti: *Mind-object identity theory: is consciousness an object*

Riccardo Manzotti proposes a physicalistic theory of consciousness and therefore automatically subject to the basic objections against physicalism (the problem of free will and hard problem related to the identification of physical correlates of qualia). Neuroscientists often identify conscious experience as the state of brain. Manzotti identifies conscious experience about an object as the object itself. We had a nice discussion with Manzotti about this theory.

It is a good exercise to invent objections against Manzotti's vision.

1. We perceive also our own body so that it must be also a possible object. One can argue that we perceive also our brain (at least when we have head ache!). This conscious experience would be our brain so that one would have more or less neuroscientist's physicalism extended to allow also identification with the objects of external world. Alternatively, one ends up with the dualistic view that conscious mind must be outside the physical world.

2. Visual perceptions depend on illumination: the color of object is not a property of object but determined by the light reflected from the object. Is seems necessary to include also the interaction between sensory apparatus and object to the picture.

3. What about attention: can one really say that this notion is eliminated by eliminating self directing the attention? Why the body defines a preferred object: consider only proprioception and sensory-motor apparatus. One could answer that sensory-motor actions assignable to central nervous system imply the preferred nature.

4. Illusions (such as non-existing objects like Penrose triangle), hallucinations (no real object present), and various brain syndromes represent a challenge to Manzotti's theory. To my best understanding Manzotti proposes is that the perceptive field is effectively 4-dimensional and that hallucinations are mixtures of contributions from different values of time in past.

TGD is not a physicalistic theory. Consciousness is not a property of space-time in this framework: the contents of consciousness are about limited regions of space-time (space-time surfaces inside causal diamond (CD)), which leads to the illusory identification of conscious entity with the contents of its consciousness demonstrated by various illusions in which one experiences external object as part of body.

Attention is a central notion in TGD. Self has space-time surface (or their superposition) as a correlate and attention means concrete flux tube connection serving as a correlate for entanglement between their ends (this is the TGD analog of ER-EPR correspondence with wormholes replaced by flux tubes and discovered almost two decades ago [L8]). Perceptive field in zero energy ontology (ZEO) is 4-D as also Manzotti's theory seems to demand and the arrow of time is not fixed. This explains memories in terms of communications with geometric past.

3.1.4 Alex Hankey: *Direct Mind-to-mind communication: its basis in bio-regularization*

Alex Hankey proposes a model of mind-to-mind communication (MMC), which one could perhaps translate to active telepathy. I have met Alex a couple of times for decade or so ago and had email discussions and the ideas of Alex have something in common with the TGD view. The term MMC suggests dualistic philosophy.

1. The high physiological temperature is argued to exclude quantum coherence and therefore quantum explanation of MMC. I tend to agree that in ordinary quantum theory this is the case. Complexity and criticality meaning instability and manifesting itself as $1/f$ frequency distributions are taken key notions. Self-organized criticality is a stronger notion. Criticality makes the system sensitive to external perturbations and allows large variety of reactions to stimuli.

2. Mind is assigned to instability, at which the notions of mechanism and machine break down. Hankey talks about double aspect structure (mind and matter as different aspects of the same substance in accordance with dualistic view of Chalmers). The objections against dualism are well-described by Chalmers himself: the basic problem is that consistency with the laws of physics tends to eliminate free will.

   The information assignable to criticality would not be digital information. Unfortunately, the abstract does not allow to see whether there is some explicit information measure involved. The definition involves internal feedback loop that is claimed to explain awareness, the internal sense of time flow, reduction of wave packets by consciousness and resolve Schrödinger paradox. The emergence of the precise rules of state function reduction from self-organized criticality would be really a victory since one does not begin from quantum measurement theory.

3. It is argued that a rigorous theory of MMC emerges in this framework. Hankey talks about gestalts and their communication.

In TGD $h_{eff}/h = n$ hierarchy assignable to quantum criticality [K11] and in ZEO perhaps even ordinary criticality (quantum theory is square root of thermodynamics at least formally)

brings in large scale quantum coherence even in physiological temperature. The analog of self-organized criticality would be implied by Negentropy Maximization Principle (NMP) [K2] serving as the fundamental variational principle of consciousness theory and forcing the generation of negentropic entanglement assignable to large h_{eff}/h phases.

In the tri-partistic framework of TGD (quantum states - space-time surfaces as preferred extremals - state function reduction as a building brick of conscious mind) feedback loop introduced to explains self-referentiality of consciousness is replaced with self referentiality as ability to become conscious about what one *was* conscious. This replaces infinite regress with evolution.

Conscious information is assignable to negentropic entanglement relying crucially on the notion of p-adic number fields and the fusion of reals and p-adic number fields to adele carries negentropy identified as conscious information and defined as generalization of Shannon entropy to adelic context [L9]. The basic rules of state function reduction reduce to Born rule and NMP generalizes state function reduction to a basic element of consciousness: state function reduction is not anymore caused by consciousness - it is consciousness.

TGD the counterpart of gestalt would be negentropic entanglement having interpretation as a rule or abstraction with the instances of the rule represented by superposed state pairs. Maximal entanglement is a special case of negentropic entanglement (NE) and has a special property that it can be cloned [L9] so that information in this sense could be copied also in quantum context.

The conjecture is that also more general negentropic entanglement giving rise to maximal entanglement in some p-adic sectors of adeles but not in real sector) and assignable to entanglement probabilities in algebraic extensions of rationals can be cloned. Hence the communication as teleportation of maximal entanglement without destroying the original maximal entanglement is possible. Teleportation would necessary involve also classical communications naturally identified in terms of signals formed by dark photons propagating along magnetic flux tubes.

3.1.5 Antonio Giuditta: *The phylogenetic origin of mind*

Antonio Giuditta discussed in his talk the phylogenetic origin of mind. The main message is that this could help in attempts to understand minds at higher evolutionary levels. A kind of reductionism would apply.

1. Mind would represent the only ontological level and one could classify the approach as idealistic monism.

2. Mind would be present already at molecular level. This approach differs from the neuroscientific view assigning mind only with brain.

It is interesting to compare this picture with TGD.

1. TGD differs from the physicalistic, idealistic, and dualistic views. Quantum physics a would have classical space-time dynamics as exact counterpart - quantum-classical correspondence. This gives two ontological levels. State function reductions/quantum jumps between quantum states as 4-D entities would define the third aspect of the ontological "holy trinity": this identification of mind as something between physical realities rather than as property of physical realities would resolve the basic problem of quantum measurement theory and give rise to evolution in terms of quantum jumps forced by Negentropy Maximization Principle (NMP): Universe would maximize its negentropic entangLement (this notion makes sense only if one allows p-adic and adelic physics).

   In TGD Universe one has a hierarchy of conscious entities, selves. This would simplify the description enormously since one would have no need to postulate the notions of subconscious and unconscious mind separately.

   Self would experience its sub-selves as mental images. Our mental images would correspond to rather large brain regions - maybe synchronously firing pyramidal cells in cortex generating EEG. These would represent naming of sensory experiences, conceptualization, not sensory qualia.

   Sensory experiences could be at the level of sensary organs: one could circument rather obvious objections if one accepts TGD view about space-time and time - in particular the

view that the arrow of time can vary and does so in living matter as already Fantappie proposed plus macroscopic quantum coherence and entanglement. This identification would conform with the idea that already monocellulars have sensory qualia.

The TGD view would differ from physicalistic view in that one would have fractal hierarchy instead of reduction of everything to smaller scales, eventually to Planck scale. Every level in the hierarchy would bring in something new. At space-time level the new hierarchy level would mean emergence a space-time sheet in larger scale at which smaller sheets are glued. At the level of conscious experience higher level self. The hierarchy would continue ad infinitum and we would be mental images of self at the next level of hierarchy.

2. Also in TGD molecular structures could be seen as conscious entities (this is practical but somewhat imprecise expression in TGD framework). My guess is that the consciousness of molecular selves corresponds to sub-conscious from our perspective. A concrete examples would be aromatic molecules (DNA, 4 amino-acids, etc...). The aromatic rings could carry currents (possible dark currents) at associated flux tubes and they could form molecules selves, tiny conscious entities fusing to larger units as in the case of DNA. They appear also in microtubules and Hameroff proposed that they are fundamental.

3. MB carrying dark matter as dark $h_{eff} = n \times h$ phases is a key notion of TGD inspired biology and distinguishes it from standard biochemical view: MB would control bio-chemistry and receive sensory input from biological body and control it by using dark photons giving rise to a fractal generalization of EEG. The 6-layered structure of cortex could correspond to the scale hierarchy considered by Bandyonophya coming as powers of $10^3 \simeq 2^{10}$. Lowest level would begin from 1 Hz and highest level from 10^{15} Hz (UV energies). The values of Planck constant $h_{eff}/h = n$ would come as powers of 2^{10}.

4. I tend to believe that also cognition (mind) as opposed to sensory mind is present in nature in all scales, even in elementary particle scales albeit in much more primitive form. My bet is that the description of physics correlates of cognitive mind requires the introduction of new mathematics. p-Adic number fields labelled by primes p=2,3,5,..and their fusion to a bigger structure known as adeles are excellent candidates in this respect. Simulation would be the basic cognitive process and realized already at the level of fundamental field equations. p-Adic space-time physics would obey same field equations as ordinary real number based physics but p-adic physics would allow classical non-determinism making possible to understand the correlates of imagination, which is key aspect of cognition.

3.2 Talks and posters related to biology

3.2.1 Anirban Bandyonophyay

The work of Bandyonophyay's team related to the effect of AC em fields at certain resonance frequencies on microtubules is familiar for me and I have written about it [L3]. The experiments indicate that at these critical frequencies microtubuli behave like quantum coherent systems and that super-conductivity along the conduction pathways whose identification in terms of microtubular geometry is suggested. The basic problem of the microtubule hypothesis is that the required microtubules of type A with helical symmetry are not realized in nature as stable entities. Microtubules are found to be of type B with helical symmetry reduces since there is a kind of cut along the microtubular cylinder. Quantum criticality suggests that at critical frequencies a phase transition increasing h_{eff}/n occurs and transforms microtubules of type B to those of type A.

I lost part of the lecture and maybe I had got the full dose of information for that day (lecture was held at 16.20): I simply could not follow the lecture. Since the lecture was not about the same topic as the abstract so that it is difficult to reverse engineer what was really said. This is of course not lecturer's fault! Certainly the lecture was related to Anirban's work with proteins.

Anirban talked in personal discussion about the appearance of protein folding shapes, whose 2-D projections can be modelled in terms of certain curves with shapes between tear drop and ellipse, which can be parameterized in terms of ordered decompositions of integers to primes. The claim was that these shapes are universal and appear also in other systems such as cylindrical cavity where they characterized different superposition of modes with frequencies coming as multiples of

the fundamental frequency. There was also a proposal that a connection between geometry and music exists. Also the existence of some kind of geometric fractal hierarchy having as building bricks objects with 3-fold cyclic symmetry was claimed.

3.2.2 Antonio Giuditta: *Brain metabolic DNA*

The notion of brain metabolic DNA (BMD) was a new notion to me (see `http://tinyurl.com/z6kjwo4`). TGD suggests active R&D like process driving genetic evolution and I have been a little bit disappointed since epigenetics is too passive in this respect. BMD would fit with my crazy speculations.

I try to summarize my first impressions about brain metabolic DNA.

1. The profiles for both the repetitive and non-repetitive fractions differ from native DNA and for learning rats differs from those for control rats. Stress and learning situations induce this process and it occurs at least in brain.

2. Wikipedia lists DNA replication and repair as the basic mechanisms of DNA synthesis. They would yield essentially a copy of native DNA. Does this mean that there could be some new mechanism responsible for the synthesis?

I have worked with two new new mechanisms of DNA synthesis emerging from TGD based new biophysics for which MB consisting of magnetic flux tubes carrying dark matter identified as large $h_{eff} = n \times h$, n integer, phases is crucial.

These new phases of ordinary particles identifiable as dark matter would make possible macroscopic quantum coherence in much longer length scales than usually for large values of n since Compton length is proportional to h_{eff}. Large h_{eff} would make living matter a macroscopic quantum system. Large h_{eff} phases would be created at quantum criticality: the large values of Compton lengths would be correlates for long range correlations and quantum fuctuations. Quantum criticality is indeed emerging as a basic aspect of living matter.

1. The experiments of Montagnier et al [L1] [L1] suggest that remote replication of DNA involving sending information about the template strand using light is possible. Peter Gariaev's group has made similar claims much earlier. Together with Peter Gariaev we published an article in Huping Hu's journal DNADJ about remote replication of DNA before the work of Montagnier [K14] (see `http://tinyurl.com/gnj5bxh`.

   The idea is that what I call dark photons (see below) carry genetic information. Dark photons would have energies in visible and UV range and could transform to biophotons with same energy. This would make them bio-active since biomolecules have transition energy spectrum in this range. The challenge is to understand the details of the information transfer mechanism. What would be needed would be regeneration DNA or dark DNA at the receiver end using the information. How this precisely occurs is of course only a subject of speculation.

   This mechanism as such would not however apply to this situation since the ordinary DNA could not serve as template.

2. The notion of dark DNA is one of the key new physics notions of TGD and the transcription of dark DNA to ordinary DNA could be involved with generation BMD.

   (a) The proposal is that genetic code has realization at the level of "dark" nuclear physics [L6] (see `http://tinyurl.com/jgfjlbe`). Dark DNA would correspond to dark proton sequences having interpretation as dark nuclei. Darkness would mean that the protons are in phase with non-standard value of Planck constant given by $h_{eff} = n \times h$, n integer which can vary. The value of h_{eff} learns as a kind of intelligence quotient since it tells the scales of long term memory and intentional action and also the size scale of the system). It could serve as intelligence quotient of cells and pyramidal neurons generating EEG as Josephson radiation (frequency of Josephson radiation is $f = 2eV/h_{eff}$ in terms of membrane potential V) could be the neuronal intellectuals).

(b) Dark DNA could accompany ordinary DNA as parallel dark proton strands. The negative phosphate charge would neutralize the positive charge of dark protons so that the system would be classically stable. The ability to pair in this manner would quite generally select preferred biomolecules as winners in evolution.

(c) For instance, the transcription of dark DNA to ordinary DNA is possible: dark DNA would serve as template for the ordinary DNA codons. Dark variants of biomolecules could make possible R&D in living matter. Evolution would not be by random mutations plus selection but intentional and more analogous to occurring in R&D laboratories.

(d) If dark DNA strands were used as tempates in the generation of BMD one could understand why learning BMD differs from the native DNA. Primarily the dark DNA would be modified as a response to learning and the modification would be transcribed to that of ordinary DNA.

The interesting question is whether these changes could also be transferred to the germ cells say by sending the information in form of light and generating copies of newly generated DNA portions replacing the original ones.

3.2.3 Other talks

There were many other excellent talks but I lost some of them. In the following I mention those talks, which I heard and which mentioned some effect, which might be relevant for developing further the TGD view about biology.

1. **Olle Johansson**: *Adverse health effects of modern em fields from wireless telecommunication, such as mobile phones and WiFi.*

   Johansson told about very interesting effect of low frequency radiation on skin. These effects look like effects caused by UV light. This could be understood if classical radiation field is accompanied by dark photons with large $h_{eff}/h = n$ implying that the energies of dark photons are in visible and UV range as predicted by TGD. The transformation of dark photons to ordinary photons (about which biophotons represent an example) could explain these effects. The burning of water caused by radiowaves [D1] would be similar effect [K7].

2. **Sarah Knox**: *Biophysics Systems Dynamics and the Current Biomedical Research Framework.*

   Knox mentioned that cancer cells seem to have reduced magnitude of the membrane potential (depolarization) or even vanishing membrane potential.

   One can imagine the following explanation based on TGD. Josephson radiation would be essential for the communications of cell membrane with MB and the reduction of the magnitude of membrane potential below critical value could mean that this communication is lost since resonance conditions not hold true anymore. The outcome would be that MB could not receive sensory input and control the cell since resonance conditions would not hold true anymore. Also coherence associated with group of cells would be lost and cells would enter into purely selfish mood with replication the only goal. This mechanism would look rather plausible explanation for what happens in cancer. One can also imagine that the mechanism making cell membrane self-loading battery based on the generation of Pollack's EZ's generating negative charge in cell interior could fail if the Josephson radiation from cell membrane has too low an energy.

   Knox also provocatively asked whether God could after all have a place in the scientific world order. This led to a lively and even emotional panel debate. One could formulate the question also in less provocative manner by talking about - say - Universal Consciousness. The neuroscience based theory of consciousness of Tononi (IIT) assumes panpsychism and from this there is not a long way to the idea about Universe as conscious entity.

   In TGD framework the hierarchy of selves as entire universe at the top and if one could call it God. This God is not however personal God. The hierarchy however contains lesser conscious entities above us - should one call them angles or demons - and they might have

time also for our problems: we would however represent the mental images of the semigod immediately above us - say our family or even collective consciusness of humankind. These semigods would make their god-like nature manifest by recreating themselves again and again and there is hope that the recent gods are not so cruel as that of Old Testament.

1. **Anders Rydberg**: *On low frequency magnetic exposure of biological cells and the possibility of windowing effects and cell-to-cell interaction*

   Rydberg talked also about frequency windowing (unfortunately I lost the talk). In TGD framework frequency windowing would take place by the presence of ionic Bose-Einstein condensates at MBs: cyclotron frequencies would correspond to preferred frequencies. Also the generalized Josephson junctions assignable to cell membranes would generate radiation at generalized Josephson frequency with nerve pulse patterns coded by frequency modulation to a kind of "whale's song". Ordinary Josephson radiation is obtained as special case.

   Blackman [J2] and other pioneers of bio-electromagnetism talk also about *amplitude* windowing and I have tried to understand what might happen in this process. Topological light rays carry transversal electric and magnetic fields orthogonal to each other. For slow frequencies these fields are approximately constant. One can also have static extremals with time independent transversal electric and magnetic fields as non-vacuum extremals if volume term implied by the twistorial lift of TGD is present in action.

   Suppose that a charged particle enters to static topological light ray in the direction of electric field. The situation is essentially the same as in magnetron (see `http://tinyurl.com/cmlg9gf`) if the almost static electric field is such that the charged particle turns just at the other boundary of CD meaning that the orbit of the particle is closed and generates cyclotron radiation (there is TGD application involving the magnetron as a generator of dark cyclotron radiation [L11]). This value of electric field would in non-relativistic approximation be proportional to mass/charge ratio of the particle. Amplitude windows could correspond to this kind of preferred values of electric field. For instance, one could imagine that the topological light rays are attached to cell membranes.

2. **Curt Lindmark and Georg Wikman**: *Endogenous electrical pulses from egg membranes: a quantum phenomenon*

   Egg generates periodically very sharp pulses with rising time of order 4 μs. The abstract does not tell the period of the pulsing but the graph shown in the lecture suggests that the it is of order 10 kHz. This would be the scaled up alpha frequency if the hypothesis about 2^{10}- scalings of EEG spectrum makes sense. Could this be seen as a kind of alpha rhythm in shorter time scale? One cold argue that the pulses are induced by a biorhytm generated by the MB of the egg.

3. **Göran Brusewitz**: *Two electrical systems in the body, a basis for a new, holistic biology (Becker and Nordström)*

   Brusewitz told about Becker's experiments to the application of an em field to the healing of wounds and to bone repair. Becker discovered a direct current system in organism and found that the electric voltages in various scales correlate strongly with consciousness. Björn Nordenström discovered a system of local electric flows which he called Biologically closed electric circuits. Blood vessels would provide one example.

   In TGD framework these systems would be naturally associated with networks of magnetic flux tubes carrying dark matter serving as templates for various circuitries. The nodes of this network would be negentropically entangled and the network would make possible proprioception. This kind of networks have been suggested to lead to the emergence of 3-space. The TGD view would be that they lead to the emergence of experience about 3-space. These networks, known as tensor networks, are now studied in condensed matter and would represent a vision about how complexity emergies in condensed matter. Holography is an essential assumption and in TGD it strengthens to strong form of holography (SH) in which 2-D data characterize both space-time surface and quantum states.

4. **Daniel Felse**: *Experimental Evidences for electromagnetic cell communications between unicellular organisms (Paramecia Caudatum).*

Felse reports evidence for non-chemical regulation of population size, effects across the species border, and linkage between populations and the environment resembling patterns in entanglement experiments. A possible TGD inspired interpretation would be in terms of the MB of the population receiving collective "sensory" data and performing control. TGD suggests the possibility of collective genomes assignable to (say) organelles, organs, the living entity, and even populations. This would make possible collective coherent gene expression induced by the collective MB.

3.3 Talks related to parapsychology

3.3.1 Rupert Sheldrake: *The Extended Mind*

To my opinion some talks under this heading can be thought of as belonging also under the heading "quantum biology and consciousness": Sheldrake's talk is not the only example of this. Morphogenetic is the basic notion of Sheldrake. It would not correspond to ordinary field such as em field. This leaves a lot of room for identification and to my opinion it is better to interpret "field" as metaphor.

Morphogenetic fields would serve as correlates for non-local aspects of consciousness: hence the term "extended mind". They would make possible learning and formation of habits at the level of species. Even condensed matter systems could learn habits. Morphogenetic fields would also explain various telepathy such as phone and email telepathy and why dogs are able to precognize that their owner is arriving home. Also experience of becoming aware of being stared at could be understood. In fact, attention would be mediated by morphogenetic fields giving rise to a kind of bond between the systems in question. The theory would apply also to inanimate matter such as water and the learning at the level of species need not be restricted to living matter as we identify it. Sheldrake as collected a lot of personal stories about this kind of experiences and done experiments. Unfortunately, mainstream scientists refuse to consider seriously the notion. One might hope that the situation is changing: for instance, neuroscientists like Tononi and Koch are proposing panpsychism [J5] [L10].

I have commented Sheldrake's notion of morphogenetic fields from TGD point of view already earlier [L2] and considered possible TGD correlates for it.

1. Usually classical fields are not believed to provide correlates for telepathic effects: Maxwell's theory does not allow precisely targeted communication and signal is lost in the noise produced by other systems. In TGD Universe the extreme non-linearity for the TGD counterpart of Maxwell equations however implies what I call topological field quantization. Any system can be said to possess field identity, field body or MB and the classical fields of different systems usually correspond to different space-time sheets having only wormhole contacts. Test particle experiences their sum since it touches the parallel sheets extremely near to each other: this allows to understand QFT-GRT limit of TGD gauge potentials are sums of the induced gauge potentials determined by the surface property. Same applies to gravitational field and Einstein's equations are local remnant of Poincare invariance.

   Signals could propagate as topological light rays assignable to the flux tubes of the MB to precisely defined target, without dispersion, and with maximal signal velocity. The large value of $h_{eff}/h = n$ for dark photons and also other dark particles propagating along the flux tubes would make possible to avoid the problems caused by finite temperature.

2. MB (MB) and topological light rays would be natural classical analogs of morphogenetic field. Dark photons and dark particles with large $h_{eff}/h = n$ propagating along the flux tubes of MBy could serve as quantum analogs of morphogenetic fields and large value of effective Planck constant would make possible non-locality.

3. For instance, the formation of magnetic flux tube connection between two systems would be correlate for directed attention and the flux tubes could provide an explanation for the various telepathic phenomena and the experience of being stared at. ZEO implies non-locality in the scale of causal diamond (CD) and makes possible communications with geometric past and provides a mechanism of memory. Self hierarchy having hierarchies of CDs and space-time

sheets as geometric correlates could explain learning at the level of species. Members of species could correspond as sub-selves/mental images of species as a conscious entity.

4. In ZEO MB is actually 4-D and can be seen as a classical correlate for behavior, habit, biological function, or 4-D self-organization pattern represented in terms of classical fields determined by the space-time surface. The replication of MB would induce biomolecular replication and would be actually replication of behaviors/habits. This could relate to the species memory. Also the cloning teleportation of maximal and perhaps even negentropic entanglement could correlate with species learning and learning in general.

3.3.2 Other contributions

Again I comment only the contributions that I had opportunity to listen or which were familiar from some other context.

1. **Jan Dalkvist**: *Is telepathy - if it exists - an electromagnetic phenomenon?*

   Jan Dalkvist considers the question whether telepathy is electromagnetic of quantum phenomenon. Parapsychologists themselves tend to think that it is not an electromagnetic phenomenon. Em signals are very weak and for ELF fields the energies of photons are extremely low.

   In TGD this problem disappears if one accepts the $h_{eff}/h = n$ hierarchy. In Maxwellian world view it is also difficult to understand the target selectivity and long range since classical radiation fields have $1/r$ behavior.

   Quantum mechanical explanation based on the notion of entanglement is indeed very attractive since entanglement does not depend on distance. Entanglement as such does not however provide any mechanism of communication of information.

   TGD view is that telepathy is basically quantum phenomenon as a phenomenon of consciousness but has classical field correlates. Quantum entanglement would have magnetic flux tubes as correlates. Flux tubves would also serve as correlates of directed attention essential for telepathy.

   Topological light rays assignable to flux tubes would make possible precisely targeted communication the fields would not decrease with distance. Classical communications are necessary for teleportation and they could be involved with the transfer of maximal entanglement, which is exceptional in that it can be cloned. The conjecture is that negentropic entanglement, which is maximal in p-adic sectors, is also possible to clone.

   Telepathy could be explained in terms of the same mechanisms as the interaction of personal MB with biological body. Flux tubes would serve as correlates of attention and signals along topological light rays would be precisely targeted and there intensity would not depend on distance.

   Also other biological bodies would be the target of communication and control. Maybe living matter has generated electromagnetic immune system preventing becoming "possessed". For instance, the resonance frequency spectra associated with the communications could be slightly different and active insulation mechanisms might have developed.

2. **John F. Caddy**: *What my tinnitus tries to tell me about the Milky Way*

   Tinnitus appears periodically with period which corresponds to sidereal (galactic) time. Spottiswoode has reported [J4] that precognition tends to happen at time of day which is roughly mid-day but sidereal time.

   A possible explanation of both phenomena in TGD framework relies on the notion of MB (for the explanation of Spottiswoode's finding see `btart`nonlocal). Also galactic magnetic field with strength of order 1 nT could be part of our MB so that the motion of Earth around Earth and galaxy could have effect on consciousness. The cyclotron frequencies assignable to galactic magnetic field could explain biorhythms with periods above EEG range and below one day whereas the endogenous magnetic field of strength .2 Gauss could correspond cyclotron frequencies of ions in EEG range. Intriguingly proton's cyclotron period in magnetic field of 1 nT is 1 second.

3. **Anabela Ventura**: *Intention and braid-to-brain communications with non-invasive techniques*

   I missed the talk of Anabela Ventura but luckily I have been in the same discussion group organized by Lian Sidorov. She told about work, which she has participated in Persinger group concerning the effect of intention to remote target which is brain. The work was published in Journal of Non-Locality and Consciousness. The synchrony between EEGs of the targets is taken as an indication of remote intentional action one can find the link to this work titled "Non-Locality changes in intercerebral theta band coherence between practitioners and subjects during distant Reiki procedures" at `http://tinyurl.com/j58pwdl`. Bio-photon emission is also detected in the experiments of Persinger and their fluctuation spectrum corresponds to that for EEG. A TGD based model relies on magnetic flux tubes making possible long range entanglement and serving as correlates of attention plus dark photons decaying partially to bio-photons [K9, K8].

4. **Brenda Dunne**: *Consciousness as life force*

   I missed also the talk of Brenda Dunne. Dunne has been the collaborator of Robert Jahn in PEAR project studying the possible effects of intention on random processes like random event generator (RGE). The experiments provide evidence for a small but real effect on random generators. Dunne mentions the shifts in input distributions, gender disparities, associated physiological effects like change in skin conductance, pupil dilation and effects of brain activity. The effects can appear even the presentation of stimuli.

   The TGD explanation would involve the notions of MB, hierarchy of Planck constants as a correlate for dark matter, and ZEO allowing signals also in the reverse time direction and assignable to time reversed selves for which the arrow of geometric time is opposite to the standard arrow of time (Libet effect). An interesting question is whether it is possible to detect the effects caused by these ghostly entities with non-standard arrow of time.

   Life force is somewhat provocative term and to my opinion should be taken as a metaphor. I would identify life force as conscious information, negentropy. NMP states that Universe tends to increase negentropy by generating negentropically entangled systems. The notion of negentropic entanglement makes sense only if one extends the notion of real number based physics to adelic physics so that it includes also various p-adic physics serving as correlates for cognition.

5. **Jan Pilotti**: *Conscious Space-time. Experiences localized in space-time and a mathematical conjecture towards a proof of conscious experiences existing beyond brain*

   Pilotti criticises the neuroscientific vision: Tononi and Koch state that every experience has neuroscientific correlate (I am not sure whether this statement is anymore consistent with the IIT theory of Tononi, which assumes pan-psychism). OBEs and NDEs represent basic candidates for experiences for which this is not the case. Pilotti speculates with the possibility of higher than 3-D sensory experiences describable in terms of $N \geq 5$-dimensional space-time.

   In TGD framework there are several objections against brain as a sole seat of consciousness.

   (a) Conscious experience is between two quantum realities (connected by state function reduction) and about space-time region rather than being a property of space-time region.

   (b) Sensory organs serve as reasonable candidates for the seats of qualia so that brain would only provide names for the experiences and could give rise to secondary sensory experiences at neuronal level unconscious at our level of hierarchy (TGD view about space-time could allow to circumvent the obvious objections to this view).

   (c) MB binds the components of experience together in quantum coherent manner. OBEs and NDEs could be experiences in which only MB (MB) would be involved but sensory and motor contribution from brain coded by EEG would be absent. For instance, the unpleasant experience in stomach that one has near a precipice might be due to the imagined falling motion realized as a reverse motion of biological body (BB) with

respect to stationary MB. Could these experiences have correlates assignable with MB only? One can argue that MB and BB together define the correlates.

$D = 4$ is the dimension of space-time and the natural implication is that sensory experiencing of higher-D realities is not possible. In particular, the 8-D $M^4 \times CP_2$ cannot be experienced sensorily. Higher-D spaces can be only imagined in terms of mathematical language as mathematicians do.

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