

How to test TGD based vision about living matter and remote mental interactions?

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Abstract

The general TGD inspired vision is that both biology, consciousness, and remote mental interactions and related phenomena labelled as paranormal share the same basic mechanisms. This purpose of this chapter is to summarize the new physics effects involved with the TGD inspired quantum view about consciousness and living matter and its applications to remote mental interactions and related phenomena. Also tests are discussed when possible. By the universality of the mechanisms most of the tests reduce to tests for a new physics predicted by TGD.

1 Introduction

The proposed theory of living systems and remote mental interactions involves a large number of general ideas which represent something new and one should be able to invent tests. Since the basic mechanisms of remote mental interactions are same as those of TGD inspired model of living matter, there is no special reason to restrict the tests to remote mental interactions. The emphasis is on new physics predicted by TGD. The following is an attempt to list the most important ideas and imagine possible tests. Most tests are tests of the proposed new physics suggested to be crucial for living matter. I do not possess the required background to propose any detailed experimental protocols and my hope is that I would be able to represent the basic ideas so clearly that others could invent manners to test them.

Chi (life energy) and Yin (intent) provide a good example about what is involved. Usually one just tries to find correlates chi and intent by using various kinds of detectors [J6]. The detector for a given speculative effect could be physical detector measuring fields, particle currents etc., chemical methods could be used to detect the effects, biological materials and even human body could serve as a detector. If one takes TGD seriously, one can reduce the test for chi and intent to a tests for its new physics correlates. The general vision also suggests optimal choices of targets of remote mental interactions.

While preparing this chapter I learned about two articles providing reviews about empirical testing of notions of chi and intent. The first article by Kevin Chen - titled *An analytic review of studies on measuring effects of external Qi in China* [J6] - summarizes the various methods of measuring external Chi (EQ). Second article is by Lian Sidorov and Kevin Chen and titled *Biophysical Mechanisms of Genetic Regulation: Is There a Link to Mind-Body Healing?* [J10]. The main message of the article is that intent has a direct effect on DNA and that electromagnetic fields play an important role in both communication and energy metabolism. It would be interesting to combine existing general ideas with the experimental input discussed in these articles.

The appendix of the book gives a summary about basic concepts of TGD with illustrations. Pdf representation of same files serving as a kind of glossary can be found at <http://tgdtheory.fi/tgdglossary.pdf> [L3].

2 Zero Energy Ontology

Zero energy ontology (ZEO) is one of the cornerstones of TGD and has become part of TGD during last six years. Zero energy states are identified as superpositions of pairs of positive and negative energy states assigned with the future and past boundaries of causal diamonds (CDs) and correspond in ordinary ontology to physical events with positive and negative energy parts of the state identified as counterparts for the initial and final states of the event. Effective 2-dimensionality allows a further reduction to the level of partonic 2-surfaces: also their 4-D tangent space data matter. Symmetry considerations lead to a beautiful view about generalizations S-matrix to U-matrix in terms of orthogonal basis of M-matrices, which in turn are expressible as products of hermtian square root of density matrices and unitary S-matrix [K19]. One can say that quantum theory is “complex” square root of thermodynamics.

Therefore one should try to find tests for ZEO.

2.1 The Hierarchy Of CDs

The basic assumption is that the sizes of CDs come as integer multiples of CP_2 scale R and for prime multiples of R correspond to secondary p-adic length scales $L_{p,2} = L_{p,1}\sqrt{p}$, $L_{p_1} = R\sqrt{p}$, where R denotes CP_2 scale. For electron with $p = M_{127} = 2^{127} - 1$ one has $T_{p_2} = .1$ seconds and defines a fundamental bio-rhythm. This time scale should have preferred role in physics. More generally the secondary p-adic time scales assignable to elementary particles should define time scales relevant to macroscopic physics. The corresponding size scale can be assigned to the magnetic body of the elementary particle. Also it should be possible to assign to quark mass scales special biological time scales as has been indeed done [K4]. h predictions could be tested.

2.2 Generalization Of Standard Conservation Laws In ZEO

ZEO together with sub-manifold geometry provides a new view about conservation laws and resolves the problem posed by the fact that gravitational interactions do not seem to respect energy conservation in cosmological time scales. Conservation laws holds true only in the scale associated with given CD, not universally (this would allow only single infinitely large CD).

Superconducting coherent states involve quantum superposition of states with different numbers of Cooper pairs and therefore break the super-selection rule associated with fermion number in ordinary ontology. In ZEO they could be understood without giving up the superselection rule associated with fermion number.

Experimental tests should try to prove that quantum number conservation is a length scale dependent notion. For instance, creation of matter from vacuum is possible in ZEO, and one might hope that its occurrence could be in some scale for CDs artificially.

2.3 Breaking Of Second Law In Standard Form

In standard physics second law states that all systems are entropic but a system can reduce its entropy by feeding its entropy to the environment. Negentropic entanglement carries genuine information and life can be seen as islands of negentropy in the sea of entropy. This forces to generalized second law. The proposed generalization (see <http://tinyurl.com/ybg8qypx>) [L1] [K15] can be characterized as maximally pessimistic.

The generation of negentropic entanglement is assumed to be accompanied by generation of compensating entropic entanglement. The modified form of second law is suggested by the mechanism of directed attention based on negentropic entanglement assignable to magnetic flux tube connecting selfandtarget. Negentropic entanglement prevails during the attention but disappears after state function reduction giving rise to entropy at the level of ensemble. Second law would hold true above time scale assignable to the duration of negentropic entanglement.

There are also other reasons to reconsider second law. The breaking of second law in standard form since the arrow of geometric time can change locally. Living systems are indeed accompanied by syntropic effects as realized by Italian quantum physicist Fantappie [J7, J11]. These effects could be understood as entropic effects but with a reversed arrow of geometric time. The mechanism would be based on negative energy signals. Phase conjugate laser waves are known to obey second law in reversed direction of geometric time. Cooling effects due to the absorption of negative energy signals inducing the breaking of the standard form of the second law are predicted to be possible. One can also imagine a spontaneous excitation of atoms generating radiation in the return to ground state in a situation when there is a target able to receive negative energy signals emitted in spontaneous excitation.

Standard form of second law assumes that quantum coherence is absent in the scales in which it is applied. Both the hierarchy of Planck constants and negentropic entanglement however make possible macroscopic quantum coherence characterized by the scale involved and the natural guess is that the time scale associated with causal diamond in question defines the scale above which one can expect second law to hold. There is evidence for the breaking of second law in time scale of .1 seconds [D1].

2.4 Negative Energy Signals

Zero energy ontology allows to assign to zero energy states an arrow of time naturally since one can require that states have well defined single particle quantum numbers at either upper or lower boundary of CD. Also the spontaneous change of the arrow of geometric time is possible. The simplest possible description for U-process is that U-matrix relates to each other these two kinds of states and state function reductions can occur at upper and lower boundaries of CD meaning reduction to single particle states with well defined quantum numbers. The precise correlates for the generation of geometric arrow of time are not completely understood.

Negative energy signals to geometric past would serve as counterparts for time reversed states in the case of radiation and phase conjugate laser waves are natural counterparts for them. The signal property requires a dissipative process proceeding in preferred time direction and this kind of process has been assigned to sub-CDs and should proceed as state function reduction sequence in preferred direction of time determined by the quantum arrow of time for the zero energy state. This process would be essential for the experience of flow of time in preferred direction and for generation of arrow of geometric time as explain in previous chapter and also in [K3]. For phase conjugate laser beams the reversed time direction for dissipation is observed.

Negative energy signals make possible remote metabolism as sucking of energy from remote energy source provided resonance conditions for transitions are satisfied. The counterpart of population inverted laser could serve as ideal source and the negative energy signal could serve as a control switch inducing phase transition like process taking the excited atom like systems to ground state (induce emission). This process should occur in living matter. Anomalous excitation of atomic state by absorbing energy by remote metabolism and subsequent generation of radiation could also serve as a signature. It could also lead to cooling effects breaking second law.

Negative energy signals would also make possible realization of intentional action by initiating the activity already in geometric past. This would be very desirable in rapidly changing circumstances. The time anomalies of Libet for active aspect of consciousness could be interpreted in terms of time mirror mechanism [J2] and further experiments in longer time scales might be perhaps carried out.

Negative energy signals could be also essential for the mechanism of long term memory. They would induce a breakdown for a system analogous to population reversed laser via induced emission meaning generation of strong positive energy signal [K17].

3 P-Adic Physics

3.1 P-Adic Length Scale Hypothesis And Mersenne Hypothesis In Living Matter

p-Adic length scale hypothesis states that favored primary p-adic length scales proportional to square root of p-adic prime correspond to primes which are near powers of two: $p \simeq 2^k$. Favored secondary p-adic length scales would correspond to favored CD sizes coming as octaves. Mersenne primes are in special position. This leads to rather specific predictions in the case of living matter since the length scale from 10 nm to 5 μm contains as many as four electron Compton scales $L_e(k) = \sqrt{5}L(k)$ characterized by Gaussian Mersennes, which correspond to ordinary primes with $k = 151, 157, 163, 167$. This can be seen as a mathematical miracle and it is interesting that it associated with the biologically most interesting length scale range. This leads to Mersenne hypothesis [K4] stating that in living matter the p-adic length scales associated with both ordinary and Gaussian Mersennes are important. Besides this the hypothesis states that those values of Planck constant come as proportional to

$$r = 2^{k_i - k_j} ,$$

where k_i and k_j are primes characterizing two Mersenne primes. This predicts a large number of preferred time and length scales which might be relevant in living matter. Also this hypothesis could be tested.

3.2 Negentropic Entanglement

Negentropic entanglement is suggested to be a basic characteristic of living matter whereas the hierarchy of Planck constants would make possible macroscopic quantum coherence. Negentropic entanglement (see **Fig.** <http://tgdtheory.fi/appfigures/cat.jpg> or **Fig. ??** in the appendix of this book) and dark matter hierarchy allow to circumvent the basic objection against viability of computation: even technological applications can be dreamed of. At this moment the only support comes from proposed applications to particle physics and from the modelling of living matter and is only indirect. The basic challenge is to learn whether Nature has chosen negentropic entanglement and hierarchy of Planck constants as its tools. The next challenge would be to develop technological tools for handling them.

For instance, phase transitions changing Planck constant from ordinary to larger one would effectively mean disappearance of ordinary matter and this could serve as a signature. Negentropic entanglement makes possible abnormally long duration of entangled period resembling that appearing in Orch Or of Hameroff and Penrose [J4] and anomalously low dissipation could serve as a signature of both negentropic entanglement and of hierarchy of Planck constants.

Negentropic entanglement could be associated with many-particle states at magnetic flux tubes. Either non-local single particle excitations of Bose-Einstein condensates of bosonic states (Cooper pairs of electrons say) or many-fermion states can be considered [K20]. Metabolic energy quantum liberated in $\text{ATP} \rightarrow \text{ADP}$ would generate the excitation. NMP does not tell whether a transfer of negentropic entanglement from high energy phosphate bond to flux tube takes place or whether the negentropic entanglement is created in the process. Exactly the same process would take place in photosynthesis as a first step and there is evidence for non-local excitations of electrons [I4]. Whether electrons or their Cooper pairs are in question will be known probably very soon. The general prediction is that metabolic energy transfer always takes place via a transfer of dark photon. The decays of these photons to ordinary photons should produce bio-photons with energy around 5 eV and IR photons with this energy could have biological effects.

3.3 Shnoll Effect As Evidence For P-Adic Physics?

In Shnoll effect [E1] the expected probability distribution with single peak develops several peaks and the effect depends on periods assignable to solar system. The effect is very general and appears even for atomic nuclei. There exists no standard physics explanation for it.

1. The TGD inspired model of Shnoll effect [K2] as a statistical effect is based on the interpretation of probability distribution having integer valued argument as p-adic valued distribution and the replacement of the parameters and variables with their images under canonical identification. For electron the magnetic body has size scale of the Earth so that this effect should be mediated by the magnetic body assignable to the CD and could be seen as evidence for these notions.
2. The oscillatory character of the effect with periodicities assignable to solar system inspires the question whether the transformation of intention to action mediated by canonical identification might be involved. If so this mechanism would apply also to experimental situations involving effect of intent on both living and inanimate systems. The prediction is the appearance of characteristic number theoretical signatures in the form of probability distributions. It has however turned out that the idea about p-adic-real phase transitions is not mathematically sound.

4 Magnetic Body As Carrier Of Dark Matter

Magnetic body carrying dark matter is certainly a central concept.

4.1 Dark Matter As A Hierarchy Of Phases With Large Value Of Planck Constant

1. Dark matter is identified as a hierarchy of phases with effective value of Planck constant coming as a multiple of ordinary Planck constant. A more stringent hypothesis inspired by

spin glass degeneracy is that given multiple of Planck constant correspond to an effective local singular covering of the imbedding space. In biological systems the values of Planck constant could be rather larger: the condition that a photons with given frequency correspond to energies above thermal energy at physiological temperatures allows to estimate \hbar as ratio of thermal energy with the photon energy for ordinary value of \hbar . This dark matter must be distinguished from galactic dark matter (which could be actually magnetic energy) assignable to long flux tubes like structures around which galaxies concentrate like pearls in necklace. The values of Planck constant proposed for flux tubes mediating gravitational interaction between bodies with masses M and m is gigantic: $\hbar > GMm/c$ and can be assigned to dark energy rather than to dark matter.

It is assumed that at partonic 2-surfaces the sheets of multiple covering become completely degenerate and partially degenerate at two kinds of preferred 3-surfaces. n_1 -fold branching occurs both at space-like ends fo space-time surface assignable to CD boundaries and n_2 -fold branching at light-like orbits of wormhole throats at which induced metric changes its signature. At partonic 2-surfaces branching to $n_1 n_2$ surfaces occurs. There is mathematical analogy between 3-surfaces and partonic 2-surfaces with 2-branes which are also obtained as piles of copies of surfaces which degenerate to single one. Now the degeneration of 3-branes would occur only at the 3-D boundary of the brane.

2. Living matter would be ordinary matter controlled by dark matter at magnetic flux quanta assignable to living system. Magnetic body would have onion-like layered structure. For instance photons with energies in EEG range would correspond to parts of magnetic body with the scale of wavelength which is now of the order of Earth radius.

Tests for the presence of dark matter.

1. The basic prediction is the existence of scaled versions of standard model physics. Particles with large Planck constant would have same masses as ordinary ones but scaled up Compton wave lengths would make gossible macroscopic quantum phases in much lower densities as usually. The proposal is that living matter involves scaled variants of electroweak physics and hadron physics. Also p-adically scaled variants with scale mass spectrum can be considered and resonant interactions between members of the two fractal hierarchies are natural when the scales co-incide.
 - (a) The scaled variant of QCD like physics is needed if color qualia are due to quark color. This is achieved by coding A, T, C, G to spin states of u quark pairs assignable to flux tube pairs in the model of DNA as TQC. Findings of mathematician Barbara Shipman [A1] suggests that the mathematics of colored quarks are involved with the honeybee dance via so called flag manifold $SU(3)/U(1) \times U(1)$ parametrizing different choices of color quantization axis. Could the presence of dark u quarks at the ends of flux tubes attach to DNA and lipid layers be tested? For instance, could it be detect the presence of quark charge equal to $2/3$?
 - (b) The prediction would be that at space-time sheets corresponding to given value of Planck constant long ranged color and/or electroweak interactions are present meaning the presence of new long range forces. Could these be partially responsible for the coherence of living matter: could color confinement play an essential role? Elementary particles are pairs of magnetic monopoles separated by Compton length: could also second monopole containing only neutrino pair be made visible by a suitable experimental arrangement? Maybe even ordinary condensed matter physics could involve Z^0 force below atomic length scale [K8].
2. One motivation for the hierarchy of Planck constants was the evidence that water behave as $H_{1.5}O$ in atto-second scale. The explanation was that 1/4 of hydrogen nuclei (protons) are dark. Could these experiments be carried out in other time scales and living matter? I have proposed that the rich anomaly spectrum of water above freezing point could be understood if it is a multiphase system containing also dark components [K8]. Could one test this hypothesis by concrete model building and comparison with experimental facts?

3. Dark nucleons correspond to the states of DNA, RNA, tRNA, and amino-acids and vertebrate code has simple realization for dark nucleons. Could one prove experimentally the existence of dark nucleons? Perhaps as a dark plasma like phase?
4. Quantum coherence in unexpectedly long scales is predicted to be possible for dark matter. For instance, super-conductivity at temperatures at which it should not exist, becomes possible [K5, K6, ?]. I have proposed a model of high T_c superconductivity and also its biological variant based on electron pairs with large Planck constant and Compton length of order cell membrane thickness. Josephson current through cell membrane is one testable prediction. EEG would be partially determined by these Josephson currents. It is now known that photosynthesis involves macroscopic quantum coherence in unexpectedly long length scale. The model is in terms of large \hbar electron Cooper pairs. Also this model should be testable.
5. With inspiration coming from the model of quantal effects for ELF photons on vertebrate brain, EEG photons are identified as dark photons and bio-photons as their decay products [K4]. This identification predicts that the energies of these photons are in visible and UV range. Could it be possible to see the emission of dark EEG photons with these energies in metabolic book keeping?

4.2 Tests For The Notion Of Magnetic Body

What kind of tests can one imagine for the notion of magnetic body?

1. The existence of magnetic bodies.
 - (a) Could one photograph dark matter at magnetic bodies? The mechanism would be transformation of ordinary photons to dark photons scattering from dark charged particles and transformation back to ordinary photons. Peter Gariaev might have already done this [K1]. This kinds of experiments might be continued and refined.
 - (b) How the existence of magnetic flux tubes connecting two objects - say living organisms - could be tested? What happens to flux tubes when the cells of living organism are taken far away from the organism. The experiments of Cleve Backster (see <http://tinyurl.com/43wbd6>), who introduced the notion of primary perception in the study of electrical reactions of plant which was harmed or threatened to be harmed suggest that this connection continues. Do the flux tubes remain intact and imply correlations between the distant cells and organism or - in the case that they are loops - are they split by reconnection mechanism? Could the flow of biologically important ions occur between the ends of flux tubes (it could also be that only electrons and protons and perhaps some dark nuclei - even quarks participate the flow). Could one use markers for the ions to test the existence of this kind of flows.
 - (c) How to measure the presence of the flux quanta of magnetic fields of magnetic bodies via the interaction of ordinary matter with classical electromagnetic fields created by dark particles? The description of this interaction (see <http://tinyurl.com/y9exp84r>) is in terms of topological condensation to multiple space-time sheets [K21]. Now imbedding space effective covering and space-time has sheets analogous to those of Riemann surface of function $z^{1/n}$. This multi-sheetedness does not correspond to ordinary many-sheetedness. If all physics reduces to that associated with partonic 2-surfaces then classical fields carrying different values of Planck constant should interact since different sheets co-incide at partonic 2-surfaces. The (effective) value of Planck constant defined as the number of sheets of covering can depend on the region of 3-surface. Are there rules governing this change?
 - (d) Could one demonstrate the presence of magnetic monopoles at flux tube ends? Even elementary particles should possess magnetic body with largest flux tubes having length scale defined by the p-adic secondary p-adic length scale characterizing particle and characterizing the size scale of CD assignable to elementary particle. Also smaller layers of magnetic body should be present: in particular that corresponding to the primary p-adic length scale of order Compton length. Secondary p-adic length scale corresponds to

a time scale of .1 seconds for electron, the fundamental biorhythm. Could one identify bio-rhythms assignable to quarks which are more massive than electron. The QCD estimates for u and d quark masses are about 5 MeV and 20 MeV and this gives an idea about secondary p-adic time scale which should be a negative octave of .1 seconds. 12.5 ms (80 Hz) and 2.5 ms (400 Hz) are the estimates for the secondary p-adic time scales.

- (e) Magnetic body having fractal onion-like structure would play a key role neuroscience. The effects of ELF em fields on vertebrate brain at multiples of cyclotron frequencies were the original motivations for introducing the hierarchy of Planck constants. EEG would serve as communication and control tool in the system defined by magnetic body and biological body. EEG frequencies should correspond to linear combinations of harmonics of Josephson frequency for cell membrane as electronic (at least) superconductor and harmonics of cyclotron frequencies for dark ions. This leads to a rich spectrum of quantitative predictions about EEG spectrum and attempts have been made to understand the dependence of EEG spectrum on state of consciousness. For Calcium ion the cyclotron frequency is 15 Hz.
- (f) Also magnetic body has dynamics - highest layers of body can disappear or reappear or completely new layer can emerge- and one can ask whether this dynamics could be experienced directly. The effects induced by Persinger's God helmet [?]ould have interpretation in terms of dynamics of magnetic body. Also OBEs could be understood as effects related directly to magnetic body [K18]. One can also ask whether astrophysical phenomena could effect directly the magnetic bodies and therefore conscious experiences. Effects of solar storms and auroras represent basic examples of this kind of effects. Maybe this could be tested?

2. The dynamics of flux tubes.

- (a) Phase transitions changing Planck constant would induce shrinking of magnetic flux tubes. These could correspond to volume changing transitions of gel phase in living matter. Bio-catalysis would rely on these phases transitions and they would allow bio-molecules in the dense soup of bio-molecules to find each other [K4].
- (b) Reconnection of magnetic bodies second fundamental dynamical process playing key role in living matter. $ATP \leftrightarrow ADP$ process would be involved with reconnection. ATP as a molecule of consciousness would accompany negentropic entanglement. Information molecules attaching to receptors would represents of ends of flux tubes attaching to receptors and forming longer connected flux tubes. This would be basically generation of qualia in the length scale defined by the distance of the cell sending the information molecule and the cell receiving it. Remote sensory perception would rely on the same mechanism. One should be able to test the hypothesis that the stretching of flux tubes accompanying the diffusion of information molecule from sender to target represents deeper level of the dynamics of information molecules? The transfer of dark particles along the flux tube could be one possible signature.

If it is possible to demonstrate the existence of magnetic flux tubes t by studying the flow of dark particles between two systems, one could try to test whether changes in the flow pattern by reconnection could become manifest via the flows.

- (c) Also remote mental interactions should involve generation of flux tubes between the biological and magnetic bodies of the target and operator and reconnection for loops could be the mechanism. Quantization of magnetic flux is necessary for this mechanism to work. Particle flows between target and operator would be one signature. For living target the coherence of counterparts of EEG would be second signature.

4.3 Bio-Superconductivity

4.3.1 TGD inspired model of high T_c superconductivity

TGD inspired view about high T_c electronic superconductivity and its biological counterparts are discussed in [K5, K6, ?]. Also the TGD inspired model for ordinary high T_c electronic superconductivity relies on flux tubes assigned with stripes found to serve as kind of highways carrying

supra currents. High T_c super-conductivity involves two critical temperatures: T_c and T_{c_1} . Below the higher critical temperature T_{c_1} Cooper pairs with large Planck constant are assumed to be present but magnetic flux tubes are assumed to be rather short and closed (the phase is antiferromagnetic) so that macroscopic supra currents cannot flow. Around the lower critical temperature T_c flux tubes fluctuate and form by reconnection longer flux tubes and percolation type process giving rise to macroscopic supra currents becomes possible. By p-adic length scale hypothesis the basic dimensional parameters could correspond to cell membrane thickness (10 nm) and cell nucleus length scale (2.5 μm) even for ordinary high T_c super-conductivity.

An analogous mechanism is expected to be at work for cellular system and give rise to electronic supra current. Also biologically important bosonic ions should give rise to cyclotron Bose-Einstein condensates with large value of Planck constant. In the case of fermionic ions Cooper pairs would be required. Another possibility is formation of exotic ions when some neutral color bonds between nucleons in nuclear strings become charged. The energy change should be relatively small- of order keV- and there is evidence for this kind of states: nuclear reaction rates vary with a period of year explainable in terms of the variation of the distance from the Sun effecting also the intensity of X ray radiation from Sun.

4.3.2 Leakage of supra currents as basic mechanism

The basic element of the proposed vision is remotely induced leakage of supra currents from magnetic flux tubes to atomic space-time sheets. This same mechanism works for both endogenous biological self-organization and remote mental interactions which would form a standard element in the construction of our sensory representations. The most economic experimental strategy would be a direct verification of this basic mechanism.

An especially dramatic effect would be the appearance of ions from magnetic flux tubes to the target of remote mental interaction not present in the target initially. Sue Benford has found evidence for the appearance of S, Mg, and Al in X ray films which were exposed to the radiation coming from so called torsion generator [I12]. Intentional effort was involved with the experiment. What happened was that dots and tracks with typical size scale of one millimeter appeared in the X ray film. The dots and tracks did not allow identification as tracks of charged particles, and the exposed regions contained S, Mg and Al not present elsewhere. The leakage of energetic super-conducting ions to atomic space-time sheets dissipating their energy by emitting electromagnetic radiation and ionizing the atoms is the natural explanation for the effect [I12, I6]. Note that both X ray films and nuclear emulsions contain gelatin which is an organic compound and might increase the sensitivity of the system.

4.3.3 Time reversal for the leakage of supra currents

The time reversal of the mechanism generating the leakage of supra currents could be especially important for healing. This mechanism is consistent with the presence of remote bound state entanglement and anomalous production of metabolic energy when binding energy is liberated.

The mechanism would be accompanied by a mysterious disappearance of marker ions in the tissue, and manifest as time reversed function of various molecular machines certainly detectable. Phase conjugates of (that is time reversed) microwaves at critical frequencies could induce the healing process. For instance, de-differentiation of cells might be induced in this manner.

As explained earlier, geometric time reversal could typically involve generation of anomalous radiation by excitation of atoms or molecules by emission of negative energy photons. Rotating magnetic systems (Searl machine) would be especially interesting for proving that time reversal indeed occurs. One could try to demonstrate that biological rhythms correspond to dissipation-healing cycles (wake-up sleep period and metabolic cycles being basic examples).

4.4 Direct Supra Currents Along Magnetic Flux Tubes

Direct supra currents along magnetic flux tubes are also predicted besides Josephson currents. Direct supra currents would be excellent candidates for the currents of Becker (see <http://tinyurl.com/ybnjk9bq>) [L2]. This model assumes that living matter is a semiconductor having underlying regular liquid crystal like structure.

The lipid layers of cell membranes are indeed liquid crystals and the braiding of magnetic flux tubes induced by the flows of the 2-D liquid formed by lipids is central in the model of DNA as topological quantum computer. According to Mae-Wan Ho liquid crystal patterns provide memory representations: in TGD one would achieve the same by the storage of liquid crystal flow patterns to the braidings of flux tubes. For the direct quantum currents the assumption of actual semiconductor structure might be un-necessarily strong.

Magnetic flux tubes can also carry longitudinal electric field and one can construct a simple model for the quantum states of charged particles in this kind of electric field. Large value of Planck constant is natural for long flux tubes. Flux tubes could have size scale of body or of even magnetic body. The model provides unexpected insights about character of quantal currents, allows to understand the amplitude windows for the effects of ELF em fields on vertebrate brain, the effective semiconductor property of living matter, and the effect of needles in acupuncture as metabolic effect. Disease as a loss of negentropic entanglement, healing as a regeneration of negentropic entanglement, the association of negentropic entanglement with ATP and high energy phosphate bond perhaps assignable to a Cooper pair like state, vacuum zero point kinetic energies as fundamental metabolic quanta, and loading of metabolic energy batteries by acceleration of charged particles in electric field so that they can be kicked to smaller space-time sheets are the basic of the model (it is essential that the currents are non-ohmic!). The challenge is to test the model for DC currents and the models of healing and acupuncture.

The model also proposes that the interaction of radiation fields is based on acceleration of charged particles on flux tubes having also topological sum contacts to “massless extremals” representing space-time correlate for radiation fields. The optimal situation is achieved when the electric field of ME is parallel or antiparallel to flux tube and ME therefore orthogonal to it. If the flux tube is near critical voltage for the generation of quantal DC current, the perturbation caused by the radiation field can induced by the quantal DC current accelerating charged particles and loading metabolic batteries by kicking them to smaller space-time sheets. This would directly correspond to the generation of ATP responsible for negentropic entanglement and generating eventually liberating metabolic energy. The killer prediction is that the biological effects are caused only at the second half of the cycle. In the case of EEG theta waves there is indeed evidence for this [J12].

5 TGD View About Consciousness And Biology

In the following TGD based view about consciousness and biology is summarized with emphasis on mechanisms. Proposals for tests are made when possible.

5.1 The Notion Of Conscious Hologram

Living system as conscious hologram is a metaphor emphasizing the fractal structure of sensor and cognitive representations. The model to be discussed relies heavily on the notion of magnetic flux tube and negentropic entanglement.

5.1.1 Attention

What is attention? What are its characteristic properties? What could be the quantum physical correlate for it. The naive view western view is that attention and perception is directed: there is observer and observed. The “Eastern” view says that observer and observed are one and same thing and this distinction applies only to memory about attention.

The proposed identification for the correlate of attention as negentropic entanglement (see **Fig. <http://tgdtheory.fi/appfigures/cat.jpg>** or **Fig. ??** in the appendix of this book) having as space-time correlates magnetic flux tubes corresponds to the “Eastern” view: I have made also an attempt to explain how asymmetry between perceiver and perceived could emerge [K9]. Directing attention to an object of external world means formation of flux tubes connecting perceiver to the object. Qualia prevail as long as this attention continues. There is a resemblance with Orch Or of Hameroff and Penrose [J4] and with active information of Bohm [J5]: attention is the activity.

This view about attention means that ordinary sensory perception is a non-local process involving in an essential manner also the target.

The test would be finding whether (for instance) visual attention implies “intentional imprinting” in the object of attention. This relates directly also to the proposed mechanism of remote mental interactions. In the case of hearing our ability to tell whether the sound comes from external world or not is a mystery if one believes that qualia are product of some neural activity. The flux tube model would assign also to hearing flux tubes which are attached to some object oscillating with the sound wave, even molecules of air. How it is possible to identify the sound source “correctly” if anything that oscillates with sound wave can serve as target of attention? The natural definition of source is in terms of intensity maximum. Both ears are needed to identify the direction of maximum intensity.

5.1.2 Model for qualia

Directed attention involves qualia. The qualia correspond to quantum number increments during the process leading from ZEO counterpart of initial prepared state to the final entangled states (identified as states at lower and upper boundaries of CD). State function reduction which eventually happens reduces the negentropic entanglement at the upper end of CD and after this there is possibly a memory of qualia, not genuine qualia anymore. Flux tubes connecting observer and observed are the correlates for the sensory perception and generation of qualia. This leads to sensory capacitor model in which the analog of dielectric breakdown amplifies the polarization between the ends of flux tubes. Besides this the process involves scaling up the lengths of the sensory capacitor flux tubes: perhaps by a phase transition increasing the value of Planck constant.

Various electrets and strong electric fields characterizing biomatter could relate to sensory perception at molecular and cellular level. Cell membrane could give rise to sensory perception of external world during nerve pulse which indeed involves dielectric breakdown. One might hope of finding at test for the generation of polarization in longer length scale during generation of qualia.

5.1.3 Fractality of sensory percepts and EEGs

The model of qualia suggests fractal sensory percepts. Sensory perception would be a process propagating from long to short length scales and generating qualia transforming to memories about qualia. Cell membranes and DNA could be end points of this process and lipids of the cell membrane liquid crystal would form pixels for a representation of external world analogous to that provided by computer monitor. In case of ordinary cells this representation would be about chemical environment, in the case of neurons about the external world. How this representations relates to our conscious experience?

It might be that negentropic entanglement in the scale of magnetic body is involved so that the process generating qualia begins from the level of magnetic body and proceeds downwards.

EEGs consisting of dark large \hbar photons with energies in visible and UV range are used to communicate sensory data to magnetic body as Josephson radiation from cell membranes with frequencies characterized by the value of Planck constant. The radiation would propagate along flux tubes and flux sheets. What is the precise meaning of this communication? Is it communication of symbolic representation constructed by brain and therefore communication of memories?

The fractal onion-like structure of magnetic body requires fractal hierarchy of analogs of EEG which could be called XYGs. Even weak bosons and gluons could give rise to the analog of EEG in appropriate length scales if dark matter hierarchy is realized. Biophotons are tentatively identified as decay products of large \hbar EEG photons and their scaled variants. Could this be tested somehow?

Fractality of memory representations would mean that scaled down “stories” lasting much shorter time than the real episode are formed and could be formed as several copies. This could be one of the key elements of intelligent behavior. There is evidence for this has been found by Yamaguchi et al [J12, J13] in the case of theta waves. TGD based explanation in terms of phase transitions generating scaled versions of the real time representation of the event is discussed in [K9]. It might be possible to test this aspect of memory representations in terms of EEG waves as in the work of Yamaguchi.

5.1.4 Fractality of sensory representations

The notion of conscious hologram means that practically any part of body can represent any other part of body or even external world. Concerning the notion of conscious hologram at the length

scale of body, Kirlian imaging with simultaneous electrical stimulation of other body parts, in particular ear, is very promising manner to test the hypothesis [I13]. It is also known that ear forms kind of fractal miniature of body with respect to acupuncture points so that stimulation of particular part of ear electrically creates sensation that particular part of body is stimulated [J8].

PLR spectroscopy [I7] provides a precise and accurate manner to prove the viability of the notion of conscious hologram empirically. What is needed is the analysis of the frequency spectrum: does it really contain the predicted differences of cyclotron harmonics. If this approach and its variants really work it becomes possible to determine experimentally the densities of super-conducting ions and Cooper pairs at parallel space-time sheets.

At the level of remote mental interactions the stimulation of brain electrically could induce in other brain nerve pulse pattern or even experience correlating with the nerve pulse pattern or even experience in the stimulated brain. Even water near criticality could provide this kind of representations. In Imaging laboratory at Hilversum, Holland the following experiment has been performed with success. The experiment involves water droplet near freezing point. A person with abilities of a healer asks for Universe to express something in the structure of the droplet. What results are beautiful fractal patterns representing say plant leaves, even a picture about the laboratory's architecture has been generated in this manner. Also the work of Emoto [I11] and work carried out in Aerospace Institute in Germany [I3]

5.2 TGD View About Metabolism

TGD view about metabolism involves two new elements. First of all, TGD leads to the idea of universal metabolic quanta. These would make possible metabolism before the development of a complex chemical machinery which also would rely on universal metabolic energy quanta. Secondly. ATP seems to have two roles as a molecule of consciousness and as a metabolic quantum? These roles are very closely related and the connection with the modification of second law of thermodynamics is suggestive.

5.2.1 Many-sheeted space-time and universal metabolic energy currencies

The dropping of particle to a larger space-time sheet liberates energy which is the difference of the energies of the particle at two space-time sheets. If the interaction energy of the particle with the matter at space-time sheet can be neglected, the energy is just the difference of zero point kinetic energies. This energy depends on the details of the geometry of the space-time sheet. Assuming p-adic length scale hypothesis one obtains a general formula for the difference of zero point kinetic energies. These energy increments define ideal candidates for universal metabolic currencies and under certain additional conditions (say resonance with energies of some important molecular transitions) these currencies could be predecessors of the standard metabolic currency of order .5 eV. There is a more detailed treatment of universal metabolic currencies in [K4]. A model for how universal metabolic currency .5 eV assignal to the dropping of proton from atomic space-time sheet is discussed in [K14].

In many-sheeted space-time particles topologically condense at all space-time sheets having projection to given region of space-time so that this option makes sense only near the boundaries of space-time sheet of a given system. Also p-adic phase transition increasing the size of the space-time sheet could take place and the liberated energy would correspond to the reduction of zero point kinetic energy. Particles could be transferred from a portion of magnetic flux tube portion to another one with different value of magnetic field and possibly also of Planck constant h_{eff} so that cyclotron energy would be liberated. In the following only the "dropping" option is discussed.

The hypothesis predicts the existence of anomalous lines in the spectrum of infrared photons. Also fractally scaled up and scaled down variants of these lines obtained by scaling by powers of 2 are predicted. The wavelength corresponding to .5 eV photon would be $\lambda = 2.48 \mu\text{m}$. These lines should be detectable both in laboratory and astrophysical systems and might even serve as a signature for a primitive metabolism. One can also consider dropping of Cooper pairs in which case zero point kinetic energy is scaled down by a factor of 1/2.

Interestingly, the spectrum of diffuse interstellar medium exhibits three poorly understood structures [I2]: Unidentified Infrared Bands (UIBs), Diffuse Interstellar Bands (DIBs) [I1], and Extended Red Emission (ERE) [I14] allowing an interpretation in terms of dropping of protons

or electrons (or their Cooper pairs) to larger space-time sheets. The model also suggests the interpretation of bio-photons in terms of generalized EREs.

It must be emphasized that the identification of metabolic energy quanta as increments of zero point kinetic energies is untested and allows variants. Magnetic flux tubes are in longitudinal degrees of freedom effectively one-dimensional boxes, and the energy increment for the longitudinal excitations could replace the increment of zero point kinetic energy in the transfer of the particle between space-time sheets. Also excitations in transversal degrees of freedom (increment of cyclotron energy) are possible. These excitation energies could define universal metabolic energy quanta. This option emerges in the model for the generation of negentropic entanglement giving also the connection with the findings about effects of ELF em fields on vertebrate brain. The model predicts that metabolic energy transfer always involves generation of dark photon absorbed by magnetic flux tube so that negentropically entanglement non-local single particle excitation is created. One expects that IR photons with energy around 5 eV (metabolic energy quantum) have biological effects. Also bio-photons resulting from the transformation of dark photons to ordinary photons at this energy are possible.

5.2.2 Plasmoids as prebiotic life forms

A natural conjecture is that plasmoids involving charged plasma at magnetic flux quanta define prebiotic life forms [K10]. The minimum prerequisites for life would be present if the proposal for universal metabolic quanta is correct. Even dark nuclei could be regarded as plasma like structures so that even genetic code and nuclear counterparts of basic biomolecules could be involved.

The model of high T_c super-conductivity and the general vision about dark matter hierarchy have led to a rather precise model for magnetic body as an intentional agent utilizing biological body or its part as motor instrument and sensory receptor [K7]. Dark matter plasmoids and plasma oscillation patterns as representations of control commands are one important aspect of the model. The prediction is that plasmoids should have been predecessors of ordinary life forms. There is laboratory evidence that plasmoids behave like life forms [19, I8]. Very high temperatures catastrophic for ordinary life forms could prevail at magnetic flux quanta associated with plasmoids. This forces a radical reconsideration of the question how pre-biotic life have evolved and forces to ask whether even the hot interior of Earth could have served or still serve as a seat of life.

The old Expanding Earth hypothesis explains the observation made already at the time of Wegener that all continents fit to a structure covering entire Earth if the radius of Earth were one half of the recent radius. A phase transition increasing the value of Planck constant for the space-time sheet of Earth by factor two could explain this finding and leads to a rather non-trivial vision about early life at Earth (see <http://tinyurl.com/y7uuy119>) [K11].

ATP cannot serve as a correlate of negentropic entanglement during prebiotic period but this does not mean that negentropic entanglement would not be possible. One should understand why ATP makes possible negentropic entanglement. Negentropic entanglement allows states with negative binding energy which are not bound states in the usual sense. Why high energy phosphate bond would be example of this kind state? Understanding this might help to understand the conditions under which negentropic entanglement is possible. The laboratory evidence for plasmoids as prebiotic life forms [I8, I10] raises hopes that one could learn to create situations in which negentropic entanglement prevails.

In situations in which the target is in-animate matter, universal metabolic quanta might be relevant for the realizations of remote mental interactions.

5.2.3 Controlling metabolism by IR laser beams and DNA functioning by maser beams?

One could also test the “dropping” of ions to larger space-time sheets. If the dropping ions have dissipated their energy this means that system acts like a maser at wavelength defined by the reduction of the zero point kinetic energy liberated in the dropping of the ion. The pumping process would correspond to the leakage of the supra currents to atomic or some other space-time sheet, and induced emission to the dropping induced by the photons already present.

1. The effectiveness of metabolic energy production in which proton drops and absorbs a negative energy photon of energy about 5 eV could be amplified by a beam of coherent IR light

“kicking” protons back to the atomic space-time sheets. The irradiation by phase conjugate beam would “steal” energy from living system by inducing the dropping without locally usable energy. Whether living systems can “steal” energy from other life-forms in this manner could be tested. The “stealing” of the metabolic energy (there is probably a fractal hierarchy of “energy currencies”)from cancer cells by phase conjugate laser light might be the first principle explanation for why Priore’s machine works.

2. The dropping of ions from say $k = 151$ space-time sheet to larger space-time sheets creates microwaves with frequencies corresponding to zero point kinetic energies about $2^{-15}/A$ eV, A atomic number. For electron the energy is about 1/16 eV. These processes could define exotic forms of metabolism, perhaps at the level of DNA. This process could be amplified by an external microwave beam or its phase conjugate and phase conjugate beam could induce the correction of genetic errors.

The transformation of photon energy to metabolic energy could be following. Suppose that the electric field of IR photon is parallel to the flux tube which carries an electric field and is near criticality for the generation of quantal DC currents. If the direction of polarization is correct, the additional contribution to electric field induces direct current and acceleration of electrons and protons and their transfer to smaller space-time sheets and therefore loading of metabolic batteries. This could also make generation of ATP possible.

3. The scaling law of homeopathy [I5] states that high and low frequencies accompany each other and are in a constant ratio for which TGD predicts several values determined as ratios of zero point kinetic energies and cyclotron energies at magnetic flux tubes. The scaling law can be understood as follows: dropping of ions to cyclotron states generates with the zero point kinetic energy and cyclotron photons. Low frequency photons can interact resonantly with the system for which the internal excitations have same low frequency. This generates internal excitation with wavelength which is of the order of system size and this excitation couples resonantly to photons with wavelength equal to system size: thus high frequency photons result.

Thus one might achieve the above proposed effects using also low frequency irradiation. For instance, irradiation by kHz waves in order to achieve generation of bio-photons and irradiation by ELF waves in order to achieve generation of microwave photons. In fact, I started to develop the vision about living system as a macroscopic quantum system from the finding of Blackman [J3] and other pioneers of bio-electromagnetism that ELF radiation has delicate effects in the functioning of living matter. It seems that the basic mechanism might be the dropping of ions between space-time sheets or its time reversal. This mechanism could be tested also for remote objects.

5.3 The New View About DNA

The new view about DNA and cell involves several aspects.

1. The first vision about DNA was inspired on many-sheeted space-time alone and on the idea about the role of magnetic body of DNA. There was also a proposal about hierarchy of codes containing as a successors of genetic code memetic code assignable to Mersenne prime M_{127} characterizing electron [K12]. The codewords of this code could be represented as sequences of 21 DNA codons.
2. DNA as topological quantum computer model [K9] introduced a completely new level of information processing as counterpart of topological quantum computation made possible by magnetic flux tubes connecting DNA nucleotides and lipids of nuclear or cell membrane defining braiding. A realization of genetic code is involved. Perhaps the most convincing realization is in terms of 3+1 spin states of fermion pairs assignable to pairs of flux tubes. The realization using u quarks allows to stabilize DNA carrying 2 units of electric charge per nucleotide. The positive charge $4/3$ at the end of flux tube pair serves as possibly testable experimental signature for the proposal. Introns would be optimal for the topological quantum computation and the increase of the intronic fraction of DNA with the increase of

evolutionary level conforms with the idea that the evolution of magnetic bodies distinguishes between us and our cousins.

The notion of magnetic body inspires also the proposal that magnetic flux sheets traversing through DNA make possible integration of genomes to higher level structures: this leads to the notions of super genome and hypergenome. Could these higher level genomes manifest themselves as coherent gene expression in the scale of organism and even of population? The development of collective levels of consciousness and cultural evolution would reflect directly the presence of this level of information processing. One implication is the failure of genetic determinism. For this there already exists empirical support. Already the fact that the genomes of humans and of rather primitive life forms do not differ much (apart from intronic portion) suggests that an unidentified level of information processing is involved.

3. Dark DNA as sequences of dark nucleon strings is a fr completely unexpected twist in the development of ideas related to DNA and genetic code [K16, K13]. The theoretical challenge is to understand the relationship with ordinary DNA and its companion molecules. Is the transcription between dark nucleon counterpart of DNA, RNA, tRNA, amino-acids to their chemical variants possible? How could one make dark protons and nuclear strings “visible”. Scattering of photons from dark proton strings would involve transformation to dark photons and back. Also classical em fields created by the dark nuclei are in principle observable.

The presence of dark DNA could make possible active genetic engineering using the “virtual” world of dark DNA, and its companions and one can imagine that biology applies the analog of R&D in industry. This is obviously in conflict with the dogma that evolution is solely due to random change and selection.

4. What is amusing that the model for water memory and homeopathy led to this proposal [K13]. In the succession process water clusters would “steal” the magnetic bodies of dissolved polar ions and representations of the magnetic bodies as dark nucleon sequences would be generated. There could be also evolution driven by repeatedly occurring mechanical agitation implying increase of Planck constant associated with the magnetic bodies involved. All polar molecules have representation as a DNA sequence. The fundamental mechanism of immune system would be reconnection of magnetic flux tubes associated with the polar ions and the structures representing them so that the cyclotron radiation propagating along them could not interact with the biomolecules. Immunity would be the outcome from this “stealing of attention”. If the transcription of dark nucleon sequences to the biochemical counterparts exist this could make possible to automatically generate genes coding for proteins which in turn “catch” the polar molecules that they represent.

A fascinating possibility is the transfer of genes homeopathically. Genes would be dissolved into water and succession process could be used to induce evolution of the magnetic bodies of the dark DNA associated with genes. These could be transferred to cells and germ cells and transcription to ordinary DNA would make possible genetic engineering.

5.4 Model Of Cell Membrane As Almost Vacuum Extremal

The model for cell membrane as almost vacuum extremals brings in additional new physics predicted by TGD. Vacuum extremals are basic solutions of field equations and their small non-vacuum deformations are expected to be important for quantum TGD. For instance, the long length scale limit of the theory in gravitational sector is expected to rely on almost vacuum extremals. 4-D spin glass degeneracy is also due to vacuum extremals and allows to have classical space-time correlates also for the non-deterministic aspects of quantum theory as a failure on standard form of classical determinism. Vacuum degeneracy also implies the realization for the hierarchy of Planck constants in terms of effective multiple coverings of the imbedding space.

Since quantum criticality is expected to be key attribute of sensory receptor, one expects that cell membrane is almost vacuum extremal. This would also imply that large values of Planck constant and dark matter are involved.

The model for cell membrane as almost vacuum extremal involves an assumption that Weinberg angle in this phase differs from its value for elementary particles, which are in many respects diametrical opposite of almost vacuum extremals. The model makes precise predictions about

preferred photon energies in visible and UV range and these photon energies correspond to peak frequencies for the photoreceptors.

6 General Model For Remote Mental Interactions

The assumption that the notion of magnetic body and hierarchy of Planck constants defines key element in remote mental interactions reduces the tests at the level of physics to tests for these notions.

6.1 Direct Metabolic Correlates For Remote Mental Interactions

The proposal is that ATP is the molecule of consciousness in the sense that its presence as relay in flux tube connection carrying negative entanglement entropy. ATP would be also the molecule of attention if negentropic flux tubes connecting perceiver and attended system serve as correlates of attention. There is complete symmetry between the two systems which conforms with the “Eastern” vision that there is no distinction between observer and observed during observation. The distinction emerges only after the observation is over and sensory percept has become a memory.

Also remote mental interactions should have ATP as a correlate of intentional action at the end of the operator and the rate of metabolism might be used as a correlate for the remote mental interaction such as psychokinesis or intentional imprinting or human-machine interactions.

6.2 How To Choose Senders And Receivers?

In the above discussion only the new physics phenomena suggested to be essential for both biology, neuroscience, and remote mental interactions are considered, and many experiments could be carried out without operator and target as they are used in remote mental interaction experiments. One might however hope that the model could give some idea about optimal planning of experiments related to remote mental interactions.

In these experiments an important aspect of testing is optimal choice of targets and the persons acting as sender.

1. Quite generally, the optimal target system for demonstrating these effects would be a critical system very sensitive to small perturbations. Any critical system would work, and one might even consider that the critical systems used to detect elementary particles might be used. Overcooled vapor or liquid or overheated liquid is one possibility. One could take register what happens in the system using same methods as in particle physics. Organic compounds might be by definition be this kind of systems.
2. One could also try to identify optimal “senders”. Persons with strong will power or with firm belief on the effect, or persons with lower level of inhibition (children, actors, artists, ...) could be considered as optimal “senders”. One could find whether some drugs which remove inhibition, could enhance telepathic and psycho-kinetic abilities. The “blessed are the meek since they quantum entangle” prediction could be also tested. Indeed, one of the most dramatic experiments supporting psychokinesis was done using chicken which imprinted to a robot [J9]. The robot, whose behavior was programmed earlier by random number generator, tended to stay near the chicken, as if chicken had induced a quantum jumps changing the geometric past in macro-temporal time scales.

7 The Tip Of Iceberg: Placebo, Experimenter Expectation And Interference Phenomena In Subconscious Information Flow

The answers to the questions discussed below require a summary of the recent view about basic notions of TGD inspired theory of consciousness. The vision of Jeff Hawkins about neocortex led

to a considerable updating of the vision about quantum jump as a moment of consciousness, and also about the notion of self allowing rather concrete connection with what happens in brain and the basic notions of Hawkins have quantum parts in TGD based vision. The question by Jean Burns inspired a model for how the memories and expectations of future are read without affecting the memories by using interaction free measurement. Remote mental interactions can be seen as special case of those occurring between magnetic body and biological body in TGD based view about living matter and brain and the answers to the questions rely on this vision.

7.1 The Vision Of Jeff Hawkins About Neo-Cortex

The progress in these aspects came from working out a general model for quantum jump in zero energy ontology (ZEO) with inspiration coming from the book of Jeff Hawkins (for book see <http://tinyurl.com/ybva3x1b>).

1. Hawkins suggests a general model for how neocortex constructs sensory representations and motor actions. One of his key observations is that these two basic operations look like time reversals of each other a model for sensory perception gives a model for motor action.
2. Hawkins emphasizes the role of time: not only spatial patterns but temporal sequences of them are stored in memory. Hawking introduces also the notions of invariant representation, association, abstraction and its reverse process, and hierarchy of abstraction levels having interpretation in terms of structure of neo-cortex and the basic question as what are the (possibly quantum) physical correlates of these notions.
3. Pattern recognition is the basic process and is carried out at various levels of hierarchy by comparing sensory input with standard patterns stored in memory. If the pattern fails to be recognized at given level it is sent to higher level where it is represented in lower resolution and might be recognized as a part of a larger pattern.

7.2 A Generalization To A Vision About The Anatomy Of Quantum Jump In Zero Energy Ontology

The vision seems to generalize to an interpretation of the anatomy of quantum jump by generalizing to various notions involved to quantum TGD context. This was to my a surprise. The basic observation and in zero energy ontology (ZEO) quantum jumps occur in two varieties: state function reduction to upper or lower boundary of causal diamond (CD). The interpretation for these two kinds of quantum jumps would be as generalizations for forming sensory representations and performing motor action. The processes would be carried out at various levels of the self hierarchy. Even at the level of elementary particles (see <http://tinyurl.com/yc46pq86>).

7.2.1 Sensory perception and motor action as time reversals of each other

In this framework sensory representations are not only (short term) memories but also predictions, symbolic representations for expectations and beliefs about future. Same applies to their p-adic counterparts defining cognitive representations in which sensory percept consists of objects. Motor actions correspond to sensory representations in reversed time direction and same statements apply to them as also their p-adic counterparts.

1. I assume the basic ideas about zero energy ontology (ZEO) and causal diamonds (CDs) known. Denote the light-like boundaries of causal diamond CD (cartesian product of the intersection of future and past directed light cones of M^4 with CP_2) by CD_{up} and CD_{low} . “Up” resp. “low” could be also taken to mean “future” resp. “past”. Let us use small letters $a, b, ..$ for positive/negative energy states, which are state function reduced and thus look classical since particle numbers and quantum numbers are well-defined unless negentropic entanglement is present. Big letters are preserved for states which do not have this property. In any state of quantum jump sequence one has state of form (a, B) or (A, b) by the basic properties of state function reduction in ZEO. Note that state function reduction and state preparation are the same thing but occurring at opposite boundaries of CD in zero energy ontology.

2. Suppose first that CD_{low} is in a state function reduced state a with well defined single particle quantum numbers. State a could be regarded as an outcome of sensory perception process (top-down cascade of state function reductions with standard arrow of imbedding space time) leading from perceptively fuzzy initial state to perceptively precise state. The state B at CD_{up} cannot be prepared/state function reduced if S-matrix is non-trivial and represents a superposition of states, something non-classical like qubit or Schrödinger's cat. State B could be seen as a fuzzily defined goal, plan of future, or prediction resulting in sensory perception. This conforms with Hawking's vision that sensory perception defines also a plan of future, expectation.

The p-adic variant of $a \rightarrow B$ obtained by cognitive map mapping real space-time surfaces in the superposition to p-adic counterparts (these surfaces represent among other things nerve pulse patterns) would be cognitive representation, kind of symbolic representation describing the goal, expectation, or prediction, intention. Its fuzziness corresponds to the fact that we cannot predict future precisely.

3. Let us now make state function reduction at the opposite boundary CD_{up} , which after this is in perceptively precise state function reduced state b . The interaction is as motor action identified as time reversal of sensory perception. b represents now an achieved goal. b is of course not completely predictable and only the probability of particular b can be known. CD_{low} is state A with is not anymore state function reduced and classical looking. It can be interpreted the initial fuzzy motor plan represented as quantum superposition of options without fixing the details. The cascade of state function reductions proceeding from top to bottom for given CD and its sub-CDs only fixes the details.

The p-adic of this zero energy state would be cognitive representation for the realized motor action leading to final state b : a realized intention, cognitive representation for how intention was realized.

4. If this picture is correct, the outcomes of quantum jumps in ZEO would universally organized into a sequence of pairs $(a_n, B_n), (A_n, b_n)$ of zero energy states corresponding to sensory perception and motor action and the basic structure for the functioning of conscious brain would be part of quantum theory. This decomposition would take place in various scales of the scale hierarchy (sheets of many-sheeted space-time with various time scales and CDs containing sub-CDs containing...). This picture is consistent with the vision of Hawking at the structural level and if true, brain would not be so special system as neuroscientists tend to think but could be seen only as a highly specialized and highly developed instrument for producing sensory and cognitive mental images and controlling the external world. Also the localization of contents of consciousness to brain alone would be misleading in this framework.

7.2.2 Quantum counterpart of association

Association is key concept of neuroscience and should have quantum counterpart.

1. To explain the idea one needs first some words about Negentropy Maximization Principle (NMP). NMP is analogous to second law. It states that the information gain in state function reduction is maximal. One can define information gain as difference between informations of initial and final zero energy states. NMP implies standard quantum measurement theory for Shannon entropy as entanglement entropy. If entanglement probabilities are rational numbers or even algebraic numbers one can however define a hierarchy of number theoretic entanglement entropies corresponding to various p-adic numbers fields Q_p , p prime and in this case the entropy can be negative and thus describes information interpreted as information carried by the entanglement. The pairs in quantum superposition would represent instances of a rule. Entropy would in turn characterize the loss of information about the state of either entanglement system.

NMP is analogous to second law and its natural to imagine the analogs of temperature and various other parameters as characteristics of "thermal equilibrium" under some constraints with respect to NMP instead of second law. These would be macroscopic parameters characterising the state of consciousness, and one can easily imagine psychological counterparts of thermodynamical notions. Psychological pressure would not be a mere metaphor!

2. Negentropic entanglement (see **Fig.** <http://tgdtheory.fi/appfigures/cat.jpg> or **Fig. ??** in the appendix of this book) provides a model for associations as rules in which superposition of tensor product states defines rule with entanglement pairs defining its various instances. This generalizes to N-fold tensor products. Associations would be realized as N-neuron negentropic entanglement stable against NMP. One could also think of realizing associative areas in terms of neurons whose inputs form entangled tensor product and when sensory inputs are received they form analogous tensor product in representative degrees of freedom.

Thus negentropic entanglement is necessary for mental images (having sub-CDs as correlates) to mental images representing spatial patterns. Negentropic entanglement in time direction for these patterns (zero energy states) is in turn necessary to bind them to sequences of mental images representing abstract memories as sequences of mental images. Negentropically entangled sequence would be a quantal counterpart for the original association sequence introduced as purely geometric concept.

3. Collective consciousness could involve formation of associative (tensor product) networks analogous to neuronal networks as this kind of negentropically entangled tensor products. They could be very relevant for remote mental interactions. Experimenter effect, effect of group to remote mental interactions such as healing, etc... They would form hierarchy and the communications between hierarchy levels would be important. The remote viewer or healer would be only part of a bigger structure.

7.3 Self Or Only A Model Of Self?

Negentropic entanglement provides a model for associations as rules in which superposition of tensor product states defines rule with entanglement pairs defining its various instances. This generalizes to N-fold tensor products. Associations would be realized as N-neuron negentropic entanglement stable against NMP. One could also think of realizing associative areas in terms of neurons whose inputs form entangled tensor product and when sensory inputs are received they form analogous tensor product in representative degrees of freedom.

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This picture however challenges the identification of self as quantum jump. Should the negentropically entangled sequences of mental images define selves so that self would be something characterizing zero energy state rather than something identified as quantum jump? Could they define a model of self to be distinguished from self identified as quantum jump? Or could one give up the notion of self altogether and be satisfied with model of self? At this moment it seems that nothing is lost by assuming only the model of self.

By definition negentropic entanglement tends to be preserved in quantum jumps so that it represents information as approximate invariant: this conforms with the idea of invariant representation and quite generally with the idea that invariants represent the useful information. There is however a problem involved. This information would not be conscious if the original view about conscious information as a change of information is accepted.

The recent formulation of TGD inspired theory as quantum measurement theory in Zero Energy Ontology and assuming NMP requires that negentropic entanglement assignable to the passive boundary of causal diamond (CD) is directly experienced and defines what might be called unchanging self. The active boundary defines the changing part of self - the "Maya".

Sensory and memory representation based on bits assignable to the active boundary of CD are however possible. Could one imagine a reading mechanism in which this information is read without changing the representations at all? By non-cloning theorem this is too much to hope but one might achieve it with arbitrary accuracy. This reading process would be analogous to deducing the state of a two-state system in interaction free measurement to be discussed below in

more detail. The interaction free measurement would thus allow to read memory representations constructed in terms of bits without changing them at all at the never-achievable idealized limit.

7.4 Could Interaction Free Measurement Be Used To Read Memory Representations?

If memory representations are realized in terms of bits, there should exist a manner to read them without changing them. No-cloning theorem prevents this but one can imagine a reading mechanism inducing no changes at idealized limit. The following proposal for non-destructive reading of memories and future plans allows to resolve this problem.

7.4.1 Bomb testing problem as a model for interaction free measurement

One can consider a generalization of so called interaction free measurement as a manner to deduce information about self model realized in terms of bit representations. This information would be obtained as sequences of bits and might correspond to declarative, verbal memories rather than direct sensory experiences.

1. The bomb testing problem of Elitzur and Vaidman gives a nice concrete description of what happens in interaction free measurement, see <http://tinyurl.com/kx2jsyu> [?] for an illustration of the system considered.

The challenge is to find whether the bomb is dud or not. Bomb explodes if it receives photon with given energy. The simplest test would explode all bombs. Interaction free measurement allows to make test by destroying only small number of bombs and at idealized limit no bombs are destroyed.

The system involves four lenses arranged in square and two detectors C and D at the upper right corner of the square. In the first lense at the lower left corner the incoming photon beam splits to reflected and transmitted beams: the path travelled by transmitted beam contains the bomb.

- (a) The bomb absorbs photon with a probability which tells the fraction of photon beam going to the path at which bomb is (is transmitted through the lense). The other possibility is that this measurement process creates a state in which photon travels along the other path (is reflected). This photon goes through a lense and ends up to detector C or D through lense.
 - (b) If the bomb is dud, the photon travels through both paths and interference at the lense leads the photon to detector D. If C detects photon we know that the bomb was not a dud without exploding it. If D detects the photon, it was either dud or not and we can repeat the experiment as long as bomb explodes, or C detects photon and stop if the detector continues to be D (dud). This arrangement can be refined so that at the ideal limit no explosions take place and all.
2. The measurement of bomb property is interaction free experiment in the sense that state function reduction performed by absorber/bomb can eliminate the interaction in the sense that photon travels along the path not containing the bomb. One might say that state function reduction is an interaction which can eliminate the usual interaction with photon beam. State function reduction performed by bomb can change the history of photon so it travels along the path not containing the bomb.

This picture is only metaphorical representation of something much more general.

1. Bomb could be of course replaced with any two-state system absorbing photons in one state but not in the other state, say atom. Now one would test in which state the atom is gaining one bit of information in the optimal situation. Two-state atom could thus represent bit and one could in principle read the bit sequence formed by atoms (say in row) by this method without any photon absorption so that the row of atoms would remain in the original state.

2. Two-state system could be replaced with N -state system. In this case the testing selects at first step one state as analogs of bomb intact and the remaining states as analogs of dud. If the answer was “dud” in the first step, the next step selects one preferred state from $N - 1$ states and regards the remaining states as “dud”. The process continues until the state of the system is measured.
3. In TGD framework the photon paths branching at lenses correspond to branching 3-surfaces analogous to branching strings in string model and photon wave splits to sum of waves travelling along the two paths.

7.4.2 Memory recall as an interaction free measurement

One can imagine several applications if the information to be read in interaction free manner can be interpreted as bit sequences represented as states of two-state system. Lasers in ground states and its excited state would be analogous many particle quantum system. In TGD framework the analog of laser consisting of two space-time sheets with different sizes and different zero point kinetic energies would be the analogous system.

For instance, a model of memory recall with memories realized as negentropically entangled states such that each state represents a qubit can be considered.

1. Reading of a particular qubit of memory means sending of negative energy photon signal to the past, which can be absorbed in the reading process. The problem is however that the memory representation is changed in this process since two state system returns to the ground state. This could be seen as analog of no-cloning theorem (the read thoughts define the clone). Interaction free measurement could help to overcome the problem partially. Memory would not be affected at all at the limit so that no-cloning theorem would be circumvented at this limit.
2. A possible problem is that the analogs of detectors C and D for a given qubit are in geometric past and one must be able to decide whether it was C or D that absorbed the negative energy photon! Direct conscious experience should tell whether the detector C or D fired: could this experience correspond to visual quale black/white and more generally to a pair of complementary colors?
3. ZEO means that zero energy states appear have both imbedding space arrows of time and these arrows appear alternately. This dichotomy would correspond to sensory representation-motor action dichotomy and would suggest that there is no fundamental difference between memory recall and future prediction by self model and they different only the direction of the signal.
4. Since photon absorption is the basic process, the conscious experience about the qubit pattern could be visual sensation or even some other kind of sensory qualia induced by the absorption of photons. The model for the lipids of cell membrane as pixels of a sensory screen suggests that neuronal/cell membranes could serve defined digital self model at the length scale of neurons.
5. Active/passive dichotomy can be represented in very simple manner physically. One has two state system in which lower energy state can be excited to a long lived higher energy state by photon absorption. System in higher energy state is passive and that in lower energy state active.

This model can be applied also to telepathy and maybe also to ESP since the basic mechanism are expected to be the same.

7.4.3 What abstraction means in zero energy ontology?

A further central notion used by Hawkins is that of abstraction.

1. For sensory and cognitive representations abstraction means just a process of forgetting irrelevant details besides going to a longer time and length scales (example: sequences of music pieces in CD is the mental image instead of single piece).

2. The more abstract the representation the longer the corresponding time scale is. This suggests that the sequences of negentropically entangled mental images get longer as abstraction level increases. In state function reduction the quantum superposition of CDs with second boundary localized contains all scales for CDs and reduction localizes the opposite boundary but forces de-localization of the original boundary. This also means that the average size of the CDs increases and the sequences of negentropically entangled sub-CDs become longer as new sub-CDs (mental images) are created. These sequences of sub-CDs would give rise not only to self but also self-model
3. Getting rid of details is the second aspect of abstraction. In TGD framework measurement/ cognitive/ sensory resolution is a natural concept in this respect and emerge unavoidably if one interprets cognitive representations as maps of real space-time surfaces to their p-adic counterparts. Only discrete set of rational (or perhaps algebraic) points of space-time surface can be mapped to their p-adic counterparts as such. The p-adic space-time surface is a completion obtains as a preferred extremal containing these points. There are in general very many preferred extremals with this property and their quantum superposition represents the cognitive representation in finite measurement resolution. Quantum superposition in given resolution defines therefore abstraction and increasing the level of abstraction means reduction of the resolution. Note that also the reverse maps from p-adic preferred extremals to real ones define reversals of cognitive maps and have realization as a transformation of intention to action.

7.4.4 Remote mental interactions as a special case

This general model applied also to remote viewing and psychokinesis assumed to be special cases of what happens when magnetic body interacts with biological body, could provide new insights.

1. The first conclusion would be that several levels (scales) are probably involved in both processes: not only various hierarchical levels of brain (various sensory and motor areas, and their 6-layered structure, various size scales in brain anatomy) but also the hierarchy of magnetic bodies would be present meaning that remote mental interactions involve collective levels of consciousness rather than only the operator and target. The presence of these collective levels suggests that the experimenter effect and many other analogous effects considered in the questions are real.
2. In the case of brain self hierarchy allows to understand various agnosias [J1] which look mysterious if one assumes only single level in the self hierarchy. One of the agnosias is blind sight: person sees but does not see consciously. The visual areas of the person are intact. Person indeed receives the visual information as but some other level of self level sees becomes clear from the fact that she can perform motor actions possible only if there is an access to the visual information generated in visual areas. Simplest explanation would be that the sub-selves representing mental images do not negentropically entangle with the other sensory mental images: associative areas would not work as they should. Agnosia would be disorder in tensor producting! The would entangle with unconscious-to-us motor mental images. The explanation would be that some other self in hierarchy enjoys visual consciousness, perhaps above, at same level, or several level below in the hierarchy.

Could remote viewing be like blind sight: one sees but not consciously - some lower or upper level in the self hierarchy remote views consciously and and the remote viewer manages to guess some of this information? The presence of self hierarchy extending even to the level of magnetic bodies and collective levels of course complicate the modelling attempts. For instance, one must ask how can one know that remote viewer does not read the thoughts of some person in the experimental group instead of remote viewing. In any case, the presence of the hierarchy and the crucial role of attention would also explain the difficulties related to the interpretation of experiments.

3. Ironically, various experimenter effects and placebo effect might provide the strongest support for remote mental interactions and the effect of intentions and expectations to the future history. In ZEO sensory perception produces not only summary of what happened but also

an expectation what will happen and one could interpret the expectation also as a quantum fuzzy goal. The next quantum jump realizes this motor plan. In ZEO we are really re-creating our reality repeatedly by just sensorily perceiving in the two different time directions. If one believes on hierarchy of Planck constants, and negentropic entanglement, the effects need not be minor anomalies masked by thermal fluctuations but can become manifest in everyday scales.

7.5 Possible Answers To The Questions

Question 9: Both Dr. Solfvin and Dr. Moddel have conducted remote influence studies (on animal models, respectively random event generators; Solfvin, 1982; Moddel, 2012) in which participants expectation seemed to dominate the outcome. In the first case, animal handlers were told that half of their assigned mice were inoculated with babesia and half with sterile saline, and that half of each group would receive remote healing influence from an accomplished healer. In reality, all mice were inoculated with the same dose of babesia, and there was no remote healer. In spite of this, significant differences were recorded between inoculated and control groups, as well as between healer and control mice which, the paper concluded, could only be attributable to handlers expectations. In Moddels study, where a random event generator (REG) was set up to arbitrarily shut off the power to another, sequence-recording REG, eventual loss of interest by the experimenters invariably resulted in the initially spectacular PK effect size dropping to non-significance levels.

Are you aware of similar experiments corroborating these results? Can you think of a way to isolate the experimenter expectation effect from the overall outcome? How significant do you think experimenter expectations may be in mainstream clinical trials? Could a reduced level of emotional trepidation/ expectancy build-up on the part of principal investigators in post-marketing drug trials, when compared to pre-approval phase, mirror the steep decline noted with Moddels 2-REG experiments? What makes a system more susceptible to experimenter expectation?

Answer: One could understand these findings qualitatively in the proposed general vision. In particular, the loss of interest means that experimenter does not anymore direct attention to situation and there is no intention to achieve desired results. If emotions basically correspond to negentropy gradients then their lack means that attention is not directed to the target.

Question 10: Like the REG/DMILS studies above, the Schlitz/Wiseman experiments (Wiseman and Schlitz, 1998) suggest that the ganzfeld process is susceptible to experimenter expectation. However, these correlations are not consistent - successful remote viewing and PK have also been achieved in the presence of skeptics. Is there any supporting evidence for experimenter expectation in the GCP data or in other field-REG studies? Do you feel that some psi processes may be more robust in the face of experimenter expectation for example, that the spontaneous mass emotional response typically associated with the major events registered by the Global Consciousness Project is more likely to dominate the outcome than the motivation of a typical operator trying to affect a bench top random event generator in the classical REG experiment?

Answer: Ganzfeld process would seem to be almost by definition a process involving several collective levels of consciousness so that if the vision discussed in the beginning makes sense, one could expect the susceptibility. What I fail to understand is how mass emotional response could lead to coherent effect on REG since the intention to obtain definite deviation from true randomness is obviously lacking.

Maybe one could think some kind of effect - via say periodic perturbation of magnetic fields of the collective magnetic body (Schumann resonances?) transferred also to the magnetic body assignable to the recording. William Tiller has reported this kind of effects due to intentional action in his books. I have proposed a rather crazy idea of demonstration of PK leaving no doubt about its reality by comparing records of RG with affected by PK able person with those not affected in this manner (see <http://tinyurl.com/yckq32pv>).

Question 11: In “The Possible Role Of Intention, Attention And Expectation In Remote Viewing” (see <http://tinyurl.com/yacazbus>) (May and McMoneagle, 2004) the authors argue

that the sharply focused attention of all unit personnel on the one assigned task while doing operational remote viewing was likely responsible for the exceptional level of data produced. This seems to be corroborated by a series of experiments (Watt, 2003) in which subjects focus on a given task was shown to be significantly enhanced by a remote assistant concentrating their supportive attention on the operators. If these findings are correct, then it would seem that attention itself is a cumulative network phenomenon. Could that joint mass focus on the event being studied be a factor in the remarkable consistency of GCP results? **Answer:** To answer this question as

a physicist's one should have a physical model for attention. My own model of attention relies on the identification of magnetic flux tube connections as a correlate of attention. Negentropic entanglement is present bringing in conscious information at this level of self hierarchy. Flux tubes create also quantum coherence in the sense that the systems connected by flux tubes form a single quantum coherent system in some degrees of freedom (dark matter with large value of \hbar_{eff} at connecting flux tubes and systems themselves).

Sharply focused attention of all unit personnel means that the level of consciousness of the collective mind created in this manner is high and one can expect that remote viewing is more effective. Note that remote viewing as analog of sensory perception would involve information transfer between different levels of this hierarchy in both directions: to abstraction and back to more detailed view.

Question 12 (from B. Millar): Are there effects known in physics where three or more initially separate systems become quantum coupled or entangled? Do these have any consequences for remote mind-mind and mind-matter interactions?

Answer: There are. Quantum entanglement between electrons of atom and at molecular level are this kind of phenomena. Also quantum entanglement between valence quarks inside proton ($N=3$). 2-particle entanglement is however special. So called monogamy theorem states that system can have maximally entropic entanglement with single system only. Therefore maximal entanglement between A and B, A and C, and B and C is not possible in 3-particle entanglement. The really happy couple must isolate themselves from the rest of the world!

Question 13 (from J. Burns): We know through abundant evidence that ESP can travel without any physical signal to carry it. Up until recently the only way known, according to physical laws, to make a connection with no physical signal was through quantum entangled states. This possible method for the travel of ESP has the problem that quantum entanglement does not allow the transmission of information, but only correlations between certain events. However, it is thought that perhaps the extension of currently known quantum mechanics, which describes the interactions of matter, to incorporate interaction with consciousness might then provide an explanation.

However, recently a method has been proposed in which, according to the presently known laws of quantum mechanics, information can be transferred without a physical signal (see <http://tinyurl.com/cr5e6tzapr/16/alice-and-bob-communicate-without-transferring-a-single-photon>). It differs from the latter method in that it uses the Zeno effect, which is produced through multiple instances of de-coherence, such as wave function collapse or interaction with the environment. Which method do you favor as a means by which ESP can travel? Why? If you favor a third method, please describe.

Answer: I already described the interaction free measurement realized in terms of lenses and photon beams. The bomb testing problem of Elitzur and Vaidman gives a nice concrete description of what happens (see <http://tinyurl.com/kx2jsyu>).

The basic idea of interaction free measurement and its possible application to memory recall allowing to avoid destruction of the memory represented in terms of bits (sub-selves, sub-CDs) was discussed in the first section ???. It was noticed that the absorption of photons could give rise to visual quale (black/white) as a representation for the bit that has been read and that the lipids of cell membrane could serve as pixels of sensory screen allowing to define mental images at neuronal level of self hierarchy.

One can imagine several applications if the information to be read in interaction free manner

can be interpreted as bit sequences represented as states of two-state system. Lasers in ground states and its excited state would be analogous many particle quantum system. In TGD framework the analog of laser consisting of two space-time sheets with different sizes and different zero point kinetic energies would be the analogous system.

1. Mind reading - telepathy - might be possible using this mechanism if thoughts are expressible as qubit sequences or more general patterns. The mind reader sends a split beam of photons to the system which it wants to read. The target notices nothing at the idealized limit since no photons are absorbed by the target but a pair of systems analogous to detectors C and D: mind reader must of course be able to see whether either of these systems detects a photon. This mechanism would differ from TGD inspired model of telepathy based on TGD inspired notion of sharing of mental images. Sharing of mental images requires that entanglement of mental images is possible although systems having those mental images as sub-selves (sub-systems) are not entangled. This is possible if one accepts TGD based view about space-time and corresponding view about hierarchy of subsystems. One can have two disjoint space-time sheets containing topologically condensed smaller space-time sheets which are connected by flux tubes. In the resolution of larger space-time sheets there is no entanglement. In the resolution of smaller space-time sheets there is entanglement and shared mental images.
2. Could this model apply to ESP?
 - (a) The recent TGD based model of ESP relies on much more classical picture. Magnetic flux tubes generated by remote viewer and serving as correlates of attention connect the remote viewer with the target (here macroscopic quantum coherence is required). Along the flux tubes travel the dark photon beams (photons with large \hbar_{eff} and thus scaled up wavelength for given energy) and are reflected at the second end and return back. This is very much like ordinary seeing using lamp but forcing the light beams to travel inside flux tubes so that the intensity of beam is not reduced with distance.
 - (b) There does not seem to be any compelling need for interaction free ESP as there is in the case of reading of negentropically entangled memories or future predictions.
 - (c) Furthermore, visual perception does not seem to be a process in which qubits are read. Note however that in the above described model reading of memories involves photon absorption by system C or D: these systems code for the values of bit and one could assign to this process a visual quale.

Question 14: If PK is goal-oriented, independent of an operators understanding of the complex physical or biological mechanisms involved in achieving the desired effect, then should we assume that the operator is essentially interacting with the target at a future point in time, with causality apparently flowing backward to the present, to affect the target and all those connected to it ? Does the universe we share then find its probability course like a stream shaped by the resultant landscape of our collective intents, beliefs and expectations?

Answer: One could understand the possibility of PK without understanding how it is achieved, if the operator is only a part of collective mind. Although operator knows nothing about mechanisms, the higher or lower levels might know and could help to reach the desired effect. PK as any motor action would be a cascade proceeding from higher levels to lower ones with a lot of feedback if the lower level is not able to realize what higher level wants so that command is sent back for refinement.

In ZEO motor action can be indeed seen as a time reversal of sensory perception which also involves a lot of feedback between different abstraction levels (representations in given resolution with poorer resolution meaning higher abstraction resulting from forgetting the irrelevant details). Libet's findings support this picture in small time scales.

Also higher collective levels would be present (having magnetic bodies as correlates). This could mean that collective intents, beliefs, and expectations are indeed important and universe is reconstructed repeatedly even in macroscopic scales, as we indeed experience it to be.

Question 15 (B. Millar): Eminent parapsychologists are almost unanimous that understanding experimenter effect is crucial for the field. All this lip service has resulted in remarkably little

experimental action. Why is this and what can be done to improve matters? **Answer:** I think that the problem is that precise enough theoretical frameworks are lacking. The situation is also circular. Experimenter effect is itself remote mental interaction and it is remote interactions we try to understand by doing experiments!

Question 16: We are currently operating under the working assumption that any such consciousness - related anomalies are peripheral to our routine activities and small enough to be absorbed by the tolerances built into our systems. Is that a correct assumption and if not, which areas do you think are most susceptible to these poorly-understood effects? How critical could they become? **Answer:** If I take seriously the vision about quantum jump sequence as a universal cognitive algorithm involving large number scales and self hierarchy, I must be also ready to consider the possibility that the effects are not always small. Understanding of anomalies of ordinary consciousness in terms of self hierarchy might help considerably also in this problem.

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