Ufos, Aliens, and the New Physics

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Contents

Abstract

The TGD based view about space-time, time and consciousness allows also to develop ideas about UFOs and aliens, in particular about possible manners by which highly developed civilizations could receive information about remote parts of the Universe and to get contact with other civilizations.

Time mirror mechanism is a basic mechanism in TGD inspired theory of consciousness and it has also technological applications including instantaneous remote sensing of geometric past, communications with geometric past, and instantaneous remote utilization of energy, and perhaps even remote induction of simple life forms, about which simplest are perhaps plasmoids. The intelligent looking light balls reported repeatedly by UFO experiencers are indeed identifiable as plasmoids and quite recent experimental findings demonstrate that plasmoids satisfy the basic criteria justifying their identification as simple life forms.

The resulting vision about highly developed life forms and about how they could study the Cosmos allows to resolve Fermi paradox summarized by the simple question "Where are they all?", and reflecting in excellent manner our misguided view about life, consciousness, and physics.

TGD suggests also a mechanism making possible to reduce gravitational and inertial masses of space-ships so that they would behave like very light system as observations indeed suggest. Plasmoids could be living space-ships able to draw their energy from environment by the time mirror mechanism. It however seems that the highly developed civilizations would probably not see the trouble to travel to distant galaxies since it is un-necessary, and the finiteness of light velocity in any case would pose very strong limitations on what they could achieve in this manner.

Chilbolton and Crabwood crop circles can be interpreted as messages telling basic facts about the civilization responsible for their construction. Chilbolton message is constructed using the same format as Arecibo message and tells that both Earth, Mars, and Jupiter are colonialized. These crop circles suggest strongly the existence of intra-terrestrial life and this inspired a model for pre-biotic evolution allowing also a model for the evolution of genetic code. The highly advanced civilization could be identified as either intelligent intra-terrestrials or as ourselves in the geometric future using a technology based on time mirror mechanism to construct crop circles and using less intelligent intra-terrestrial plasmoids to construct the crop circles. Sun is depicted to have a smaller size as in Arecibo message, and Crabwood message came one year and one day after the Chilbolton message: these hints allow to make estimate about the temporal distance of this civilization of the geometric future from us.

The "sacred geometry" of crop circles involving ratios of simple rational numbers, simple algebraic numbers (in particular Golden Mean), and π, could be an attempt to tell us about the crucial importance of rational numbers and finite-dimensional extensions of p-adic numbers for cognition. If entanglement probabilities belong to an extension of rationals defining a finite-dimensional extension of p-adic numbers, one can assign to entanglement a positive information measure as a number theoretic modification of Shannon's entropy, and the interpretation as bound state entanglement crucial for macro-temporal quantum coherence is possible.

1 Introduction

My personal interest in UFOs and extraterrestrials was stimulated by a TV document for almost decade ago claiming that the locations of UFO observations seem to correlate with lines of tectonic activity. Michael Persinger's work about UFO experiences was also very stimulating. The realization that crop circles are probably not hoax led to a development of rather unconventional ideas about life forms possibly responsible for the generation of crop circles.

What are UFOs? What are aliens? The attempt to answer these basic questions requires an answer to a more general question: What is life. During the last decade I have developed rather a elaborate theory of consciousness and applied it to the modelling of living matter as a macroscopic quantum system. The new view about space-time, time and consciousness allows also to develop ideas about UFOs and aliens, in particular about possible way by which highly developed civilizations could receive information about remote parts of the Universe and to get contact with other civilizations.

In this chapter, which is actually slightly modified popular article, I try first to summarize the TGD based view about consciousness and living systems. The basic notions are many-sheeted space-time, topological quantization and magnetic body, p-adic physics as physics of intentionality

and cognition, and basic ideas of TGD inspired theory of consciousness. Time mirror mechanism is a basic mechanism in TGD inspired theory of consciousness and it has also technological applications including instantaneous remote sensing of geometric past, communications with geometric past, and instantaneous remote utilization of energy, and perhaps even remote induction of simple life forms, about which simplest are perhaps plasmoids. The intelligent looking light balls reported repeatedly by UFO experiencers are indeed identifiable as plasmoids and quite recent experimental findings demonstrate that plasmoids satisfy the basic criteria justifying their identification as simple life forms.

TGD suggests also a mechanism making possible to reduce gravitational and inertial masses of space-ships so that they would behave like very light system as observations indeed suggest. Plasmoids could be living space-ships able to draw their energy from environment by the time mirror mechanism. It however seems that the highly developed civilizations would probably not see the trouble to travel to distant galaxies since it is un-necessary, and the finiteness of light velocity in any case would pose very strong limitations on what they could achieve in this way.

Chilbolton and Crabwood crop circles can be interpreted as messages telling basic facts about the civilization responsible for their construction. Chilbolton message is constructed using the same format as Arecibo message and tells that both Earth, Mars, and Jupiter are colonialized. These crop circles might be interpreted as hints about the existence of intra-terrestrial/planetary life and this inspired a model for pre-biotic evolution allowing also a model for the evolution of genetic code. The highly advanced civilization could be identified as either intelligent intra-planetaries or as ourselves in the geometric future using a technology based on time mirror mechanism to construct crop circles and using less intelligent intra-terrestrial plasmoids to construct the crop circles. Sun is depicted to have a smaller size as in Arecibo message, and Crabwood message came one year and one day after the Chilbolton message: these hints allow to make estimate about the temporal distance of this civilization of the geometric future from us.

The hypothesis about hierarchy of macroscopic quantum phases characterized by arbitrarily large values of Planck constant [K12, K10, K11] resolved the long standing problem of interpreting properly the predicted long ranged classical weak and color fields, and induced a great leap forward in the evolution of TGD based view about consciousness and life [**?**]. This progress has motivated the insertion of some comments relating to dark matter hierarchy also in this chapter.

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 Basic Vision

The 8 online books about about TGD [K42, K39, K32, K27, K6, K26, K20, K35] and 9 books about TGD inspired theory of consciousness and quantum biology [K38, K5, K29, K3, K17, K23, K25, K34, K37] at my home page provide comprehensive (and unavoidably a little bit out of date) summary of TGD and TGD inspired theory of consciousness. The online journal JNLRMI [L1, L2] and its follower Journal of Non-locality contain several articles about TGD inspired theory of consciousness and quantum biology and its applications to remote mental interactions. Here a brief summary of what might be called basic principles is given.

2.1 Quantum-Classical Correspondence

The fundamental meta-level guiding principle is quantum-classical correspondence (classical physics is an exact part of quantum TGD). The principle states that all quantum aspects of the theory, which means also various aspects of consciousness such as volition, cognition, and intentionality, should have space-time correlates. Real space-time sheets provide kind of symbolic representations whereas p-adic space-time sheets provide correlates for cognition and intentions. All that we can symbolically communicate about conscious experience relies on quantal space-time engineering to build these representations. What makes possible to have even space-time correlates of quantum jumps and quantum jump sequences classical non-determinism of the basic variational principle determining the dynamics of space-time sheets and inherent determinism of p-adic variants of field equations.

2.2 Classical Physics As Exact Part Of Quantum Theory

In TGD Universe space-times are 4-surfaces in the 8-dimensional space $H = M^4_+ \times CP_2$ obtained by replacing the points of Minkowski space future light cone with 4-dimensional compact space CP_2 having extremely small size of order 10^{-30} meters (see **Fig. 1**). Classical physics corresponds to the dynamics of space-time surfaces determined by the criticality in the sense of having an infinite number of deformations for which the second variation of Kähler action vanishes.

The expectation is that the number of critical deformations defining the symmetries is infinite and conformal symmetries are in question. The conformal algebras would form an infinite hierarchy of sub-algebras with generators labelled by integers proportional to an integer $n = 1, 2....$ One would have n conformal equivalence classes of space-time surfaces connecting given 3-surfaces at the boundaries of CD and n would define Planck constant $h_{eff} = n \times h$ labelling the hierarchy of dark matters (see **Fig.** `http://tgdtheory.fi/appfigures/planckhierarchy.jpg` or **Fig. ??** in the appendix of this book).

This dynamics have several unconventional features basically due to the possibility to interpret the Kähler action as a Maxwell action expressible in terms of the induced metric defining classical gravitational field and induced Kähler form defining a non-linear Maxwell field not as such identifiable as electromagnetic field however.

2.2.1 Topological field quantization and the notion of many-sheeted space-time

Quantum classical correspondence is very powerful principle. For instance, the criticality of Kähler action serving as the basic variational principle can be interpreted as a space-time representation for the quantum criticality of TGD Univ erse. Hence the solutions of field equations correspond asymptotically to self-organization patterns for which dissipation represented by Lorentz 4-force vanishes. This provides the physical intuition which has led to a discovery of extremely general solution families of field equations. It might even be that the classical field equations determining space-time surfaces are exactly solvable. The study of field equations leads to general classification of the phases of matter and simple topological criterion differentiates between living and "dead" matter [K2, K28].

1. Topological field quantization

The compactness of CP_2 implies the notions of many-sheeted space-time and field quantization. Topological field quantization means that various classical field configurations decompose into topological field quanta. Space-time becomes many-sheeted (see **Fig. 2**). One can see space-time as a gigantic Feynman diagram with lines thickened to 4-surfaces. Criticality implies that only selected field configurations analogous to Bohr's orbits are realized physically so that quantum-classical correspondence becomes very predictive. An interpretation as a 4-D quantum hologram is a further very useful picture [K21] but will not be discussed in this chapter in any detail. One implication of many-sheetedness is the possibility of macroscopic quantum coherence.

Topological field quantization implies that the field patterns associated with material objects form extremely complex topological structures which can be said to belong to the material objects. The notion of field body, in particular magnetic body, typically much larger than the material system, differentiates between TGD and Maxwell's electrodynamics, and has turned out to be of fundamental importance in the TGD inspired theory of consciousness. One can say that field body provides an abstract representation of the material body.

Space-time sheets topologically condense to larger space-time sheets by wormhole contacts (see **Fig.** `http://tgdtheory.fi/appfigures/wormholecontact.jpg` or **Fig. ??** in the appendix of this book) which have Euclidian signature of metric. This implies causal horizon at which the signature of the induced metric changes from Minkowskian to Euclidian. This forces to modify the notion of sub-system. What is new is that two systems represented by space-time sheets can be unentangled although their subsystems bound state entangle with the mediation of the join along boundaries bonds connecting the boundaries of sub-system space-time sheets (see **Fig. 3**). This is not allowed by the notion of subsystem in ordinary quantum mechanics. This notion in turn implies the central concept of fusion and sharing of mental images by entanglement making possible telepathic communications of mental images over arbitrarily long distances.

2.2.2 The possibility of negative energies

A further prediction derives from the fact that space-time is 4-surface rather than an abstract manifold. Energy momentum tensor of general relativity is replaced by a collection of conserved energy and momentum currents, which are 4-vector fields. This makes the notions of energy and momentum precisely defined but also implies that the sign of energy and momentum depend on the time-orientation of the space-time sheet. Negative energies become therefore possible somewhat like in the lines of a Feynman diagram. Negative energy topological light rays have phase conjugate laser waves [D1, D2] as the most plausible standard physics counterparts, and play a fundamental role in quantum metabolism as a kind of quantum credit card [K22]. They generate also time like entanglement which corresponds to a formation of new kind of bound states.

Negative energies might be possible even for ordinary particles and could mean dramatic deviation from the standard quantum theory. The roles of annihilation and creation operators have changed for negative energy space-time sheets. This would mean that operator combinations involving both annihilation and creation operators would generate states involving positive and negative energy space-time sheets. One can even imagine that an intentional action could create states with vanishing net quantum numbers and that positive and negative energy particles could be separated from each other.

Phase conjugate waves [D1, D2] discovered by Zeldovich and his colleagues at seventies in Russia are counterparts of negative energy photons. They represent signals propagating to the geometric past and it is possible to understand their strange properties if one assumes that they have negative energies. Kozyrev was probably the first one to observe phase conjugate waves from distance astrophysical and propagating towards geometric past [H5]. Sadly, standard physicists are not yet mature to realize how far reaching this discovery is or not to even take it seriously.

2.2.3 TGD Universe is quantum spin glass

Since Kähler action is Maxwell action with Maxwell field and induced metric expressed in terms of $M^4_+ \times CP_2$ coordinates, the gauge invariance of Maxwell action as as a symmetry of the vacuum extremals (this implies is a gigantic vacuum degeneracy) but not of non-vacuum extremals. Gauge symmetry related space-time surfaces are not physically equivalent and gauge degeneracy transforms to a huge spin glass degeneracy. Spin glass degeneracy provides a universal mechanism of macro-temporal quantum coherence and predicts degrees of freedom called zero modes not possible in quantum field theories describing particles as point-like objects. Zero modes are identifiable as effectively classical variables characterizing the size and shape of the 3-surface as well as the induced Kähler field.

2.2.4 Long range classical weak and color fields

Geometrization of classical fields means that various classical fields are expressible in terms of embedding space-coordinates and are thus not primary dynamical variables. This predicts the presence of long ranged weak and color (gluon) fields not possible in standard physics context.

The proper interpretation of these fields has been the most difficult challenge that I have encountered during the development of TGD. So difficult that it took not less than 24 years before I was mature to realize that these fields can be assigned to a fractal hierarchy of copies of standard model physics, in particular the physics based on different value of Planck constantandhaving interpretation in terms of dark matter hierarchy. A good metaphor for the TGD universe is as an inverted Mandelbrot fractal so that the increase (rather than decrease) of the resolution scale reveals endlessly new and larger structures due to the scaled up variants of standard physics not possible to see in shorter length scales.

The exotic weak and color forces appear already in atomic length scales and force to modify the view about nuclear physics and condensed matter physics [K36, K12]. The charge entanglement induced by W MEs defines the most promising candidate for the general mechanism for how magnetic bodies perform quantum control of biological bodies: for instance, the model of nerve pulse generation represents an application of this [I7] [K31]. Chiral selection in living matter can be seen as a direct evidence for the exotic weak forces operating at the level of dark matter [K14, K15]. Classical color force in turn is the backbone in the model of color vision [K16]: colors correspond to increments of color quantum numbers in this model.

2.3 P-Adic Physics As Physics Of Cognition

p-Adic number fields R_p, one for each prime p, and real numbers R are completions of rational numbers. p-Adic numbers differ from real numbers in that notions of distance, nearness, and continuity are completely different. p-Adic field equations are also inherently non-deterministic. For these reasons p-adic numbers are excellent candidates for modelling of space-time correlates of cognition.

2.3.1 p-Adic numbers

Like real numbers, p-adic numbers can be regarded as completions of the rational numbers $q = r/s$ (r and s integers) to a larger number field allowing the generalization of differential calculus. Each prime p defines a p-adic number field allowing the counterparts of the usual arithmetic operations. A basic difference between real and p-adic numbers is that the notions of distance are quite different. Any rational can be written as $q = p^k \times r/s$ where r and s are not divisible by p. The p-adic norm in R_p (analogous to absolute value in real context) is $|q|_p = p^{-k}$. In particular for $q = p^k$ the norm is p^{-k} and approaches zero when k becomes infinite. Real norm would become infinite at this limit. Therefore p-adically infinitesimal corresponds to infinite in the real sense.

p-Adic numbers allow the generalization of the differential calculus. The basic rules of the p-adic differential calculus are the same as those of the ordinary differential calculus. There is however one important new element: the set of the functions having vanishing p-adic derivative consists of so called pseudo constants which are piecewise constant function. In the real case only constant functions have vanishing derivative. This implies that p-adic differential equations are non-deterministic. This non-determinism is identified as a counterpart of the non-determinism of cognition, imagination, and intentionality.

2.3.2 p-Adic length scales and p-adic cognitive codes

How the existence of preferred p-adic primes characterizing space-time surfaces emerge was solved only quite recently. The solution relies on p-adicization based on strong holography and the idea that string world sheets and partonic surfaces with parameters in algebraic extensions of rationals define the intersection of reality and various p-adicities. The algebraic extension possess preferred primes as primes, which are ramified meaning that their decomposition to a product of primes of the extension contains higher than first powers of its primes (prime ideals to be more rigorous). These primes are obviously natural candidates for primes characterizing string world sheets number theoretically and it might even happen that strong form of holography is possible only for these primes. Weak form of NMP allows also to justify a generalization of p-adic length scale hypothesis. Primes near but below powers of primes are favoured since they allow exceptionally large negentropy gain so that state function reductions to tend to select them.

Parallel space-time sheets with distance about 10^4 Planck lengths form a hierarchy. Each material object (..., atom, molecule, ..., cell, ...) corresponds to this kind of space-time sheet. The p-adic primes $p \simeq 2^k$, k prime or power of prime, characterize the size scales of the space-time sheets in the hierarchy. The p-adic length scale $L(k)$ can be expressed in terms of cell membrane thickness as

$$L(k) = 2^{(k-151)/2} \times L(151) \ , \tag{2.1}$$

where the p-adic length scale $L(151)$ and all p-adic length scales above electron length scale $L(127)$ were identified erratically in all writings about TGD before 2014. This deserves some comments.

1. The wrong identification was $L(151) \simeq 10$ nm implying wrong identification of other scales above $L(127)$ since I have calculated them by scaling $L(151)$ by an appropriate power of two. What I have denoted by $L(151)$ is actually obtained by scaling the Compton length $L_e(127) = \hbar/m_e$ by $2^{(151-127)/2}$ and therefore electrons Compton scale if it would correspond to $k = 151$. Since the mass of electron from p-adic mass calculations is given by $m_e = \sqrt{5+X}\hbar/L(127)$, the correct identification of $L(151)$ would be

$$L(151) = 2^{(151-127)/2}L(127) = 2^{(151-127)/2}L_e(151)/\sqrt{5+X} = 10/\sqrt{5+X}\ \ nm\ \ ,\ \ 0 \leq X \leq 1\ \ .$$

Here X denotes the unknown second order contribution of form $X = n/M_{127}$, n integer, to the electron mass, and in the first approximation one can take $X = 0$ - the approximation is excellent unless n is very large. In the sequel I will try to use the shorthand $L_e(k) = \sqrt{5}L(k)$ but cannot guarantee that the subscript "e" is always present when needed: it is rather difficult to identify all places where the earlier erratic definition appears. I can only apologise for possible confusions.

2. This mistake has no fatal consequences for TGD inspired quantum biology. Its detection however provides a further support for the speculated central role of electron in living matter. Since the scales obtained by scaling the electron Compton scale seem to be important biologically (scaled up Comton scale $\sqrt{5}L(151)$ corresponds to cell membrane thickness), the conclusion is that electrons - or perhaps their Cooper pairs - play a fundamental role in living matter. The correct value of $L(151)$ is $L(151) = 4.5$ nm, which is slightly below the p-adic length scale $L_e(149) = 5$ nm assigned with the lipid layer of cell membrane.

3. I have also assigned to electron the time scale $T = .1$ seconds defining a fundamental biorhythm as a secondary p-adic time scale $T_2(127) = \sqrt{M_{127}}T(127)$. The correct assignment of $T = .1$ seconds is as the secondary Compton time $T_{2,e}(127) = \sqrt{M_{127}}T_e(127)$ of electron: secondary p-adic time scale is $T_2(127) = \sqrt{M_{127}}T(127)$ and corresponds to $T_{2,e}(127)/\sqrt{5} = .045$ seconds and to $f(127) = 22.4$ Hz.

These are so called primary p-adic length scales but there are also n-ary p-adic length scales related by a scaling of power of $\sqrt{p}$ to the primary p-adic length scale. The model for photosynthesis [K22] gives additional support for the importance of also n-ary p-adic length scales $L_e(n,k) = 2^{(n-1)k/2}L_e(k)$ so that the relevant p-adic length scales would come as half-octaves in a good approximation but prime and power of prime values of k would be especially important. p-Adic length sale hypothesis allows to quantify the notion of many-sheeted space-time and make rich spectrum of predictions such as p-adic frequencies $f(k) = c/L(k)$ and corresponding energies (see **Fig.** `http://tgdtheory.fi/appfigures/manysheeted.jpg` or **Fig.** 9 in the appendix of this book).

p-Adic cognitive are realized as bit sequences defined by field patterns such that duration of codeword is $T_e(n,k) = L_e(n,k)/c$andthe number k_1 of bits is a factor of k. For prime values of k the number of bits is maximal, which is one reason for why they are in special position. Genetic code correspond to $k_1 = 6$ and memetic code to $k_1 = 126$ [K18]. These cognitive codes would be universal and especially interesting concerning communications with extraterrestrial civilizations since they correspond to precisely defined frequencies.

2.3.3 Generalization of number concept

The basic ingredient is the new view about numbers: real and p-adic number fields are glued together like pages of a book along common rationals representing the back of the book (see **Fig. 4**). This generalizes to the extensions of p-adic number fields and the outcome is a complex fractal book like structure containing books within books. This holds true also for manifolds and one ends up to the view about many-sheeted space-time realized as 4-surface in 8-D generalized embedding space and containing both real and p-adic space-time sheets. The latter are interpreted as correlates for thoughts and intentions.

2.3.4 p-Adically infinitesimal is infinite in real sense

One implication is that the rationals having short distance p-adically are very far away in real sense. This implies that p-adically short temporal and spatial distances correspond to long real distances and that the evolution of cognition proceeds from long to short temporal and spatial scales whereas material evolution proceeds from short to long scales. First a rough sketch is generated and then smaller and smaller details are added gradually. Together with the non-determinism of p-adic field

equations this explains the long range temporal correlations (ability to realize rough plans) and apparent local randomness of intentional behavior.

The fact that p-adically infinitesimal distances correspond to infinite distances in real sense means that continuous p-adic space-time sheets have a literally infinite size. Thus cognitive body is of infinite size and our thoughts have infinite size in real sense. This turns upside down the usual view about brain as seat of thoughts and forces a new view about conscious existence. Particular biological life cycle is like turning attention to a particular biological body serving as motor instrument and sensory receptor. After biological death the attention turns to some other biological body perhaps in some other galaxy. This allows also a fresh look to what one means by extraterrestrial and aliens.

2.3.5 p-Adic fractal statistics as a signature of intentionality

The failure of the real statistics and its replacement by p-adic fractal statistics for time series defined by varying number N of measurements performed during a fixed time interval T allows very general tests for whether the system is intentional and what is the p-adic prime p characterizing the "intelligence quotient" of the system. The replacement of $log(p_n)$ in the formula $S = -\sum_n p_n log(p_n)$ of Shannon entropy with the logarithm of the p-adic norm $|p_n|_p$ of the rational valued probability allows to define a hierarchy of number theoretic information measures which can have both negative and positive values and one can assign to rational valued probabilities a unique p-adic entropy S_p as maximally negative entropy and identify it as information associated with the entanglement. This kind of entanglement is naturally interpreted as bound state entanglement.

2.4 The Core Ideas Of TGD Inspired Theory Of Consciousness And Quantum Biology

The following ideas of TGD inspired theory of consciousness and of quantum biology are the most relevant ones for what will follow.

2.4.1 Quantum jump as moment of consciousness and the notion of self

"Everything is conscious and consciousness can be only lost" is the briefest manner to summarize TGD inspired theory of consciousness. Quantum jump as a moment of consciousness and the notion of self are key concepts of the theory besides quantum mechanical concepts like entanglement (see **Fig. 6**) and bound state (electron and proton in hydrogen atom provide the basic example of bound state. Generation of bound state quantum entanglement with environment means that the system loses its consciousness.

Moment of consciousness corresponds to single quantum jump, which has a complex anatomy not discussed here. Self is a system able to avoid bound state entanglement with environment and can be formally seen as an ensemble of quantum jumps. The contents of consciousness of self are defined by the averaged increments of quantum numbers and zero modes (sensory and geometric qualia). Moments of consciousness can be said to be the counterparts of elementary particles and selves the counterparts of many-particle states, both bound and free.

The selves formed by macro-temporal quantum coherence are in turn the counterparts of atoms, molecules and larger structures. Macro-temporal quantum coherence effectively binds a sequence of quantum jumps to a single quantum jump as far as conscious experience is considered. The idea that conscious experience is about changes amplified to macroscopic quantum phase transitions, is the key philosophical guideline in the construction of various models, such as the model of qualia, the capacitor model of sensory receptor, the model of cognitive representations, and declarative memories.

Selves can have sub-selves and self experiences them as mental images. The TGD based notion of sub-system allows sub-selves to entangle and this corresponds to the fusion of mental images: this occurs for instance in stereovision. In the case that the systems in question represents a mental image, entanglement means fusion and sharing of mental images. The implication is that the contents of our consciousness is not so private than we have accustomed to think. For instance, shared mental images could be behind the development of moral rules and be crucial for the existence of society.

2.4.2 Macro-temporal quantum coherence

Macro-temporal quantum coherence is second consequence of the spin glass degeneracy [K21]. It is essentially due to the formation of bound states and has as a topological correlate the formation of flux tubes connecting the boundaries of the component systems. During macro-temporal coherence quantum jumps integrate effectively to single long-lasting quantum jump and one can say that system is in a state of oneness, eternal now, outside time. Macro-temporal quantum coherence makes possible stable non-entropic mental images. Negative energy topological light rays (MEs) are one particular mechanism making possible macro-temporal quantum coherence via the formation of bound states, and remote metabolism and sharing of mental images are other facets of this mechanism.

2.4.3 Space-time as a 4-dimensional living organism

p-Adic physics as physics of cognition is a further key idea of TGD inspired theory of consciousness. The original idea that the transformation of p-adic space-time sheet to a real one in quantum jumps would be a correlate for intentional action has turned out to be unrealistic and un-necessary and lead to formidable mathematical challenges. Negative energy MEs are absolutely essential for the understanding of how precisely targeted intentionality is realized.

Entire 4-dimensional space-time can be said to be living and self-organizing structure which changes in each quantum jump. This means that our geometric future and past contain civilizations and in principle we could communicate with ourselves of geometric future. Even our own biological bodies can be lived through many times although one must assume that there is a kind of "dead time" during which large changes in the immediate geometric past are not possible: for instance, a different decision in the geometric youth could suddenly and profoundly change our life in geometric now.

2.4.4 Mersenne hypothesis

The scale of the Josephson frequencies assignable to a given neuron is determined by the value of Planck constant. TGD inspired quantum biology and number theoretical considerations suggest preferred values for $r = \hbar/\hbar_0$. For the most general option the values of $\hbar$ are products and ratios of two integers n_a and n_b. Ruler and compass integers defined by the products of distinct Fermat primes and power of two are number theoretically favored values for these integers because the phases $exp(i2\pi/n_i)$, $i \in \{a, b\}$, in this case are number theoretically very simple and should have emerged first in the number theoretical evolution via algebraic extensions of p-adics and of rationals. p-Adic length scale hypothesis favors powers of two as values of r.

One can however ask whether a more precise characterization of preferred Mersennes could exist and whether there could exists a stronger correlation between hierarchies of p-adic length scales and Planck constants. Mersenne primes $M_k = 2^k - 1$, $k \in \{89, 107, 127\}$, and Gaussian Mersennes $M_{G,k} = (1 + i)k - 1$, $k \in \{113, 151, 157, 163, 167, 239, 241..\}$ are expected to be physically highly interesting and up to $k = 127$ indeed correspond to elementary particles. The number theoretical miracle is that all the four p-adic length scales with $k \in \{151, 157, 163, 167\}$ are in the biologically highly interesting range 10 nm-2.5 μm). The question has been whether these define scaled up copies of electro-weak and QCD type physics with ordinary value of $\hbar$. The proposal that this is the case and that these physics are in a well-defined sense induced by the dark scaled up variants of corresponding lower level physics leads to a prediction for the preferred values of $r = 2^{k_d}$, $k_d = k_i - k_j$. More general prediction is $h_{eff} = nh$, where n is product of distinct Fermat primes and power 2^{k_d}.

This proposal will be referred to as Mersenne hypothesis and it leads to strong predictions about EEG since it predicts a spectrum of preferred Josephson frequencies for a given value of membrane potential and also assigns to given value of $\hbar$ a fixed size scale having interpretations as size scale of body part or magnetic body.

2.4.5 Dark matter hierarchy, sensory representations, motor action, and metabolism

Dark matter hierarchy forces a profound reconsideration of brain metabolism and allows to develop a detailed model for how magnetic bodies use biological bodies as sensory receptors and motor

instruments [K11] leading among other things to a generalization of the notion of genome.

For ordinary quantum mechanics photons at EEG frequencies correspond to ridiculously small energies. Dark matter hierarchy is accompanied by a hierarchy of EEGs and its generalizations with the scalings of frequencies predicted to come in powers $r = 2^{k_d}$, where the values of k_d are fixed by Mersenne hypothesis [K11].

The fact that arbitrarily small frequencies can correspond to energies above thermal threshold at higher levels of dark matter hierarchy implies that photons with arbitrarily low frequencies can have sizeable physical effects on matter. This conforms with the findings about the effects of ELF em fields on living matter [K11], and these effects allow to develop a rather detailed model for EEG and identify the parts of EEG correlating with communications of sensory data to the magnetic body and with quantum control performed by the magnetic body [K11].

The implication is that the transfer of energy between magnetic bodies and biological body could be major factor in metabolism. The question is whether the magnetic bodies provide metabolic energy for brain or utilize the metabolic energy provided by brain or both. Time mirror mechanism (see **Fig.** `http://tgdtheory.fi/appfigures/timemirror.jpg` or **Fig. 9** in the appendix of this book) as a mechanism of intentional action would predict that magnetic body uses the metabolic resources of brain during intentional action. Together with the strange findings about ionic currents through cell membrane suggesting that ionic channels and pumps are actually ionic receptors and the ionic currents through them are only small samples about the net currents, this vision leads to a profoundly new view about brain metabolism.

3 TGD Based View About Life

The notions of many-sheeted space-time, magnetic body, p-adic physics as physics of cognition, time mirror mechanism as a tool to realized intentional action, and possibly also classical Z^0 force, are the basic elements of TGD inspired view about life (see the figures **??**, `http://tgdtheory.fi/appfigures/manysheeted.jpg` or **Fig.** 9, fluxquant, padictoreal in the appendix of this book).

3.1 The Notion Of Magnetic Body

The magnetic field associated with any material system is topologically quantized, and one can speak about magnetic body since one can assign given magnetic flux tube to a definite material system.

3.1.1 Magnetic body as an intentional agent

An attractive idea is that the relationship of the magnetic body to the material system is to some degree that of the manual to an electronic instrument. Magnetic body would thus allow to realize both sensory and abstract symbolic representations about the material body. Magnetic body would in this case serve as a kind of computer screen at which the data items processes in say brain are communicated either classically (positive energy MEs) or by sharing of mental images (negative energy MEs).

Magnetic body is also an active intentional agent: motor actions are controlled from magnetic body and proceed as cascade like processes from long to short length and time scales as quantum communications of desires at various levels of hierarchy of magnetic bodies. Communication occurs backwards in geometric time by negative energy MEs. Motor action as a response to these desires occurs by classical communications by positive energy MEs and as neural activities. This explains the coherence and synchrony of motor actions difficult to understand in neuroscience framework. The sizes of flux tubes are astrophysical: for instance, EEG frequency of 7.8 Hz corresponds to a wave length defined by Earth's circumference. The non-locality in the length scale of magnetosphere, and even in length scales up to light life, is forced by Uncertainty Principle alone, if taken seriously in macroscopic length scales.

3.1.2 Universal metabolic currencies

The leakage of supra currents of ions and their Cooper pairs from magnetic flux tubes of the Earth's magnetic field to smaller space-time sheets and their dropping back involving liberation of the zero

point kinetic energy defines one particular metabolic "Karma's cycle". The dropping of protons from $k = 137$ atomic space-time sheet involved with the utilization of ATP molecules is only a special instance of the general mechanism involving an entire hierarchy of zero point kinetic energies defining universal metabolic currencies. This leads to the idea that the topologically quantized magnetic field of Earth defines the analog of central nervous system and blood circulation present already during the pre-biotic evolution and making possible primitive metabolism. This has far reaching implications for the understanding of how pre-biotic evolution led to living matter as we understand it [K14, K15].

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.

3.1.3 Dark matter hierarchy and motor control

The following general overview about quantum communication and control emerges from the model for EEG hierarchy as correlate for dark matter hierarchy discussed in detail in [K11].

1. Cyclotron frequencies relate to the control of the biological body by the magnetic body and could be assigned with the magnetic flux sheets going through DNA since it is genome where protein synthesis is initiated and is thus the optimal intermediate step in the cellular control.

2. One of the basic functions of cell membranes is to perceive the chemical environment using various kinds of receptors as sensors. Neurons have specialized to receive symbolic representations of the sensory data of primary sensory organs about the situation in the external world. A good guess is that in this case magnetic flux quanta are hollow cylindrical structures parallel to the cell membrane associated proteins serving as Josephson junctions. Also magnetic flux tubes parallel to axon serving as as templates for axons could define communication lines connecting cell membranes to the cellular magnetic body Also synaptic contacts should involve similar magnetic flux quanta connecting them to neuronal magnetic body.

3. This picture would explain why the temperature of brain must be in the narrow range 36-37 K to guarantee optimal functionality of the organism. If interior superconductivity is lost, magnetic body receives sensory data but is paralyzed since its desires cannot be realized. If boundary superconductivity is lost, magnetic body can move but is blind.

4. In the length scales below the weak length scale L_w also charged weak bosons behave as massless particles and the exchange of virtual W bosons makes possible a non-local charge transfer. Dark quark-antiquark pairs associated with the color bonds of the atomic nuclei can become charged via the emission of dark W boson and thus produce and exotic ion. The same can happen at the higher levels of dark matter hierarchy.

5. Massless extremals (MEs, topological light rays) serve as correlates for coherent states and Bose-Einstein condensates of dark bosons. Besides neutral massless extremals (MEs) TGD predicts also charged massless extremals obtained from their neutral counterparts by a mere color rotation (color and weak quantum numbers are not totally independent in TGD framework). The second non-local quantum control mechanism is based on em charge entanglement involving a superposition of ordinary ions/atoms and exotic ions connected by a W massless extremal joining magnetic body and biological body. In quantum jump this state would be reduced to exotic charge state with some probability increasing with the strength of the classical W field. Charged massless extremals could be seen as correlates for non-local quantum control by affecting charge equilibria whereas neutral MEs would serve as correlates for coordination and communication. Color charged MEs could also induce color charge polarization and flows of color charges and thus generate visual color qualia by the capacitor mechanism discussed in [K16].

6. These non-local quantal mechanisms can induce or change electromagnetic polarization in turn inducing ordinary charge flows and thus making possible quantum control of nervous system by magnetic body. The generation of nerve pulse could rely on the spontaneous state function reduction occurring for charge entangled state reducing the resting potential below the critical value by this kind of mechanism inducing charge transfer between cell interior and exterior. Also remote mental interactions, in particular telekinesis, might rely on this mechanism.

3.1.4 Emergence of symbols at molecular level and new view about hydrogen bond, water, and bio-catalysts

The first questions one can ask about dark matter is "What dark atoms could be?". This question is discussed in [K10] and more thoroughly and relating it to the general model about living matter in [K24, **?**, K8].

One can imagine two notions of dark atom. The first one is based on r^2-fold radial scaling of ordinary atom and predicts that energies are scaled down like $1/r^2$. Second is based on r-fold radial folding of the ordinary atom without changing its size. Both of these notions seem to make sense.

The radially folded atoms seems to be especially interesting biologically. The nucleus of this dark atom is ordinary whereas electrons are dark. For Mersenne hypothesis the space-time sheet associated with a dark atom is locally r-fold covering of M^4, $r = 2^{k_d}$. The sheets however integrate to a single sheet globally.

Single electron states have very nearly the same energy as in the case of ordinary atoms since principal quantum number n is fractionized to n/r. Fermi statistics allows also $N \leq r$-electron states: this is essentially due to the degeneracy caused by the r-fold local stack structure of space-time sheets.

From the point of exterior world these atoms have an effective fractional charge $1 - N/r$ since fine structure constant associated with the interaction of dark electron with external world is scaled down by a factor $1/r$. $N = r$ corresponds to full electron shell and represents especially stable state analogous to noble gas atom or magic nucleus.

Dark N-hydrogen atoms, briefly H_N-atoms are of especial interest from the point of view of biology. One ends up with the hypothesis that H_r-atom corresponds to hydrogen atom appearing in hydrogen bond. Furthermore, H_N-atoms could define r-fold alphabet and their attachment to various bio-molecules could define letters for the names of bio-molecules.

The molecules labelled by name and conjugate name would have enhanced probability to fuse along the letters and conjugate letters ($N_c = \lambda - N$): in this process one proton would be liberated and could drop to a larger space-time sheet liberating metabolic energy quantum. This process would define simultaneously the basic mechanisms of catalytic action and generation of metabolic energy quantum. H_N atoms would bring in symbolic representations and what might be called molecular sex.

The assumption that at least part of water molecules of water in living systems could be of form $H_N - O - H$ and H_{N_1}-O-H_{N_2} leads to a model for ordered water as water in which only H_r-atoms are bound to oxygen and to answer basic questions concerning the role of water in bio-chemistry. For instance, the question why hydration induces de-polymerization unless the water is in ordered phase can be answered. The prediction is that $H_N - O - H$ water acts as a catalytic poison by attaching to the letters of the names of molecules and thus spoiling catalytic specificity. The identification of ordered water as the precedessor of gel-phase emerges naturally.

In this framework it is even possible to say something non-trivial about how first replicators have emerged. The new view about hydrogen bond poses very strong constraints on allowed bio-monomers. Monomers forming negatively charged polymers at the verge of stability are ideal since they define optimal targets for catalytic action.

3.1.5 Magnetic Mother Gaia as conscious entity

Magnetic Mother Gaia could also form sensory and other representations receiving input from several brains via negative energy EEG MEs entangling magnetosphere with brains. The multi-brained magnetospheric selves could be responsible for the third person aspect of consciousness and

for the evolution of social structures. Some aspects of remote viewing very difficult to understand if remote viewing involves only the target and viewer [J4], the successful healing by prayer and meditation groups [J3], and the experiments of Mark [J5] [J5] support the view that multi-brained possibly magnetospheric selves are involved. Magnetic flux tubes could function as wave guides for MEs and this aspect is crucial in the model of long term memory.

3.2 Time Mirror Mechanism As A Fundamental Mechanism Transforming Intentions To Actions

Time mirror mechanism (see **Fig.** `http://tgdtheory.fi/appfigures/timemirror.jpg` or **Fig.** 24 in the appendix of this book) is based on the generalization of what happens in the reflection of light. Instead of reflecting in spatial direction, light propagating in the direction of past is reflected in time direction. Phase conjugate light waves can be identified as light propagating in the direction of geometric past and with its photons having negative energies. Reflected light consists in turn of ordinary positive energy photons.

3.2.1 Intentional actions

Long ranged electro-weak fields, in particular ELF em fields, are crucial for the TGD inspired model of brain and a natural assumption is that "topological light rays" (massless extremals (MEs)) are involved with intentional actions.

A concrete picture about the materialization of intentions emerges, when one asks how a precisely targeted intention could be realized at the atomic or molecular level. The view about quantum measurement theory based on Zero Energy Ontology (ZEO) has modified considerably the original vision about intentional action as a quantum transition replacing p-adic space-time sheet to a real one.

1. Contrary to the original view, intention according to the recent view is something, which develops as mental image (sub-self) and is realized as action when this mental image dies. This sub-self corresponds to a sequence of state function reductions at fixed boundary of CD and the first reduction to the opposite boundary means the death of this mental images and its re-incarnation at opposite boundary of CD. It would seem that intention can be realized in a precisely targeted manner only for the transitions, which cannot occur spontaneously, and thus involve the emission of negative energy MEs.

   By NMP negentropy is typically generated in this transition tending to increase the value of Planck constant $h_{eff} = n \times h$ and thus reducing quantum criticality and occurring therefore spontaneously. Negentropy Maximization Principle eventually forces the occurrence of volitional action - self experiences the urge to perform the action so strong that cannot resist. Subself representing the mental image about intention tries to prevent it as long as possible because it means death: all living systems try to stay at the existing level of criticality and avoid the fatal final state function reduction by practicing homeostasis and using metabolic energy. Weak form of NMP states that self has freedom to decide whether it performs the reduction producing maximal entanglement negentropy. It can also perform ordinary quantum jump reducing entanglement entropy to zero and destroying entanglement. The outcome is isolation from the external world. The motivation for the weak form of NMP is that we do not live in the best possible world and have free will to choose between Good and Evil. Strong form of NMP would produce always mazimal negentropy gain and would mean best possible world.

2. The generation of negative energy MEs utilizes the buy now-let others pay mechanism of metabolism, which implies extreme flexibility since system gets energy instantaneously. Of course, there must exist an unselfish self, which is able to pay and this puts severe constraints on the mechanism.

3. W MEs inducing charge entanglement involving exotic nuclear ionizations of opposite sign in entangled systems are an especially attractive candidate for inducing generalized motor actions. The mechanism relies on the generation of classical electric fields at dark space-time sheets in turn inducing via Faraday law electric fields at space-time sheets containing

the ordinary matter: this leads to generation of ordinary ohmic currents. The generation of nerve pulse could represent one example of a generalized motor action realized in this manner by magnetic body [K31].

3.2.2 Time mirror mechanism, scalar wave pulses, and wormhole magnetic fields

Many-sheeted space-time makes possible many-sheeted lasers since cold space-time sheets can contain Bose-Einstein condensates of ions and their Cooper pairs. If the system contains population inverted many-sheeted laser for which the increment of zero point kinetic energy corresponds to the energy of photons associated with negative energy MEs, the absorption of negative energy photons gives rise to a phase transition like dropping of particles to larger space-time sheet by the induced emission mechanism, and the control signal represented by negative energy MEs can be amplified if a critical number of particles drops to the larger space-time sheet. This control mechanism allows an instantaneous motor control in which intention is transformed to desired represented by negative energy MEs and generates in geometric past a reaction representing the desired response, say neuronal activity giving rise to a motor action. This process probably involves entire hierarchy of magnetic selves realizing their intentions as desires communicated to lower level magnetic selves and the lowest level corresponds to the regions of brain responsible for liberating metabolic energy.

The simplest possibility is that the transformation of the intention to action generates negative energy topological light rays. The generation of scalar wave pulse transformed is an alternative mechanism - assuming of course that TGD allows scalar wave pulses! When scalar wave pulse moves in matter, charges end up to the space-time sheet of the scalar wave pulse and accelerate without dissipation. Instead of brehmstrahlung the accelerated charges emit negative energy "acceleration radiation" having negative energy MEs as space-time correlates. Since dissipation is negligible this leads to a generation of a strong negative energy signal. The resulting negative energy photons in turn induce the phase-transition like dropping of particles of population inverted many-sheeted laser to larger space-time sheets liberating a beam of positive energy photons, which is much more intense than the control signal consisting of negative energy photons. A good guess is that scalar wave pulses provide a fundamental control mechanism in living matter, and that nerve pulse represents only a special case of this control mechanism.

Intentions could be transformed also to actions by generation of magnetic flux tubes: so called wormhole magnetic fields [K43] correspond to pairs of magnetic flux tubes having opposite time orientations and therefore also opposite energies. Wormhole magnetic fields could be created in quantum jumps. The phase transition like changes of EEG spectrum involving emergence or disappearance of EEG band might be due to the generation of wormhole magnetic fields giving rise to EEG resonance frequencies via cyclotron transitions and thus represent motor actions of magnetic body [K11].

3.3 Applications Of Time Mirror Mechanism

Time mirror mechanism has become a corner stone of TGD inspired theory of consciousness and biological applications translate easily to technological applications, which provide a fresh new about how advanced civilizations might study the surrounding cosmos.

3.3.1 Biological applications

Long term memory, sensory perception, and realization of intentional actions, in particular motor actions rely on time mirror mechanism mechanism. The idea is simple. To remember is to "see" the brain of the past. Ordinary seeing is based on reflection of light on an object. Seeing the brain of past is based on reflection of light in time direction by mirror mechanism. The same mechanism explains remote mental interactions. Now reflection occurs some other brain or some other system containing population inverted lasers.

The strange time delays associated with active and passive aspects of consciousness discovered by Libet [J7] can be interpreted as due to the finiteness of light velocity and astrophysical size of the magnetic body, and thus lend support for the notions of magnetic body and time mirror mechanism.

Time mirror mechanism allows also instantaneous remote metabolism: system gets positive energy by sending negative energy topological light rays/photons to some system able to receive them. If the receiving system is population inverted laser, a cascade like process generating positive energy photons propagating to the future and to the system which sent the negative energy photons. The cascade results because the probability of bosons to drop in ground state is proportional to the number of bosons already in ground state. This mechanism makes biological system extremely flexible since any part of it can get energy instantaneously if needed.

3.3.2 Instantaneous quantum remote sensing?

Ordinary remote sensing technology is limited by the finite velocity of light making it impossible to remote sense actively objects that are too faraway. Time mirror mechanism suggests a technology of active remote sensing based on time reflection at the studied object and thus involving no time lapse, and making possible remote sensing of arbitrarily distant, even astrophysical, objects due to the possibility of amplification in reflection and the fact that topological light rays are "outside" the space-time and the interaction with matter is very weak. The only additional condition is the presence of the many-sheeted population reversal. This condition could be satisfied for living matter at least.

Dela-Warr camera [J2] might be based on this mechanism. Even more science-fictively and a little bit of tongue in cheek, one can consider also the possibility of communicating with the civilizations of the geometric future by using population inverted lasers. Send to the geometric future classical k-bit signals (k harmonics of the fundamental) at frequencies $f(n,k)$ to tell that we have discovered p-adic cognitive codes, and wait whether the population inverted lasers at these frequencies return to the ground state with an abnormally high rate! One can easily imagine simple codes for communication. For instance, for p-adic length scales corresponding to visible wave lengths the typical number of bits would be 163.

3.3.3 Remote utilization of energy

In the technological context remote metabolism would translate to a remote utilization of energy stores making un-necessary the costly transport of the fuel. Only negative energy signal of critical intensity would be required to generate amplified positive energy signal from the geometric past providing the energy instantaneously and over long distances. Since many-sheeted lasers defined by space-time sheets of many-sheeted space-time are everywhere (energies correspond to zero point kinetic energies), the spaceship could get its energy almost in any environment which is sufficiently many-sheeted.

The need to carry large amounts of fuel and the limitations posed by the maximal classical signal velocity are the basic problems of the space technology. The technological variant of the remote metabolism might provide at least a solution to the fuel problem. The work with the Searl machine suggests that phase conjugate laser beams could also generate antigravity effects [K40].

3.3.4 Sharing of mental images and telepathic communications

Time mirror mechanism allows also the system of geometric now to entangle with that of the geometric past. This means that the systems of geometric now and past share mental images. This could be the mechanism of episodal memory in which events of geometric past are re-experienced. The mechanism makes also possible telepathic sharing of mental images: for the system in future the experience represents memory (not necessarily personal) and for the system of past to precognition. It might be that the civilizations of remote geometric future have developed this mechanism to a refined technology allowing them to directly experience what the civilizations of geometric past and future experience. Encounters of UFOs and aliens could be this kind of remote contacts. They would be absolutely real encounters in the sense that the sensory perceptions are about real aliens but generated telepathically.

3.3.5 Plasma oscillation patterns as holograms

The so called 4-wave interaction involves four laser beams: probe beam and its phase conjugate and two laser beams in opposite directions and interfering to a standing wave [K4]. In bio-systems

probe beam and its phase conjugate would be responsible for remote metabolism providing the energy needed to build the hologram by time mirror mechanism. Standing wave in turn would define a simple hologram serving as a fundamental sensory representation from which more complex sensory representations are constructed. If the oppositely moving laser beams have slightly different frequencies, the standing wave pattern moves. Nerve pulse could basically result in this manner.

Plasma oscillations of ionic charge densities represent standing waves since the plasma oscillation frequency does not depend on the wavelength so that the standing pattern repeats periodically. The metabolic energy needed to build up plasma oscillation patterns would be obtained by time mirror mechanism using wave and its phase conjugate (probe beam and its phase conjugate).

This would be one reason for why ions are so crucial for living cell. All atomic nuclei are completely ionized Z^0 ions and this would make possible further plasma oscillations. In fact, the Z^0 plasma frequency of water corresponds to the fundamental metabolic energy currency .44 eV so that metabolism could be used to build Z^0 holograms based on water molecules. Many-sheeted space-time predicts entire hierarchy of plasma frequencies coming as powers of 2.

3.4 Vision About The Evolution Of Life

The notion of many-sheeted space-time could allow to understand many puzzles related to the pre-biotic evolution [I4, I14]. There are many constraints on the models for pre-biotic evolution. The models have also many difficulties [I6, I12].

3.4.1 Cognitive evolution proceeding from long to short scales is also present

General principles of TGD lead to an overview about how evolution must have proceeded. Usually the evolution of life is seen as an evolution proceeding from short to long length scales (atoms, molecules, cells, ...). Also cognitive evolution must have occurred in parallel with the chemical evolution, and since p-adically small means large in real sense, one can argue that cognitive growth must have proceeded from long length and time scales to short ones. Learning of a motor skill and carving a statue by starting from a rough sketch and adding gradually details are good examples of the process. Magnetic flux tubes structure must have developed gradually more and more intricate by the emergence of local structures by a process analogous to a construction of a fractal. The resulting magnetic flux tube structures have in turn served as templates for the formation of bio-matter.

The study of field equations leads to a classification for the phases of matter according to the dimension of CP_2 projection. Magnetic field structures for which CP_2 projections have dimensions $D = 2$ and $D = 3$ have interpretation as phases analogous to ferromagnetic phase and spin glass phase respectively and $D = 2 \to 3$ phase transition would be presumably induced by the interaction of flux tube structures with bio-matter and lead to the extremely complex but organized phase identifiable as living matter. $D = 4$ phase would in turn correspond to chaotic phase analogous to a demagnetized phase.

These ideas lead to a rather detailed vision about how the pre-biotic evolution might have proceeded.

1. Standard vision about pre-biotic life is problematic

The prevailing mechanistic world view forces to conclude that life emerged accidentally in young Earth during a relatively short time period of about.3 billion years. On basis of extensive computer simulations, one can fairly say that a spontaneous generation of life in primordial ocean seems extremely implausible [I6].

TGD replaces materialistic view with a continual re-creation in which classical universe in 4-dimensional sense is replaced by a new one in each quantum jump. p-Adic length scale hypothesis allows to formulate the notion of evolution precisely as a generation of increasingly larger space-time sheets characterized by preferred p-adic primes meaning also a sequence of symmetry breakings. Macroscopic and even astrophysical quantum coherence becomes a key features of living matter. Theory is partially non-deterministic also in classical sense but the absolute minimization of Kähler action and self-organization lead to Darwinian selection of selected patterns.

2. Did life develop in the womb of Mother Gaia?

A stable star and planet providing appropriate conditions such as temperature for liquid water is needed. The many-sheeted view about life widens dramatically the spectrum of possible environments for the pre-biotic evolution. In fact, the interior of the many-sheeted Earth could contain Mother Gaia's womb providing a shielded environment for the evolution of life instead of the rather harsh environment defined by the primordial atmosphere and ocean.

The womb would be located somewhere below the boundary at which $k = 137$ atomic space-time sheets transform to very hot $k = 131$ space-time sheets: this should occur when the thermal de Broglie wave length becomes equal to the p-adic length scale $L(131)$. The transition occurs above the crust-mantle boundary (1300 K). Below the $131 - 137$ boundary, the temperature at k=137 atomic space-time sheets diminishes and the range of temperatures could cover also room temperature. Mantle-core boundary (4000 K) is a good candidate for the surface at which the temperature at $k = 137$ space-time sheets is near to the room temperature.

In a sharp contrast to the standard wisdom, something like a mirror image of the biosphere should exist at the other side of the mantle if one takes many-sheeted space-time seriously. The hot $k = 131$ space-time sheets yield a thermal radiation with wave lengths containing ordinary metabolic energy currency about.5 eV. The dropping of ions O, C, N from the hot $k = 131$ space-time sheets to larger space-time sheets generates light at visible frequencies replacing solar light so that even intra-terrestrial counterpart of photosynthesis could develop. The dropping of oxygen atoms could make also possible development of oxygen based metabolism.

3. Was chemical evolution guided by magnetic body of Mother Gaia?

The notions of many-sheeted body, topological field quantization, and classical Z^0 modify profoundly the views about chemical evolution.

1. Atoms like C, N, and O and smaller amounts of P and S giving rise to bio-monomers, and metals like Al, Fe, and Zn are the basic building blocks. The formation of various chemical bonds like hydrogen bonds, covalent bonds, and peptide bonds could involve many-sheeted physics in a nontrivial manner.

2. The formation of biological monomers (amino acids, nucleotides, fatty acids, sugars) is an essential element of life. Except for DNA nucleotides, basic monomers evolve in the circumstances simulating to what have been believed to be the primordial atmosphere. These bio-monomers are found even in the interstellar space and in galactic clouds so that the question is not whether the pre-biotic life can develop but whether our recent day materialistic science allows to understand how it develops. The standard wisdom about primordial atmosphere as a reducing environment (containing no oxygen) indeed leads to grave difficulties. Also the concentrations in the primordial ocean seem to be quite too low for the bio-monomers to be synthetized [I12]. Magnetic flux tube structure of the magnetosphere acting as a nervous system and a metabolic circuitry of the magnetic Mother Gaia could make possible controlled metabolism already during the pre-biotic period and allow to circumvent these difficulties.

3. The formation of the biological polymers such as proteins, nucleic acids, lipids, and carbohydrates occurs universally by dehydration. The problem is that in water environment polymers are un-stable against decay by hydration: it would seem that a metabolic energy feed is required already at this stage to guarantee non-equilibrium situation. The solution to the difficulties could be quantum control from the magnetic flux tubes of magnetosphere providing primordial metabolism with the same universal energy currencies as associated with the recent metabolism. Phosphate-sugar polymers form the backbone of nucleic acids and metabolism is based on ADP and ATP formed from adenine and phosphate ions. It has been already earlier found that the generation of ATP and its metabolic utilization involve the flow of protons between the atomic space-time sheets and some larger space-time sheets, say magnetic flux tube of Earth [K22]. It will be found that this mechanism is involved also with the dehydration leading to polymerization and phosphorylation. The reversal of this process also implies the un-stability of DNA in an ordinary aqueous environment.

4. The assembly of these macro-molecules into organized aggregates like chromosomes, microtubules and cell organelles could involve many-sheeted physics. Classical Z^0 fields generated

by nuclei, which are completely ionized Z^0 ions, are screened by neutrinos but not locally since the size of neutrinos is much larger than the size of the nucleus. Classical Z^0 fields, besides explaining chiral selection of bio-molecules, could be a central tool in the control of the molecular engineering since Z^0 tidal forces allow to distinguish between nuclei with different A-Z/A ratios.

5. Also the emergence of catalysts, metabolism, and the membrane bound structures should be understood. Super-conductivity at magnetic flux tubes and its breakdown, as well as the possibility of negative energy MEs having phase conjugate laser waves as standard physics counterparts, are expected to be especially relevant for the catalytic action. Bound state quantum entanglement in macroscopic length scales is also an absolutely essential part of this mechanism. Intentional action realized in terms of negative energy MEs and appearing already at the molecular level, is expected to become an increasingly important aspect of catalytic action when the complexity of the structures increases. In TGD framework a primitive many-sheeted metabolism is present from the beginning and becomes only refined during evolution. Most importantly, metabolic currencies are constants of nature by the p-adic length scale hypothesis. Self-organization in many-sheeted space-time is expected to automatically lead to the generation of the gel phase as a possible precedessor of membrane bounded structures as well as of membrane structures themselves containing liquid crystal water stabilizing also DNA nucleotides.

4. Emergence of genetic code

The emergence of the genetic code has remained a mystery in various scenarios of pre-biotic evolution. The TGD inspired solution of the puzzle came from a rather unexpected (or should one say un-respected) direction. Chilbolton and Crabwood crop formations [H1, H2, H3, H4] led to the realization of the exact A-G symmetry and slightly broken T-C symmetry of the genetic code. These symmetries strongly suggest that the evolution of the triplet code occurred as a fusion of singlet and doublet codes. One ends up with a detailed model for how this happened by using some hints provided by Chilbolton crop formation [H1, H2] and the structure of tRNA molecule carrying in its fossilized parts detailed information about the evolution of the code. Nanno-bacteria [I15, I9] might correspond to some precedessor of the recent genetic code. Nanno-bacteria accompany mineral structures and actively manipulate them: this conforms with the view that mineral interfaces have been indeed important for the evolution of polymers.

Introns are the basic mystery of DNA. TGD predicts that language is a universal phenomenon. It appears already at prokaryotes and is based on genetic code realized as temporal field patterns and at level of eukaryotes introns define memetic code (code word has 126 bits) besides genetic code and define kind of higher level language. Memes represented as sequences of 21 DNA triplets and expressing themselves as field patterns associated with MEs would realized this higher level universal language.

3.4.2 Plasmoids as primitive life forms?

If the self-organization leading to the generation of life proceeds from magnetic body of to the biological body then simple many-sheeted topological quanta containing plasma, plasmoids, should be the simplest life forms. For instance, plasmoids could carry torus like magnetic flux configurations. The flux tubes of magnetic field can form extremely complex knotted and linked structures. This topology provides almost enormous representational capacity and one can wonder whether the opportunistic Nature could really have failed to notice this opportunity.

Perhaps the simplest plasmoids (even ball lightning!) might be regarded as the magnetic counterparts of the simplest monocellulars. Note that small plasmoids should be generated also when supra-currents in bio-matter leak out from the magnetic flux tubes. Neural circuits might be accompanied by plasmoids responsible for the self-organization of the ordinary matter around them.

The zero point kinetic energy liberated when particles drop from say atomic space-time sheets to the space-time sheets magnetic flux tubes, would define basic metabolic energy quanta for the plasmoid. Therefore metabolic energy quanta would be by p-adic length scale hypothesis universal and same everywhere in Universe. Thus metabolism would not be result of biochemical evolution

but precede it. Plasma oscillation patterns at plasma-frequency are ideal hologram like sensory representations built using time mirror mechanism so that plasmoids could have primitive sensory systems.

1. *Plasma sheet as a "microchip"*

There is a fascinating finding about the "memory chip" character of the organization of the ionic velocity distribution in the plasma sheet [F1] at the night side of the Earth's magnetosphere. The belief was that the distribution is a Maxwellian thermal distribution but an complex organization of the number of ions as a function of speed and direction relative to the direction of the local magnetic field has been detected [F1]. By coloring the bins representing small volumes of the velocity space, one finds that 3-dimensional features like "eyes" and "wings" appear! The proposed interpretation is that these features codes the history of ionic currents. One cannot exclude the possibility that these ionic currents could reflect even our sensory experiences. The prediction is that also other transition regions (in particular magneto-pause) should exhibit similar complex self-organization patterns.

2. Plasmoids in laboratory

It seems that one of the most craziest predictions of TGD inspired theory of consciousness has been realized at laboratory. Quite recent report tells about plasmoids generated in a simple diode involving plasma generator creating plasma column between itself and the positively charged anode [I13]. The plasmoids are self-organizing structures able to evolve in a period of few microseconds. They possess many properties that life forms are expected to have. Plasmoids

1. grow from micrometer size up to cm size,
2. replicate by simply dividing into two pieces,
3. have an outer negatively charged surface separating the positively charged interior from the environment and obviously analogous to the cell membrane. Hence the plasmoid is analogous to a capacitor, and the exchange of matter with the environment could correspond to a di-electric breakdown essential for qualia in TGD based model of the sensory receptor,
4. possess a metabolic cycle involving the transfer of matter between the interior of the plasmoid and environment. This cycle is seen as a periodic generation of visible light at specific frequencies: the light balls are typically found to be red or yellow. The frequency of metabolic oscillations is at 25-45 kHz frequency range,
5. are able to communicate by generating electromagnetic radiation by inducing vibrations in the receiving plasmoid at the same frequency.

These findings give valuable hints concerning the more detailed modelling the "biology" of plasmoids. Plasmoids are in a key role in the TGD inspired model of pre-biotic evolution discussed in [K14, K15]. For instance, one can ask whether the preferred colors might be interpreted in terms of quantized increments of zero point kinetic energies liberated when atoms or ions (such as C, N, and O) drop from the hot $k = 131$ space-time sheets (temperature being of the order of the zero point kinetic energy) to larger space-time sheets.

3. Plasmoids and the emergence of dark H_N-atoms

As already discussed briefly, the notion of dark N-atom leads to a new vision about hydrogen bond and water, and allows to identify a fundamental mechanism of catalysis. For instance, H_N atom at $k = 1$ level of dark matter hierarchy can be regarded as a space-time sheet folded r times in radial direction. Single electron energies are in the lowest order approximation same as for ordinary hydrogen atom and the sizes of H_N- and H-atoms are also same. What is new that the number of electrons can range from $N = 1$ to $N = r$. This means that H_N-atoms define ideal letters for the names of molecules obtained by replacing ordinary hydrogen atoms capable of forming hydrogen bonds with H_N-atoms. The fusion of H_N- and H_{N_c}-atom ($N_c = r - N$) is strongly favored since it gives rise to r-atom expected to be especially stable as a full electron shell.

The identification of the hydrogen atoms of hydrogen bonds as H_r-atoms leads to a general vision about how symbolic representations appear at the molecular level and how the extreme

selectivity of bio-catalytic is due to the enhanced probability molecules with name and conjugate name to fuse to hydrogen bonded reaction complex and spitting out one proton dropping to a larger space-time sheet and liberating metabolic energy quantum in this process kicking the reaction complex over the potential wall to the final state. Also the exceptional role of water in the evolution of life can be understood.

How the first H_N atoms did emerge becomes the basic question about pre-biotic evolution. A plasma phase containing free electrons seems to be a necessary prerequisite if one takes seriously the hypothesis that the increase of Planck constant as a phase transition taking place as gauge interactions become so strong that the perturbative treatment fails (color confinement of quarks is good example of this phenomenon).

This supports the view about plasmoids as precedessors of molecular life forms, and also encourages to take more seriously the crazy sounding idea that hot temperatures, say those prevailing in planetary interiors or even solar photosphere, are a necessary prerequisite for the emergence of plasmoids and possible N-molecular variants of life [**?**, K9].

3.4.3 Dark matter hierarchy and evolution

Dark matter hierarchy leads to an amazingly concrete picture about evolutionary hierarchy allowing to identify the counterparts for concepts like mineral, plant, and animal kingdom that we learned during schooldays and ceased to take seriously as students of theoretical physics as we learned that other sciences are just taxonomy. Even more, a view about what distinguishes between prokaryotes, eukaryotes, animal cells, neurons, EEG, and even about what makes cultural evolution, becomes possible.

Mersenne hypothesis [K11] predicts a hierarchy of Planck constants $\hbar = \hbar_0$, $r = 2^{k_d}$, with values of k_d fixed by the condition that Mersenne primes and their Gaussian counterparts define p-adic length scales to which one can assign fractally scaled up variant of weak interactions and perhaps also color interactions. The condition that dark variants of these physics include the Mersenne length scales poses strong conditions on the values of k_d and leads to a detailed view about biological evolution.

Ordinary matter corresponds to $k_d = 0$ and ordinary value of $\hbar$ and higher levels correspond to scaled up values of $\hbar$. This mean scaling up of various quantum length scales and also the sizes of space-time sheets by r. It seems that magnetic flux quanta are the primary structures forming hierarchy of this kind and large $\hbar$ means that cyclotron energy scales expressible as $E = \hbar eB/m \propto r$ so that an arbitrarily weak magnetic field strength can in principle correspond to a cyclotron energy above thermal threshold at room temperature.

The appearance of space-time sheets zoomed up in size by a power of r means the emergence of new levels of structure and it is natural to identify big leaps in evolution in terms of scaling of $\hbar$ by r and emergence of new large magnetic flux sheets satisfying magnetic flux quantization condition with the unit of flux scaled up by r. This leap is quantum leap but in different sense as thought usually. The emergence of higher dark matter levels would basically mean the integration of existing structures to larger structures. A good metaphor are text lines at the pages of book formed by magnetic flux sheets whose width is scaled up by r as the new level of dark matter hierarchy emerges.

This conceptual framework gives rather strong guidelines for the identification of the levels of evolutionary hierarchy in terms of dark matter hierarchy. The outcome is a detailed vision about big evolutionary leaps discussed in [K24] in detail.

3.5 Could Simple Life Forms Be Induced By Intentional Action?

Since life would involve self-organization of magnetic flux tube patterns, one can consider the possibility that intentional actions could induce this self-organization and in well-defined sense give the spark of life to the dead matter. Obviously, the highly advanced civilizations of geometric future might have developed a kind of spark-of-life technology and using time mirror mechanism they could induced self-organization inducing life in remote geometric past. Perhaps we are doing this all the time for our brains of the geometric past when we remember.

There is some support for this wild speculation. William Tiller in Stanford University has carried out impressive experimental work with what he calls intention imprinted electronic devices

(IIED), and his results challenge that standard assumption that the intentions of experimenter do not affect the experimental apparatus [J11, J8, J9]. The simplest explanation for the findings is that intentional action induces magnetic self-organization of IIED and of the target material used in experiments. For instance, purified water develops pH-, temperature- and conductivity oscillations and its pH becomes sensitive to external magnetic fields.

3.5.1 Experimental arrangement

The goal was to try to imprint a specific intention into a simple, low tech electronic device so as to influence the companion, specific, well-designed, target experiment. The intentional imprinting was attempted in a meditative state. The intentionally imprinted device, IIED, was sent to a laboratory located at distance of about 1500 miles where colleagues had set up the experiment. The device was placed about 6 inches from a continuously running and computer-monitored target experiment and switched on (total electrical power rate was less than 1 microwatt). Over a time period of about 1-4 months the recorded results from the target experiment changed in the directions of the specific intention and the change eventually reached the selected magnitude of the specific intention. Also an identical, but not intention imprinted device was used and the results were compared in order to achieve more objective measurements about the effects of human consciousness on electric devices.

The targets used were purified water, some bio-molecules, and larvae of flies. These targets where either unshielded or shielded from radiation. For the latter purpose they were closed inside a grounded Faraday cage (FC), which screened rather effectively the radiation coming at microwave frequencies whereas for ultra low frequency (ULF) fields the screening is virtually absent (skin depth behaves as $1/\sqrt{\pi\sigma f}$ at low frequencies and $f = 2\pi\sigma$ (in units $\hbar = c = 1$) defines kind of critical frequency above which screening occurs effectively). The targets could be affected by control device (CD) or by identical IIED generating microwave radiation. Radiation was generated either at single frequency (7.3 MHz) or at three frequencies (5.0, 8.0 and 9.3 MHz) [J10].

In the case of purified water the spatial distributions of physical parameters like pH, temperature, and conductivity were measured as a function time. In the case of bio-molecules the possible effect on thermodynamical activity, which measures the thermodynamical energy of single molecule, was measured. In the case of fly larvae the possible effect on the larval development time was studied. The results from various arrangements were compared with control targets (no FC, no CD, no IIED).

3.5.2 Experimental findings

The basic experimental results were two-fold. First of all intended effects were achieved. Secondly, the "conditioning" of the laboratory resulted as an unexpected effect and continued even after the removal of the target and IIED.

1. Effects of the intentional action

1. IIED imprinted by intention to increase/decrease the pH of water gradually induced a shift in the pH of purified water to the intended value, increased the in vitro thermodynamic activity of bio-molecules, and a reduction of larval development time.

2. For bio-molecules and larvae four simultaneous side-by-side treatments were tested):

   (a) an unshielded sample,

   (b) a shielded sample,

   (c) a shielded sample with an "on" control device,

   (d) a shielded sample with an "on" IIED.

   Just the shielding of em radiation affected the thermodynamic activity of the bio-molecules, and just adding less than about 1 microwatt of microwave radiation via control device reduced the thermodynamical activity and lengthened the developmental time. Thus the microwave radiation acted as a stressor having entropic effect. When the control device was replaced with IIED, the degradation caused by microwave radiation was overcome.

2. "Conditioning" of the laboratory

Quite unexpected phenomena arose from a repeated conduct of IIED in a given laboratory space. By simply continuing to use IIED in the laboratory space, it became "conditioned in some very fundamental way". Three signatures heralded the onset of the "conditioning" process.

1. Oscillations of air and water temperature, and of pH and electrical conductivity of water with large amplitudes with the periods of oscillations in 10-100 minute range developed. The amplitudes of pH- and temperature oscillations was $\sim \Delta pH = .1$ pH-unit and $\Delta T \sim 1 - 3$ K units respectively. Even more remarkably, the oscillations were sustained in the locale even after the removal of the IIED suggesting kind of phantom effect analogous to phantom DNA effect. Oscillation amplitude had peaks at the harmonics of fundamental frequency $f_l = 1/T_l$, $T_l = 36.6$ minutes with three lowest harmonics being very clearly visible [J9] . Also $T_l = 51.2$ minutes appears as fundamental period in some experiments. The ratio of these periods is 1.4 and rather near to $\sqrt{2} = 1.41$, which might relate to p-adic length scale hypothesis.

2. When an pH-increasing IIED with intention to increase pH by one unit was turned on in an almost unconditioned space located several hundred feet away from a strongly conditioned space, a well-defined pattern of pH-oscillations in an unconditioned space emerged. This pattern was accompanied by a highly correlated pattern of oscillations in strongly conditioned space. This kind of highly correlated oscillations were not observed in several unconditioned spaces also located several hundred feet away.

3. The targets were subject to the action of a vertically aligned magnetic field in the range of $10^{-2} - 5 \times 10^{-2}$ Tesla, such that the direction of the field could be reversed. In an unconditioned space the change of the direction of the magnetic field did not affect the pH. In the strongly conditioned space the effect on pH was different for the opposite directions of the applied field and the difference in pH values was about.6 units. One can say, that the target had become sensitive to the effects of external magnetic fields.

3.5.3 Explanation of the pH oscillations in terms of the general model of intentional action

The findings described above support the notion of magnetic body as mediator of the intentional action, and provide a connection with the general TGD based vision about pre-biotic evolution. The following general model for the effects suggests itself.

1. Intentional action induces magnetic self-organization of the control device and target

The magnetic body of IIED becomes a part of the intentional agent. Also the magnetic body of the target (purified water, etc...) partially fuses with that of IIED. Even more, the general model for the pre-biotic evolution [K14, K15] suggests that the intentional action mediated via the IIED induced a self-organization of a p-adic hierarchy of topological field quanta of magnetic field in the target system. This kind of hierarchy is associated also with DNA in the TGD based model for the effects of laser radiation on DNA observed by Gariaev [I8]. The generation of magnetic structures in shorter length scales is what one expects the intentional action to generate since intentional "growth" proceeds quite generally from long to short length and time scales.

The simplest candidate for the time scale of oscillations varying in 10-100 minute range is as the time scale associated with the cyclotron frequency of magnetic field quanta responsible for the intentional action. The cyclotron period of proton lies in 10-100 minute range for a magnetic field strength varying in the range of 27.8-278 pT. For $T_l = 36.6$ minute period the field strength would be 75.9 pT. The corresponding magnetic length is 4 mm and near to $L(188) = 3.7$ mm. The harmonics of the fundamental f_l could correspond to the quantized values of the magnetic flux coming as integer multiples of the basic flux with the strength of magnetic field quantized to integer multiples. Similar quantization of the Z^0 magnetic field strength is assumed in TGD based model of hearing [K30].

Cyclotron oscillations in the magnetic field could induce by some mechanism a periodic flow of protons between the magnetic flux tubes and the atomic space-time sheets of water and in this manner affect pH. pH-fluctuations would in turn induce temperature and conductivity fluctuations as side effects. Both $T_l = 51.2$ min and $T_l = 36.6$ min appear and have ratio very near to

$L(k+1)/L(k) = \sqrt{2}$. If this finding is taken at face value, the magnetic flux quanta must be magnetic sheets for which magnetic flux scales as the inverse of the thickness $d = L(k)$ of the flux sheet having constant size in the second transversal dimension.

2. Scaling law of homeopathy and frequencies of pH-oscillations and microwaves

The experiment involves two frequencies: the ULF frequencies associated with the pH-oscillations and the frequencies associated with the microwaves generated by the control device. Since intentional action compensates for the entropic effect of microwaves, these frequencies must relate to each other and generalized scaling law is an excellent candidate in this respect.

The TGD based model explains and generalizes the scaling law of homeopathy, which states that low and high frequencies having ratio $f_h/f_l = 2 \times 10^{11}$ accompany each other. Cyclotron oscillations with frequency f_l would result when charged particles drop from smaller space-time sheets and liberate the increment of zero point kinetic energy as a radiation with frequency f_h. Also the reverse of this process could occur with generation of negative energy photons at frequencies f_h and f_l. The emission of two photons is needed to guarantee momentum conservation since the momenta of charged particles are so small as compared to photon momenta.

The generalized scaling law predicts

$$f_h/f_l = \Delta E_0/E_c(k_2) \ ,$$

where $\Delta E_0 = E_0(k_1) - E_0(k_2)$ is the zero point kinetic energy increment when a charged particle drops from the space-time sheet labelled by k_1 to the sheet labelled by k_2. $E_c(k_2)$ denotes cyclotron frequency at the magnetic flux tube labelled by k_2.

The factor f_h/f_l varies but does not depend on the mass of the charged particle and by the quantization of the magnetic flux are apart from a numerical factor proportional to the ratio $p_2/p_1 = 2^{k_2-k_1}$ defined by the p-adic primes $p \simeq 2^k$ for the two space-time sheets in question. The scaling law of homeopathy in its basic form and p-adic length scale hypothesis suggest that f_h/f_l is related by a power of two to $f_h/f_l = 2 \times 10^{11} \sim (200/256) \times 2^{38}$ so that one has

$$f_h/f_l = 2 \times 10^{11} = (200/256) \times 2^n \ ,$$

where the integer n varies.

The generalized scaling law suggests that the frequency of pH oscillations corresponds to f_l. The frequencies of microwaves would correspond to f_h identifiable as the zero point kinetic energy of proton liberated when it drops from space-time sheet generated by the intentionally induced magnetic self-organization.

3. The mechanism of intentional action

The control device generates microwaves, and the intentional action should compensate the effect of the control device. The model of the intentional action based on the time mirror mechanism supports the view that negative energy MEs and photons are involved. Phase conjugation means essentially time reversal, and it could compensate the entropic effect of the ordinary microwaves generated by IIED and acting as a stressor in case of fly larvae. This also conforms with the fact that phase conjugate microwaves and ULF waves can penetrate the Faraday cage.

The microwave radiation at frequencies f_h could induce a flow of protons between $k = 167$ space-time sheets and larger space-time sheets by providing the needed zero point kinetic energy to kick protons to $k = 167$ space-time sheet. Negative energy (phase conjugate) microwave photons would induce the reverse process. By the basic mechanism of induced emission (now induced dropping) this in turn could induce the flow of protons from atomic space-time sheets to smaller space-time sheets as a kind of domino effect, and lead to a new flow equilibrium would result with different pH. The pre-requisite of this mechanism is that the hierarchy of the magnetic flux tubes characterizing also DNA is present in the target. The IIED affected by the intentional action would give rise to this magnetic hierarchy unless it already exists. IIED would play a role similar to an object received by the person to be healed from the healer (or vice versa) in remote healing.

A more detailed space-time description for what happens might be as follows.

1. ULF and microwave fields are coherently superposed inside MEs (incoherence would mean microwave MEs inside ULF MEs) so that the corresponding transversal magnetic and electric

fields are precisely parallel by the highly non-linear properties of MEs. ULF frequencies correspond naturally to harmonics of cyclotron frequency because of the strong coupling to cyclotron phase transitions of the Cooper pair Bose-Einstein condensate.

2. MEs serve as temporary bridges connecting the boundaries of $k = 169$ and $k = 188$ space-time sheets and the oscillating electric field of ME is orthogonal to the boundaries. By quantum classical correspondence the microwave frequencies associated with ME as well as the voltage along the bridge correspond to integer multiples for the energy of a microwave photon. The same mechanism based on Z^0 MEs underlies the TGD based model of nerve pulse.

3. The superposed ULF and microwave frequency electric fields inside ME induce a periodic flow of the protonic Cooper pairs forth and back between the super-conducting flux tubes of the Earth's magnetic field ($k = 169$) and magnetic flux tubes of the field B_I ($k = 188$). Microwave part induces a rapidly oscillating force superposed to the slowly varying ULF part of the force. The oscillatory flow of protons from atomic space-time sheets to larger space-time sheets affects the proton density at atomic space-time sheets causing pH oscillations.

4. Do the three peak frequencies for pH-oscillations correspond directly to three microwave frequencies by scaling law?

Scaling law would suggest that the three peak frequencies coming as harmonics of $f = 1/T_l$, $T_l = 51.2$ min, correspond to three frequencies f_l identifiable as cyclotron frequencies corresponding to the quantized values $n = 1, 2, 3$ for the magnetic flux. The frequencies produced by control device producing microwaves in 1-10 MHz range are non-trivial [J8, J9] and the first bet is that the frequencies given by the generalized scaling law must be in this range to compensate the entropic effects. The generalized scaling law $f_h/f_l = (200/256) \times 2^n$ with $n = 33$ gives the frequencies $f_h = 3.1$ MHz and its two harmonics 6.2 MHz and 9.3 MHz as counterparts of f_l and its harmonics. The frequencies produced by the control device are 5.0, 8.0 and 9.3 MHz and not harmonics of each other. Note however that the highest frequency corresponds exactly to the third harmonic of f_l.

Rather remarkably, $f_h = 3.1$ MHz corresponds to the zero point kinetic energy of a protonic Cooper pair at $k = 169$ space-time sheet associated with the magnetic flux tubes of the Earth's magnetic field. Thus protonic Cooper pairs could drop from the super-conducting flux tubes of the Earth's magnetic field to the magnetic flux tubes of ~ 76 pT magnetic field having $k = 188$. This in turn would generate a cascade like dropping of protons from the atomic space-time sheet so that pH is changed.

5. Correlation between pH and temperature oscillations and protonic zero point kinetic energy

In the case of water at temperature $T = 300$ K the amplitudes of oscillations are $\Delta T = 3$ K and $\Delta pH \simeq .1$. If the density of protons satisfies $n = n_0 exp(-\Delta E/T)$, where ΔE is most naturally the zero point kinetic energy $.4 - .5$ eV of protons at the atomic space-time sheet, one has

$$\Delta pH = \frac{\Delta E}{T} \times \frac{\Delta T}{T} \quad .$$

$\Delta pH = .1$ would require $\Delta E \simeq .3$ eV, which is quite near $.4 - .5$ eV.

The fact that the exponential $exp(-\Delta E/T)$ happens to be near to the number $n/n_{H_2O} = 10^{-pH}$, gives further support for the idea that the zero point kinetic energy at $k = 137$ space-time sheet determines pH, or more generally, that the densities of various ions are determined by many-sheeted chemistry and by zero point kinetic energies. If this interpretation is correct, $n(137)$ can be identified as the net density of protons including also protons bound to hydrogen atoms. The net density of protons at a given space-time sheet involves a degeneracy of states factor $g(k)$ so that one would have

$$n(137) = \frac{g(137)}{g(169)} \times n(169) \quad ,$$

where $k = 169$ refers to the super-conducting flux tubes of the Earth's magnetic field. p-Adic fractality and p-adic length scale hypothesis imply that $g(k)$ scales as $1/L^3(k)$. This gives $g(169)/g(137) \sim (L(137)/L(169))^3 = 2^{-48} \simeq 4 \times 10^{-15}$.

6. Sensitivity to the external magnetic field

The effect of the pH values depends on the direction of the external magnetic field B_{ext}. This could be understood if B_{ext} interferes with the magnetic field at some level of magnetic hierarchy induced by the magnetic fields in.1 nT range which mediate the intentional action. pH is changed if the change of the magnetic field at these space-time sheets in the cellular length scale range affects the flow of protons between atomic space-time sheets and larger space-time sheets when.1 nT flux tubes with thickness around 100 μm are present. This is expected to be the case if the thickness of the flux tubes is affected by the external magnetic field. The flux tubes in a given p-adic length scale could even disappear as a result of destructive or constructive interference.

Concerning the detailed model there are two options.
i) If the magnetic field consists of flux sheets so that one has $B(k) \propto 1/L(k) \propto 2^{-k/2}$. In this case the external field strength corresponds to p-adic length scale $L(k)$ related to the length scale $L(169) \simeq 5$ μm by a scaling of $.5 \times 10^{-2} - 10^{-3}$ the length scale varies between $L(149) = .5$ nm (thickness of the lipid layer of cell membrane) and 25 nm. This option is supported at the level of DNA magnetic hierarchy by the findings of Gariaev about effects of laser light on DNA, and also by the fact that the ratio of $T_l = 51.2$ min and $T_k = 36.6$ min is very near to $\sqrt{2}$. This situation would result if the flux quanta at various p-adic length scales are quite generally obtained by scaling the flux tubes of the Earth's magnetic field in one direction by keeping the flux as constant.
ii) If the magnetic field consists of flux tubes ($B(k) \propto 1/L^2(k) \propto 2^{-k}$) $L(k)$ is related to $L(169)$ by a scaling by a factor $.1 - .03$ so that it is in the range $1.6 - .5$ μm.

7. Phantom effect

A further strange finding is that the removal of both IIED and target does not eliminate the temperature oscillations of the air although their amplitude is reduced by a factor of about ten. The phantom effect can be understood if the magnetic flux tubes associated with $k = 188$ magnetic field are present also in the air volume, and are not affected by the removal of IIED and target, so that the oscillatory flow of protons between $k = 169$ and $k = 188$ space-time sheets with cyclotron frequency continues and induces the oscillation of the proton density of air.

3.5.4 The effects caused by the quartz crystal

In some experiments the removal of the target and IIED was followed by the addition of quartz crystal [J10]. The quartz crystal was made of natural quartz (in order to avoid undesired intentional imprinting!) and had height $h = 15.24$ cm and minimum diameter $d = h/2 = 7.62$ cm. The crystal was asymmetric in the vertical direction having apex pointing upwards.

The findings were following.

1. When the crystal was in a vertical direction, its presence sharpened the existing spatial phantom profile for temperature oscillations of air and somewhat amplified it.

2. When the crystal was turned to a horizontal direction, its presence immediately increased the temporal frequency of T-oscillations by a factor slightly larger than two. The spatial profile became first almost flat and the amplitude weakened.

The interpretation of the stimulates several ideas and questions.

1. Does the spatial profile of T-oscillations correspond to a standing wave resulting as an interference pattern of microwaves?

The spatial profile for the temperature oscillations is measured using spatial resolution $D = h = 15.24$ cm, where h is the height of the quartz crystal. The profile is quasi-periodic with a period of $\lambda = 2D = 2h$. Of course, experiments with a better spatial resolution would be required to deduce reliably the profile but the measurements are consistent with a spatial oscillation having period $\lambda = 2D = 2h$. This kind of profile could result as an interference of two classical microwave beams propagating in two opposite directions and generating a standing wave with wave length $2h$. This kind of interference pattern is involved with the four-wave interaction producing phase conjugate waves: the interfering waves correspond to the reference beam and a beam opposite to it. The two additional beams correspond to beam and its phase conjugate, either of them generating the other one.

2. Does the quartz crystal act as an amplifier?

The orientation of the crystal is obviously important. This encourages to think that the incoming signal enters from a vertical direction and is amplified by the quartz crystal so that the vertical dimension determines the resonantly amplified wave lengths. Perhaps magnetic flux tubes of B_I and the Eart's magnetic field B_E are in this direction. It could be that the light-like vacuum current of ME generates positive or negative energy coherent photons with an intensity distribution having maximum in the directions orthogonal to MEs and that the presence of the quartz crystal amplifies the vacuum current inside ME. Alternatively, it could be enough that quartz crystal amplifies the the classical fields associated with MEs.

The height h of the quartz crystal is one half of the microwave wavelength. Hence it could act like an absorbing or emitting half wave antenna. The fundamental frequencies associated with the microwaves would correspond to $f_1 = c/2h \simeq 1$ GHz for the vertical crystal and $f_2 = c/2d = 2f_1 \simeq 2$ GHz for the horizontal crystal. For the vertical crystal $\lambda_1 = 2h = 2D = 30.48$ cm would be the wavelength of the spatial profile which conforms with observations. For the horizontal crystal period would be $\lambda_2 = 2d = 15.4$ cm. The observed spatial profile immediately after the turning of the quartz crystal to horizontal position is flat in consistency with this prediction. It should be easy to check out whether the oscillatory pattern is present by improving the resolution.

3. Are population inverted many-sheeted masers involved?

The frequencies f_1 *resp.* $f_2 = 2f_1$ are rather near to the zero point kinetic energies of a protonic Cooper pair for $k = 153$ *resp.* $k = 152$. In the case of electronic Cooper pairs one has $k = 164$ and 163 (the ratio of proton and electron masses is near to a power of 2: $m_p/m_e \simeq 2^{11}$). Perhaps many-sheeted population inverted micro wave lasers are involved and time mirror mechanism induces dropping of protons to large space-time sheets or the reverse process. $k = 152$ and $k = 153$ correspond to length scales $\sqrt{2} \times L(151)$ and $2 \times L(151)$, where $L(151) = 10$ nm corresponds to the thickness of the cell membrane. The four-wave interaction suggested by the interpretation of the spatial profile would presumably involve many-sheeted laser mechanism at the microscopic level.

4. Scaling law of homeopathy is satisfied

The approximate doubling of the ULF frequency of T-oscillations when the quartz crystal is turned to a horizontal position is consistent with the generalized scaling law of homeopathy. The ratio f_h/f_l of frequencies of microwave and ULF oscillations occurring at 51.2 min period is 3.1×10^{12} for $f_h = f_1$ and 6.2×10^{12} for $f_h = f_2$. In a good approximation this ratio differs by a factor 2^4 *resp.* 2^5 from $f_h/f_l = 2 \times 10^{11}$.

These findings support the scaling law of homeopathy, time mirror mechanism as a microscopic part of the four-wave interaction utilizing many-sheeted population inverted lasers, and quartz crystal as an amplifier of intentional action. Much remains however poorly understood. In particular, the question how the phenomenological description of the four-wave interaction and time mirror mechanism could be integrated to a more comprehensive theory, remains open

4 Great Vision About Biological Evolution And Evolution Of Brain

5 Great Vision About Biological Evolution And Evolution Of Brain

The following great vision about evolution and is not perhaps strictly about hierarchy of EEGs. The hierarchy of dark matter and EEGs however leads to this vision naturally. The first part of vision relates to biological evolution. Second part is about the evolution of brain. Here the key thread is evolution of two kinds of intelligences, the ordinary fast intelligence evolving via the emergence of fast computation type activities and emotional slow intelligence developing via the emergence of higher levels of dark matter hierarchy. The latter intelligence is what distinguishes us from animals.

5.1 Basic Assumptions

The great vision about evolution and brain relies on two several new notions and ideas.

1. Life as something in the intersection of real and p-adic worlds making possible negentropic entanglement- both space-like and time-like. This makes possible to understand what conscious intelligence is and NMP reduces evolution to a generation of negentropic entanglement (see **Fig.** `http://tgdtheory.fi/appfigures/cat.jpg` or **Fig. 6** in the appendix of this book). DNA as topological quantum computer hypothesis [K1] finds also a justification.

2. The notion of many-sheeted space-time (see **Fig.** `http://tgdtheory.fi/appfigures/manysheeted.jpg` or **Fig.** 9 in the appendix of this book) suggesting a universal hierarchy of metabolic energy quanta, and the notion of magnetic body.

3. Communication and control based on Josephson radiation and cyclotron transitions crucial for understanding bio-photons and EEG and its fractal generalization as a key element of bio-communications.

4. Zero energy ontology and the closely related notion of causal diamond (CD) assigning a hierarchy of macroscopic time scales to elementary particles coming as octaves of the basic time scale and justifying p-adic length scale hypothesis. Zero energy energy ontology also justifies the vision about memory and intentional action and the idea that motor action can be seen as time reversal of sensory perception.

5. The hierarchy of Planck constants and the identification of the fundamental evolutionary step as an increase of Planck constant. Evolutionary steps mean migration to the pages of the Big Book labeled by larger values of Planck constant and living system can be regarded as a collection of pages of the Big Book such that a transfer of matter and energy between the pages is taking place all the time. The change of the Planck constant implies either reduction or increase of the quantum scales-this leads to a model for biocatalysis and a model of cognitive representations as scaled down or scaled up "stories" mimicking the real time evolution.

6. A resonant like interaction between hierarchy of Planck constants and p-adic length scale hierarchy favoring the values of Planck constant proportional to powers of two, and idea that weak and color interactions are especially important in the length scales which correspond to Mersenne primes and Gaussian Mersennes. The simplest option is that weak bosons have their standard masses but appear as massless below their Compton length which scales up like $\hbar$ and preferred p-adic length scales correspond to Mersenne primes. Also copies of weak bosons and gluons with ordinary value of Planck constant and reduced mass scale can (and will) be considered.

5.1.1 How to identify the preferred values of Planck constant?

The basic problem is to identify the preferred values of Planck constant and here one can only make theoretical experimentation and all what follows must be taken in this spirit. One can consider assumptions which become increasingly stronger.

1. If only singular coverings of CD and CP_2 are possible Planck constant is a product of integers. Algebraic simplicity of algebraic extensions of rationals favors ruler and compass integers (Appendix).

2. A resonant interaction between the dark length scales and p-adic length scales with ordinary value of Planck constant favors Planck constants coming as powers of two.

3. An even stronger assumption would be that p-adic length scales coming as Mersennes and Gaussian Mersennes are especially interesting.

   (a) If weak bosons can appear with the ordinary value of Planck constant only in the p-adic length scale $k = 89$, one obtains the condition

$$k_d = k - 89 \ , \quad k \in \{89, 107, 113, 127, 151, 157, 163, 167\} \tag{5.1}$$

for the values of of $r = 2^{k_d}$ allowing dark weak bosons in p-adic length scales assignable to Mersennes. These values of k_d assign to electrons and quarks dark p-adic length scales $L(k_{eff}) = \sqrt{r}L(k)$, $r \equiv \hbar/\hbar_0 = 2^{k_d}$. The scales could correspond to size scales of basic units of living systems.

(b) If weak bosons and possibily also gluons with ordinary value of Planck constant are possible in all p-adic length scales $L(k)$, $k \in \{89, 107, 113, 127, 151, 157, 163, 167\}$, one obtains much richer structure. This hierarchy defines defines secondary dark matter hierarchies from the condition that the scaling the p-adic length scale $L(k_1)$ in this set by $\sqrt{r}$, $r \equiv \hbar/\hbar_0 = 2^{k_d}$, gives a p-adic length scale equal to another p-adic length scale $L(k_2)$ in this set. This requires $k_d + k_1 = k_2$ so that the values

$$k_d = k_2 - k_1 \tag{5.2}$$

are favored for the scaling of $\hbar$. In this case the hierarchy of dark scales assignable to quarks and leptons is much richer. The tables below demonstrate that electron appears as its dark variant for all Mersennes and also in atomic length scales $k = 137, 139$ so that this option puts electron in a completely unique position.

4. Also other scales are possible. For instance, $r = 2^{47}$ required by 5 Hz Josephson frequency gives dark weak scale which corresponds $k = 136$ as a p-adic scale. The stages of sleep can be understood in terms of scaling of $\hbar$ by factor 2 and 4 so that also the atomic length scale $k = 137$ and the scale $k = 138$ are involved.

Since the experimental input is rather meager, one is forced to do theoretical experimentation with various hypothesis. The quantitative experimental tests are rather primitive but basically quantal.

1. The time scales assignable to CDs of leptons and quarks and their scaled up counterparts for the preferred values of Planck constant should define biologically important time scales. One might even speak about evolutionary level of electron. These time scales could define fundamental biorhythms and also time scales of long term memory and planned action.

2. Josephson frequencies and cyclotron frequencies scaling like $1/\hbar$ (if magnetic field scales down like $1/\hbar$) charactering biologically important ions and elementary particles. In accordance with the quantum criticality of living matter it is assumed that cell membrane corresponds to almost vacuum extremal so that classical Z^0 force is an essential element of the model. Also these frequencies should define fundamental bio-rhythms and characterize the evolutionary level of cell. Experimentally of special importance are the cyclotron frequencies assignable to Ca^{++} ions.

3. The amplitude windows for electric field scaling like $\hbar$ for a particular cyclotron frequency define a basic prediction.

5.1.2 Tables about predicted time and length scales

The following tables summarize various predictions for time scales and length scales. They correspond to the most general assumption that exotic bosons with the ordinary value of Planck constant are possible in all length scales associated with Mersennes and Gaussian Mersennes.

Note that **Table 1** includes only the dark length scales associated with $k = 89$ gauge bosons.

k_d	p_1	p_2		k_d	p_1	p_2
4	163	167		38	**89**	127
6	107	113		38	113	151
6	151	157		40	127	167
6	157	163		44	107	151
10	157	167		44	113	157
12	151	163		50	107	157
14	113	127		50	113	163
16	151	167		54	113	167
18	**89**	107		56	107	163
20	107	127		60	107	167
24	**89**	113		62	**89**	151
24	127	151		68	**89**	157
30	127	157		74	**89**	163
36	127	163		78	**89**	167

Table 1: The integers k_d characterizing the preferred values of $r = \hbar/\hbar_0 = 2^{k_d}$ identified from the condition that the dark variant of p-adic length scale $L(p_1)$ corresponding to some ordinary p-adic length scale defined by Mersenne prime M_p or Gaussian Mersenne $M_{G,p}$, $p \in \{89, 107, 113, 127, 151, 157, 163, 167\}$ corresponds to similar p-adic length scale $L(p_2)$. If one assumes that weak bosons can appear with ordinary value of Planck constant only in the p-adic length scale $k = 89$, only the rows with $p_1 = 89$ of the table are possible: in these cases p_1 is in boldface and the row has double underline. The corresponding values of k_d are in the set $\{18, 24, 38, 62, 68, 74, 78\}$.

5.1.3 Electron and u quark are different

Before continuing an important observation is in order. Electron is exceptional when compared to quarks. It appears as a dark particle in all p-adic length scales defined by biologically important Gaussian Mersennes and also in atomic length scales $k = 137$ and $k = 139$. The reason is trivial: by the basic assumptions electron must appear at same length scales as weak bosons above $k = 127$ since it corresponds to Mersenne prime. Also for the less general option (exotic intermediate gauge bosons are possible only as the dark variants of the standard ones) it appears at cell membrane length scale $k = 151$, which is due to the fact that one has $113 - 89 = 151 - 127 = 24$. Also u quark can appear with $k_{eff} = 137, 139, 163, 167$ and also this is an accident. The light invariants of intermediate gauge bosons appearing in long p-adic length scales would naturally correspond to almost vacuum extremals making possible the criticality as the basic aspect of life. One must of course be very cautious about the masses of exotic counterparts of u and d quark: one can also consider the possibility that masses are identical.

5.2 Dark Matter Hierarchy And Big Leaps In Evolution

Dark matter hierarchy leads to an amazingly concrete picture about evolutionary hierarchy allowing to identify the counterparts for concepts like mineral, plant, and animal kingdom that we learned during schooldays and ceased to take seriously as students of theoretical physics as we learned that other sciences are just taxonomy. Even more, a view about what distinguishes between prokaryotes, eukaryotes, animal cells, neurons, EEG, and even about what makes cultural evolution, becomes possible. This view is also very useful when one tries to understand the role of microtubules.

The appearance of CDs scaled up in size by $r = \hbar/\hbar_0$ and space-time sheets scaled up in size by $\sqrt{r}$ means the emergence of new levels of structure and it is natural to identify big leaps in evolution in terms of emergence of new larger matter carrying space-time sheet magnetic flux sheets and corresponding magnetic bodies. If magnetic flux quanta are scaled by r magnetic flux quantization conditions remain unaffected if magnetic field strengths scale down by $1/r$ so that the energies of cyclotron photons are not affected. The thickness of flux tubes can remain unchanged if the currents running at the boundaries of the flux quantum cancel the magnetic flux. As already

Z, W	d	u	e	k_d
89	120	124	127	**0**
93	124	127	131	4
95	126	129	133	6
99	130	133	137	10
101	132	135	139	12
103	134	137	141	14
105	136	139	143	16
107	138	141	145	**18**
109	140	143	147	20
113	144	147	151	**24**
119	150	153	157	30
125	156	159	163	36
127	158	161	165	**38**
129	160	163	167	40
133	164	167	171	44
139	170	173	177	50
143	174	177	181	54
145	176	179	183	56
149	180	183	187	60
151	182	185	189	**62**
157	188	191	195	**68**
163	194	197	201	**74**
167	198	201	205	**78**

Table 2: The dark p-adic length scales $\sqrt{r}L(k) = L(k_{eff})$, $k_{eff} = k + k_d$, of intermediate gauge bosons Z, W, d and u quarks, and electron for the values $r = 2^{k_d}$ of Planck constant defined in **Table 1**. The uppermost row gives the integers characterizing the p-adic length scales of the particles for the standard value of Planck constant. k_{eff} characterizes also the CD times scale through the formula $T(CD, k_{eff}) = 2^{k_{eff}-127} \times .1$ seconds. The rows which correspond to the less general option for which only M_{89} corresponds to weak bosons with ordinary value of Planck constants have double underline and the corresponding values of k_d are in boldface.

k_1	k_M		k_1	k_M		k_1	k_M		k_1	k_M
113	89		113	107		163	127		163	157
127	89		119	107		167	127		169	157
151	89		123	107		133	127		173	157
157	89		113	107		139	127		163	157
163	89		117	107		143	127		167	157
167	89		111	107		133	127		161	157
95	89		175	113		137	127		169	163
109	89		181	113		131	127		183	163
133	89		187	113		225	151		207	163
139	89		191	113		229	151		213	163
145	89		119	113		157	151		219	163
149	89		133	113		171	151		223	163
103	89		157	113		195	151		177	163
127	89		163	113		201	151		201	163
133	89		169	113		207	151		207	163
139	89		173	113		211	151		213	163
143	89		127	113		165	151		217	163
113	89		151	113		189	151		187	163
119	89		157	113		195	151		193	163
125	89		163	113		201	151		199	163
129	89		167	113		205	151		203	163
95	89		137	113		175	151		169	163
101	89		143	113		181	151		175	163
105	89		149	113		187	151		179	163
95	89		153	113		191	151		169	163
99	89		119	113		157	151		173	163
93	89		125	113		163	151		167	163
145	107		129	113		167	151		187	167
169	107		119	113		157	151		211	167
175	107		123	113		161	151		217	167
181	107		117	113		155	151		223	167
185	107		195	127		235	157		227	167
113	107		201	127		163	157		181	167
127	107		205	127		177	157		205	167
151	107		133	127		201	157		211	167
157	107		147	127		207	157		217	167
163	107		171	127		213	157		221	167
167	107		177	127		217	157		191	167
121	107		183	127		171	157		197	167
145	107		187	127		195	157		203	167
151	107		141	127		201	157		207	167
157	107		165	127		207	157		173	167
161	107		171	127		211	157		179	167
131	107		177	127		181	157		183	167
137	107		181	127		187	157		173	167
143	107		151	127		193	157		177	167
147	107		157	127		197	157		171	167

Table 3: Table gives all weak boson length scales -both non-dark and dark implied by the assumption that all Mersennes primes and their Gaussian counterparts and their dark counterparts defined $k_d = k_i - k_j$ them are possible.

particle	Z, W	d	u	e
k	89	120	123	127
f(CD)/Hz	2.7488×10^{12}	1280	160	10

Table 4: The fundamental frequencies associated with the CDs of intermediate gauge bosons Z, W, d and u quarks, and electron. Note that for intermediate gauge bosons the frequency of CDs corresponds to energy $E = 1.13 \times 10^{-2}$ eV and wavelength $\lambda = 1.01 \times 10^{-4}$ m (size of a large neuron).

Z, W	d	u	e	k_d
3.64e-13	7.81e-04	6.25e-03	1.00e-01	**0**
5.821e-12	1.25e-02	1.00e-01	1.60e+00	4
2.31e-11	5.00e-02	4.00e-01	6.40e+00	6
3.73e-10	8.00e-01	6.40e+00	1.02e+02	10
1.49e-09	3.20e+00	2.56e+01	4.10e+02	12
5.97e-09	1.28e+01	1.02e+02	1.65e+03	14
2.38e-08	5.12e+01	4.10e+02	6.55e+03	16
9.54e-08	2.05e+02	1.64e+03	2.62e+04	**18**
3.81e-07	8.19e+02	6.55e+03	1.05e+05	20
6.10e-06	1.31e+04	1.05e+05	1.68e+06	**24**
3.91e-04	8.39e+05	6.71e+06	1.07e+08	30
2.50e-02	5.37e+07	4.30e+08	6.87e+09	36
1.00e-01	2.15e+08	1.72e+09	2.75e+10	**38**
4.00e-01	8.59e+08	6.87e+09	1.10e+11	40
6.40e+00	1.37e+10	1.10e+11	1.76e+12	44
4.10e+02	8.80e+11	7.04e+12	1.12e+14	50
6.55e+03	1.41e+13	1.13e+14	1.80e+15	54
2.62e+04	5.63e+13	4.50e+14	7.21e+15	56
4.19e+05	9.01e+14	7.21e+15	1.15e+17	60
1.68e+06	3.60e+15	2.88e+16	4.61e+17	**62**
1.07e+08	2.31e+17	1.84e+18	2.95e+19	**64**
6.87e+09	1.48e+19	1.18e+20	1.89e+21	**74**
1.10e+11	2.36e+20	1.89e+21	3.02e+22	**78**

Table 5: The $\hbar$-scaled fundamental time scales $T(CD, k_{eff}) = 2^{k_{eff}-127} \times .1$ seconds associated with the CDs of intermediate gauge bosons Z, W, d and u quarks, and electron for the values $\hbar/\hbar_0 = 2^{k_d}$ of Planck constant defined in **Table 1**. The scales are expressed in seconds. The uppermost row gives the time scales of CDs for the standard value of Planck constant. The rows which correspond to the less general option for which only M_{89} corresponds to weak bosons with ordinary value of Planck constants have double underline and the corresponding values of k_d are in boldface.

found, this mechanism must be at work inside living organisms wheras in far away region flux quanta are scaled up in size.

The attractive hypothesis is that the leaps in evolution correspond to the emergence of dark variants of weak and possibly also color interactions in dark p-adic length scales which correspond to ordinary p-adic length scales characterized by Mersenne primes. These leaps would be quantum leaps but in different sense as thought usually. The emergence of higher dark matter levels would basically mean the integration of existing structures to larger structures. A good metaphor are text lines at the pages of book formed by magnetic flux sheets whose width is scaled up by r as the new level of dark matter hierarchy emerges. The big leaps can occur both at the level of organism and population and organisms with rather low individual dark matter level can form societies with high dark matter levels and high collective intelligence (honeybees and ants are good example in this respect).

Certainly also other scalings of Planck constant than those summarized in tables are possible but these scalings are of primary interest. This intuition is supported by the observation that electron is completely exceptional in this framework. Electron's dark p-adic length scales corresponds to p-adic length scales $L(k)$, $k = 167, 169$, assignable to atomic and molecular physics and to the Gaussian Mersennes $M_{G,k} = (1+i)^k - 1$, $k \in \{151, 157, 163, 167\}$, assignable to the length scale range between cell membrane thickness 10 nm and nucleus size 2.58 μm. The corresponding p-adic length scales or corresponding electronic Compton lengths, the number of which is 23, are excellent candidates for the scales of basic building brickes of living matter and vary from electron's p-adic length scale up to 1.25 m ($k = 167$ defining the largest Gaussian Mersenne in cell length scale range) and defining the size scale of human body. The corresponding p-adic time scales are also highly interesting and vary from.1 seconds for electron defining the fundamental biorhythm to 9.6×10^{14} years which is by 4-5 orders longer than the age of the observed Universe. For $k = 167$ the time scale is 1.1×10^{11} years and is by one order of magnitude longer than the age of the observed Universe estimated to be 1.37×10^{10} years [E1].

This conceptual framework gives rather strong guidelines for the identification of the levels of evolutionary hierarchy in terms of dark matter hierarchy. The outcome is a more detailed vision about big evolutionary leaps. Note that in the sequel only the general option is considered: the justification for this is that for this option electron appears as a dark particle for all length scales defined by Gaussian Mersennes as well as in atomic length scales. The basic vision in nutshell is that evolution means the emergence of dark weak and gluonic physics in both dark and ordinary length scales and that the size scales of the basic biostructures correspond to Mersenne primes and their Gaussian variants.

5.2.1 A sketch about basic steps in evolution

The vision about evolution depends on what one assumes about the initial state.

1. If one assumes that weak bosons with ordinary value of Planck constant were present in the begining, evolution would mean a steady growth of k_d. The problem is that small values of $k_d = k_1 - k_2$ correspond to the Gaussian Mersennes defining cellular length scales. If these exotic weak physics were present from the beginning, large parity breaking in cellular length scales would have been present all the time.

2. An alternative and perhaps more realistic view is that the evolution means the emergence of exotic weak physics corresponding almost vacuum extremals in increasingly longer length scales. A possible mechanism could have been the induction of exotic $\hbar_0$ variant of weak physics at the nearest Mersenne length scale k_{next} by the dark variant of weak physics at level k so that one would have $k_d = k_{next} - k$. The simplest induction sequence would have been $89 \to 107 \to 113 \to 127 \to 151 \to 157 \to 163 \to 167$ corresponding to $k_d \in \{18, 6, 14, 24, 6, 6, 4\}$. A possible interpretation of exotic $\hbar_0$ physics is in terms of almost vacuum extremals and non-standard value of Weinberg angle: also weak bosons of this physics would be light. This sequence defines the minimal values for k_d but also larger values of k_d are possible and would correspond to steps between neighbours which are not nearest ones.

The following sketch about the basic steps of evolution relies on the latter option.

1. Elementary particle level

Magnetic bodies with size scale defined by the sizes of CDs assignable to quarks and leptons and possibly also weak bosons (already now the size of big neuron emerges) corresponds to the lowest level of hierarchy with the sizes of the basic material structures corresponding to the Compton lengths of elementary particles. The fundamental bio-rhythms corresponding to frequencies 10, 160, and 1280 Hz appear already at this level in zero energy ontology which suggests that elementary particles play a central and hitherto unknown role in the functioning of living matter.

2. $89 \to 107$ *step with* $k_d = 18$

The first step would have been the emergence of $k_{eff} = 107$ weak bosons inducing $\hbar_0$ weak physics in $k = 107$ length scale characterizing also ordinary hadrons. This in turn would have led to the emergence of exotic nucleons possibly corresponding to almost vacuum extremals. The reduction of the model for the vertebrate genetic code to dark hadron physics [K41] is one of the most unexpected predictions of quantum TGD and assumes the existence of exotic- possibly dark- nucleons whose states with a given charge correspond to DNA, RNA, mRNA, and tRNA. The $\hbar_0$ variants of these nucleons would interact via weak bosons with hadronic mass scale. The exotic variants of the ordinary $k = 113$ nuclei would correspond to the nuclear strings consisting of exotic nucleons [K7, K41] and define nuclear counterparts for DNA sequences. Their dark counterparts could define counterparts of DNA sequences in atomic physics length scales. Therefore a justification for the previous observation that genetic code could be realized at the level of hadron physics and that chemical realization would be higher level realization finds justification. The anomalous properties of water could be also partly due to the presence of dark nucleons and the proposal was that the presence of exotic nuclei is involved with water memory [K19]. The possible existence of the analog of DNA-RNA transcription between ordinary DNA and its nuclear counterpart would have dramatic implications. For instance, one can imagine a mechanism of homeopathy based on this kind of transription process which would also allow a modification of genome by using dark nuclei to communicate the DNA sequences through the cell membrane to the target nuclei.

3. $107 \to 113$ *step with* $k_d = 6$

The next step would have been the emergence of $k_{eff} = 113$ weak bosons inducing $\hbar_0$ weak physics in $k = 113$ length scale characterizing also ordinary hadrons. Exotic variants of the ordinary nuclei possibly corresponding to almost vacuum extremals could have emerged interacting weakly (or actually relatively strongly!) via the exchange of weak bosons with mass scale of order 100 MeV. Also dark variants of the exotic $k = 107$ nucleons could have have emerged and formed exotic nuclei of size scale $k = 119$.

4. $113 \to 127$ *step with* $k_d = 14$

At this step weak bosons in electron mass scale would have emerged. Whether these weak bosons could have induced large parity breakings in atomic and molecular length scales is not clear. Viruses, which do not yet possess cell membrane could correspond to this level of hierarchy.

5. $127 \to 151$ *step with* $k_d = 24$

This step would have been fundamental since weak bosons in cell membrane length scale would have appeared. Note that by $113 - 89 = 24$ this step also leads from $k = 89$ weak bosons to $k = 113$ weak bosons. The weak bosons assignal to $k = 151$ could correspond to the weak interactions associated with almost vacuum extremals and $sin^2(\theta_W) = .0295$ could correspond to the weak physics in question.

$k_d = 24$ step for $k = 113$ $\hbar_0$ weak bosons would have produced them in $k_{eff} = 137$ atomic length scale with $L(137) \simeq .78$ Angstrom This could have naturally led to large parity breaking effects and chiral selection.

Dark $k_{eff} = 151$ electrons appearing in the TGD inspired model of high T_c super-conductivity would have been a by-product of this step. Whether dark electrons could have transformed to light $\hbar_0$ electrons (of mass.25 keV) with a common mass scale of order 10^2 eV with exotic weak bosons is an interesting question. The model of high T_c super-conductivity predicts the presence of structures analogous to cell membrane. This would suggest that cell membranes emerged and chiral selection emerged at this step so that one could not distinguish the emergence of molecular life as a precedessor for the emergence of cell membrane like structures. This would conform with

the fact that DNA molecules are stable only inside cell nucleus. Note that for $k_{eff} = 151$ electron's CD has time scale $2^{24} \times .1$ seconds -that is 19.419 days (day=24 hours).

The smallest nanobes [I2] appearing in rocks have size 20 nm and could have emerged at this step. The size of the viruses [I3] is between 10-300 nm covers the entire range of length scales assignable to Gaussian Mersennes, which suggests that smallest viruses could have emerged at this step. Also the smallest [I1] [I1], which by definition have size smaller than 300 nm could have appeared at this stage.

6. The remaining steps

The remaining steps $k = 151 \to 157 \to 163 \to 167$ could relate to the emergence of coiling structure DNA and other structures inside cell nucleus. $k = 167$ would correspond to $k_d = 167 - 89 = 68$ to be compared with the value $k_d = 47$ required by 5 Hz Josephson frequency for the neuronal membrane for -70 mV resting potential. Note that $k_d = 48$ (state 1-2 of deep sleep) corresponds to $k = 163$.

By their smallness also double and triple steps defined by $k_d = k_{i+n} - k_i$, $n > 1$, are expected to be probable. As a consequence, electrons can appear as dark electrons at all the Gaussian Mersenne levels. At these steps the dark electrons corresponding to primes $k_{eff} = 137, 139$ would appear. For $k = 137$ dark electron appears with CD time scale equal to 128 seconds- rather precisely two minutes. The model for EEG suggests that the exotic weak bosons appear in the scales $k_{eff} = 136, 137, 138$.

Further multisteps from the lower levels of hierarchy would give structures with size scales above the size of cell nucleus possibly assignable to organs and structural units of brain. The dark levels assignable to electron are expected to be of special interest. It is encouraging that the longest scale assignable to electron in this manner corresponds to $k = 205$ and length scale of 1.28 m defining body size. As a consequence dark electrons are predicted at levels $k = 137, 139, 141, 143, 145, 147$ coming as octaves.

Prokaryotic cells (bacteria, archea) without cell nucleus for which cell membrane is responsible for metabolic functions and genome is scattered around the cell could have emerged at this step. This would mean that the emergence of the cell membrane thickness as a fundamental scale is not enough: also the size scale of membrane must appear as p-adic length scale. The sizes of most prokaryotes vary between 1 μm and 10 μm: the lower bound would require $k = 163$. There also prokaryotes with sizes between.2 μm ($k = 157$ corresponds to.08 μm) and 750 μm. Cell nuclei, mitochondria, and other membrane bounded cell nuclei would have evolved from prokaryotes in this framework. The sizes of eukaryote cells are above 10 μm and the fact that multicellular organisms are in question strongly suggests that the higher multisteps giving rise to weak bosons and dark electrons in length scales above $L(167)$ are responsible for multi-cellular structures.

This scenario leaves a lot of questions unanswered. In particular, one should understand in more detail the weak physics at various length scales as well as various exotic nuclear physics defined by dark nucleons and dark variants of nuclei.

5.2.2 Division of the evolution to that of biological body and magnetic body

Electron's Mersenne prime M_{127} is the highest Mersenne prime, which does not correspond to a completely super-astrophysical p-adic length scale. In the case of Gaussian Mersennes $M_{G,k}$ one has besides those defined by k in $\{113, 151, 157, 163, 167, \}$ also the ones defined by k in $\{239, 241, 283, 353, 367, 379, \ 457, 997\}$ [A1]. The appropriately extended model for evolution allows to distinguish between three kinds of values of k_{eff}.

1. The values of k_{eff} for which electron can appear as dark particle and thus satisfying $k_{eff} \leq 205$ (Table 5). These levels would correspond to structures with size below 1.25 m defined roughly by human body size and it is natural to assign the evolution of super-nuclear structures to the levels $167 < k_{eff} \leq 205$.

2. The values of of k_{eff} for which dark gauge bosons are possible in the model. This gives the condition $k_{eff} \leq 235$. These levels correspond to structures in the range 1.25 m-40 km. The identification as parts of the magnetic body can be considered.

3. The values of k_{eff} obtained by adding to the system also the Gaussian Mersenne pair $k \in \{239, 241\}$ allowing also the dark electrons. The lower size scale for these structures is 640 km.

4. The higher levels corresponding to k_{eff} in $\{283, 353, 367, ...\}$. The lower size scale for these structures is 3 AU (AU is the distance from Earth to Sun).

$k_{eff} > 205$ levels would correspond to the emergence of structures having typically size larger than that of the biological body and not directly visible as biological evolution. This evolution could be hidden neuronal evolution meaning the emergence of extremely low Josephson frequencies of the neurons modulating higher frequency patterns and being also responsible for the communication of long term memories.

5.2.3 Biological evolution

In principle the proposed model allowing multisteps between hierarchy levels defined by Mersenne primes and their Gaussian counterparts could explain the size scales of the basic structures below the size scale 1.25 m identified in terms of the $k_{eff} \leq 205$ levels of the hierarchy.

1. The emergence of cells having organelles

The appearance of the structures with $k_{eff} > 167$ (possibly idetifiable as magnetic body parts) should correlate with the emergence of simple eukaryotic cells and organisms, in particular plant cells for which size is larger than 10 μm, which could correspond to $k_{eff} = 171$ for electron and dark variants of weak gauge bosons. $k_{eff} = 177$ is the next dark electron level and corresponds to 80 μm scale. It seems natural to assume that these dark weak bosons do not transform to their $\hbar_0$ counterparts at these space-time sheets.

Cell nucleus would be the brain of the cell, mitochondria would be the energy plant, and centrioles generating microtubules would define the logistic system. Also other organelles such as Golgi apparatus, ribosomes, lysosomes, endoplasmic reticulum, and vacuoles would be present. These organelles would live in symbiosis by topologically condensing to $k_{eff} \geq 171$ magnetic body controlling their collective behavior. Centrosomes associated with animal cells would not be present yet but microtubule organizing centers would already be there.

The recent observations show that centrioles are not always in the characteristic T shaped conformation. Daughter centrioles resulting during the replication of mother centriole use first ours of their lifetime to roam around the cell before becoming mature to replicate. A possible interpretation is that they are also life forms and that magnetic body utilizes daughter centrioles to perform some control functions crucial for the future development of the cell. For instance, centrioles visit the place where axonal growth in neurons starts.

Cytoskeleton would act as a counterpart of a central nervous system besides being responsible for various logistic functions such as transfer of proteins along microtobuli. Centrioles give also rise to basal bodies and corresponding cilia/flagella used by simple cells to move or control movement of air or liquid past them. Centriole pair would be also used by the magnetic body to control cell division.

The logistic functions are the most obvious functions of microtubules. Magnetic body would control cell membrane via signals sent through the cell nucleus and communicated to the cell membrane along microtubuli. Basal bodies below the cell membrane and corresponding cilia/flagella would serve as motor organs making possible cell motion. Tubulin conformations representing bits would allow microtubule surface to represent the instructions of the magnetic body communicated via via cell nucleus to various proteins moving along the microtubular surface so that they could perform their functions.

TGD based view about long memory recall as communication with geometric past allows also the realization of cellular declarative memories in terms of the conformational patterns. Memory recall corresponds to a communication with geometric past using phase conjugate bosons with negative energies reflected back as positive energy bosons and thus representing an "image" of microtubular conformation just like ordinary reflected light represents ordinary physical object. There would be no need for a static memory storage which in TGD framework would mean taking again and again a new copy of the same file.

Receptor proteins would communicate cell level sensory input to the magnetic body via MEs parallel to magnetic flux tubes connecting them to the magnetic body. We ourselves would be in an abstract sense fractally scaled up counterparts of receptor proteins and associated with dark matter iono-lito Josephson junction connecting the parts of magnetosphere below litosphere and above magnetosphere. The communication would be based on Josephson radiation consisting of photons, weak bosons, and gluons defining the counterpart of EEG associated with the level of the dark matter hierarchy in question.

3. The emergence of organs and animals

The emergence of magnetic bodies with k_{eff} in the range $(177, 181, 183, 187, 189, 195, 201, 205)$ allowing both dark electron and weak bosons could accompany the emergence of multicellular animals. Magnetic body at this level could give rise to super-genome making possible genetic coding of organs not yet possessed by plant cells separated by walls from each other. The super structures formed from centrosomes and corresponding microtubuli make possible complex patterns of motion requiring quantum coherence in the scale of organs as well as memories about them at the level of organs.

4. The emergence of nervous system

k_{eff} in the range $(187, 189, 195, 201, 205)$ allowing dark electrons and weak bosons gives size scales $(.25, .5, 4, 32, 128)$ cm, which could correspond to the scales of basic units of central nervous system. What would be of special interest would be the possibility of charged entanglement based on classical W fields in macroscopic length scales. The emergence of the new level means also the integration of axonal microtobuli to "text lines" at the magnetic flux sheets making possible logistic control at the multineuronal level. The conformational patterns of the microtubular surface would code nerve pulse patterns to bit patterns representing declarative long term memories. An interesting question is whether the reverse coding occurs during memory recall.

5.2.4 The evolution of magnetic body

For mammals with body size below 1.25 m the levels $k_{eff} > 205$ cannot correspond to biological body and the identification in terms of magnetic body is suggestive. The identification of EEG in terms of Josephson frequencies suggests the assignment of EEG with these levels.

1. The emergence of EEG

EEG in the standard sense of the word is possessed only by vertebrates and one should understand why this is the case. The value of Josephson frequency equal to 5 Hz requires only $k_d = 47$ so that something else must be involved. A possible explanation in the framework of the proposed model comes from the following observations.

1. Besides the maximal p-adic scale $k = 205$ for which electron and weak bosons appears as dark variants the model allows also levels at which only gauge bosons appear as dark particles. From **Table 5**one finds that levels $k \in \{207, 211, 213, 217, 219, 221, 223, 225, 229, 235\}$ are allowed. Could it be that these levels and possibly some highest levels containing both electrons and gauge bosons as dark particles are a prerequisite for EEG as we define it. Its variants at higher frequency scales would be present also for invertebrates. The lowest Josephson frequency coded by the largest value of $\hbar$ in the cell membrane system determines the Josephson frequency.

2. The membrane potentials -55 mV (criticality against firing) correspond to ionic Josephson energies somewhat above 2 eV energy ((2.20, 2.74, 3.07, 2.31) eV, see Table 1). For 2 eV the wavelength 620 nm is near to $L(163) = 640$ nm. Therefore the Josephson energies of ions can correspond to the $L_e(k = 163)$ if one assumes that a given p-adic mass scale corresponds to masses half octave above the p-adic mass scale so that the opposite would hold true at space-time level by Uncertainty Principle. Josephson frequencies $f_J \in \{5, 10, 20, 40, 80, 160\}$ Hz correspond to $k_d \in \{47, 46, 45, 44, 43, 42\}$ giving $k_{eff} \in \{210, 209, 208, 207, 206, 205\}$.

   (a) Cerebellar resonance frequency 160 Hz would correspond to $k = 205$ -the highest level for for which model allows dark electrons (also 200 Hz resonance frequency can be understood since several ions are involved and membrane potential can vary).

k_d	f_1/Hz	f_2/Hz	f_3/Hz
0	707	1000	1412
4	177	250	354
6	89	1250	177
10	22.1	31.3	44.2
12	11.1	15.6	22.1
14	5.5	7.8	11.1
16	2.8	3.9	5.5
18	1.4	2.0	2.8
20	0.7	1.0	1.4
24	0.2	0.2	0.3

Table 6: The Compton frequencies obtained by scaling $2^{k_d/2}$ from the basic triplet $k_{eff} = (239, 240, 241)$. The values of k_d correspond to those predicted by the model based on Mersenne primes.

   (b) The 80 Hz resonance frequency of retina would correspond to $k_{eff} = 206$ -for this level dark electrons would not be present anymore.

   (c) 40 Hz thalamocortical frequency would correspond to $k_{eff} = 207$.

   (d) For EKG frequencies are EEG frequencies below 20 Hz 12.5 and heart beat corresponds to .6-1.2 second cycle (the average.8 s corresponds to $k_{eff} = 212$).

3. Even values of k_{eff} are not predicted by the model based on Mersenne primes allowing only odd values of k_{eff} so that the model does not seem to be the whole truth. The conclusion which however suggests itself strongly is that EEG and its variants identified as something in the range 1-100 Hz, are associated with the levels in at which only dark weak bosons are possible in the proposed model. Note that the size scales involved with EEG would be above the size scale of human body so that we would have some kind of continuation of the biological body to be distinguished from the magnetic body. The time scales assignable to the dark CDs would be huge: for instance, $k = 205$ would correspond to $T = 2^{42} \times .1$s making about 1395 years for electron.

2. Does magnetic body correspond to the space-time sheets carrying dark weak bosons?

The layers of the magnetic body relevant for EEG have have size of order Earth size. Natural time scale for the moment of sensory consciousness is measured as a fraction of second and the basic building blocks of our sensory experience corresponds to a fundamental period of.1 seconds. This scale appears already at $\hbar_0$ level for electron CD. The natural question concerns the relationship of the magnetic body to the $k > 205$ space-time sheets carrying only gauge bosons in the model and having size scale larger than that of biological body. Do they correspond to an extension of biological body or should they be regarded as parts of the magnetic body? The following observations suggest that they could correspond to layers of the magnetic body responsible for the fractal variant of EEG.

1. The primary p-adic time scales (Compton times) $T(239)$ and $T(241)$ correspond to frequencies, which are $2^{\pm 1/2}$ kHz. The geometric average $k = 240$ corresponds to kHz frequency. Is the appearance of kHz scale a mere accident or do the frequencies assignable to the quark CDs correspond to Compton times $\propto \sqrt{2^{k_{eff}/2}}$?

2. One can apply scalings by 2^{k_d} to the triplet $(239, 240, 241)$ to get a triplet $(239 + k_d, 240 + k_d, 241 + k_d)$. The results are summarized in **Table 6**. Clearly the frequencies in question cover also the EEG range. Note that these frequencies scale as $\sqrt{1/r}$ whereas Josephson frequencies scale as $1/r$.

Also ZEG and WEG would appear but in much shorter scales dictated by k_{eff} and might accompany EEG. Somehow it seems that the effective masslessness of weak bosons below given scale is highly relevant for life. One can of course ask whether some larger Gaussian Mersenne could change the situation. There is a large gap in the distribution of Gaussian Mersennes after $k = 167$ and the next ones correspond to $M_{G,k}$, with k in $(239, 241, 283, 353, 367, 379, 457, 997)$ [A1]. The twin pair $k = (239, 241)$ corresponds to a length scales $(1.6, 3.2) \times 10^2$ km and the minimum value for k_d are (72, 74) ($167 \to (239, 241)$ transition).

3. Long term memory and ultralow Josephson frequencies

What determines the time scale associated with long term memory is a crucial question if one really wants to understand the basic aspects of consciousness.

1. Does the time scale correspond to the size scale of CD assignable to electron scaled by $r = \hbar/\hbar_0$? In this case relatively small values of r would be enough and $r = 2^{47}$ would give time scale of 10^{13} s for for electron's CD, which is about 3×10^5 years. This does not make sense.

2. Does Josephson frequency define the relevant time scale? In this case the long term memory would require the analog of EEG in the time scale of memory span. $k_{eff} = 205$ would give 6 ms time scale for memory from the assignment of $k_{eff} = 163$ to the Josephson photons at V=-50 mV implying $k_d = 42$. Minute scale would require $k_{eff} = 217$. The highest level $k_{eff} = 235$ allowed by the model involving only Gaussian Mersennes with $k \leq 167$ would correspond to a time scale of 77.67 days (day is 24 hours). For Gaussian Mersennes defined by $k_{eff} = (239, 241)$ the time scales become about (41.4, 82.8) months (3.4 and 6.8 years). These scales should also define important biorhythms. The claimed 7 years rhythm of human life could relate to the latter rhythm: note that the precise value of the period depends on the membrane potential and thus varies. The presence of the scaled up variants of the by $k_d \leq 78$ allows longer time spans of long term memory and the scaling defined by $k_d = 167 - 163 = 4$ scales up the span of long term memories to (54.4, 108.8) years.

4. Cultural evolution

Higher levels in the hierarchy would correspond mostly to the evolution of hyper-genome coding for culture and social structures. Introns are good candidate for the nucleotides involved. The development of speech faculty is certainly a necessary prerequisite for this breakthrough. Already EEG seems to correspond to dark layers of biological body larger than biological body so that one can cask whether the weak bosons and dark electrons in the length scales $k = 239, 241, 283, 353, 367, ...$ could be relevant for the collective aspect of consciousness and cultural evolution. Maybe the size scales $(175, 330)$ km and their scaled up variants by $k_d \leq 78$ might have something to do with the spatial scale of some typical social structure (not city: the area of New York is only 790 km^2).

6 How Advanced Civilization Could Study Cosmos?

Space travel is not the best manner for the advanced civilization to study the surrounding cosmos. Rather, time mirror mechanism (see **Fig.** `http://tgdtheory.fi/appfigures/timemirror.jpg` or **Fig. 9** in the appendix of this book) seems to provide almost unlimited opportunities to achieve this. Chilbolton (see **Figs. 7** and**8**) and Crabwoodcrop circles suggest that aliens could be either intra-terrestrial life forms or ourselves in a relatively remote geometric future. The TGD based new physics suggest also a natural solution to the Fermi paradox ("Where are they all?").

6.1 Why Space Travel Is Not A Good Idea?

There are several arguments suggesting that space-travel over very long distances is not a good idea.

1. Direct encounters of life forms, which are at different evolutionary level would be probably lethal since immune systems would not be compatible. Thus there is no good reason for long space-travels.

2. With the recent technology the amount of fuel needed makes it impossible to get very far. Remote utilization of energy by time mirror mechanism could resolve this difficulty. Many-sheeted population inverted lasers might be everywhere and provide the needed energy. TGD suggests mechanisms making it possible to reduce the inertial mass of the space-ship dramatically. This kind of feather light space-ships could behave as UFOs are found to behave.

3. The finite value of the light velocity poses the most severe constraints. Time dilatation in principle allows the space-ship moving with sufficiently high velocity to get to arbitrary long distances in arbitrarily short proper time experienced by the crew. The problem is however that the civilization that send the crew to the flight could suffer extinction during the first days (as experienced by travellers) of the travel. Note however that time mirror mechanism could allow to circumvent this difficulty.

6.2 Time Mirror Mechanism As An Ideal Tool For The Study Of The Universe

Time mirror mechanism suggest a solution to the problem of communicating with civilizations in distant galaxies and light velocity ceases to be problem. Remote sensing in principle makes possible an active instantaneous scanning of arbitrarily distance galaxies. Remote motor control is also possible and in principle makes it possible to use simple life forms like plasmoids to perform desired tasks. These plasmoids could serve also as quantum mediums making sharing of mental images possible. This would give rise to a remote sensory system.

Also communications with the civilizations of the geometric future could be possible. p-Adic frequencies coming as half octaves of the frequency 10 Hz are excellent candidates for preferred frequencies and one can assign to each of these p-adic frequencies hierarchy of cognitive codes that with definite duration of code word and number of bits. Field patterns realizing these code words could provide means of communication with civilizations of both geometric future and past. ET experiences might have interpretation as a sharing of mental images induced by encounters with the plasmoids generated during the tectonic activity. Abduction experiences could represent real encounters with plasmoids.

Plasmoids could be seen an ideal realization for a living space-ship drawing its energy from environment. UFOs might be plasmoid structures emitted from the plasma sheet of some planet of a distant stellar system which have managed to penetrate through the cusp region of the magnetopause of Earth, which serves as a magneto-immune system preventing the penetration of solar and other interplanetary magnetic life forms inside magnetosphere. A civilization at sufficiently high level of development could even intentionally generate magnetic self-organization patterns leading to birth of plasmoid like life forms. The somewhat ghostly crew of a magneto-UFO could consists of magnetospheric sensory representations for the inhabitants of this planet but this would not diminish the reality of the experience. Space travel of mental images would not require transfer of huge amounts of fuel through cosmos and light velocity would not be a limitation for the communications. There are good reasons to believe that higher levels of the self hierarchy have discovered mental space travel long ago if even we have been able to invent it!

6.3 What Aliens Are?

The first possibility is that aliens are extraterrestrials. In this case one cannot say much more. If one takes crop circles as an attempt of aliens to tell something about their civilization one ends up with much more detailed speculations. Chilbolton and Crabwood crop formations are the most fascinating of these messages [H1, H2, H3, H4]. The Chilbolton and Crabwood crop circles allow to even deduce rather precise information about the genetic codes of the alien life forms, and the second genetic code involves 80 DNAs and 23 amino-acids. This would mean that the civilization in question might be at a much higher evolutionary level that we are, and could have developed antigravity technology for long time ago. I have discussed the interpretation of these formations in the [K9].

The fact that the Chilbolton message so soon after the sending of Arecibo message providing information about human kind as species and had same format as Arecibo message could mean that the constructor of the messages is inside or at least in the vicinity of solar system.

A plausible hypothesis is that the magnetosphere of Earth, or possibly also of Sun, defining kind of collective conscious entity having various biological life forms as its "cells", has generated the crop circles using the same basic mechanisms as magnetic bodies use to generate generalized motor actions in biological bodies. Magnetosphere could communicate its own higher level knowledge to us or could mediate a message from somewhere.

6.3.1 Do crop circles tell about solars or intra-planetaries?

If the crop circles are generated by control signals based on positive energy topological light rays, the constructor of the message, and perhaps also the civilization about which the message tells, can be at most at a distance of few light decades. Indeed, Chilbolton message suggests that the aliens live at Earth, Mars and Jupiter and perhaps even in Sun. The Sun is smaller than in Arecibo message, which might mean that the aliens live in below the corona, perhaps at the magnetic flux tubes of the convective zone carrying magnetic fields of order.2 Tesla for which electronic cyclotron radiation is at micro-wave range. The question is where in Earth's magnetosphere aliens could be hiding. The Freudian answer is that since they are not visible they must lurk in the cellar, that is underground. One can indeed build a vision about alien life based on this idea and consistent with the hints provided by the crop formations.

6.3.2 Do crop circles tell about futuro-terrestrials?

If the crop circles are generated by communications involving negative energy photons (phase conjugate light) then the signals responsible for the formation of crop circles arrive from the geometric future. In this case the civilization could be arbitrary far away from Earth. Chilbolton message however leaves only the possibility that the civilization is some other civilization or ourselves of the geometric future after the colonization of Mars and Jupiter. This civilization must have invented the technology making it possible to apply time mirror mechanism to induce magnetic self-organization patterns leading to the generation of plasmoids serving as mediums for telepathic communications and able to perform simple tasks like construction of crop circles.

6.3.3 How far in the geometric future futuro-terrestrials might live?

Chilbolton message could even allow to estimate how far in the geometric future the civilization constructing crop circles is located.

1. The smaller size of Sun could indeed mean a smaller size of Sun: standard model predicts that the radius increases very slowly so that this interpretation seems to be wrong in standard physics context. There are however highly controversial claims that Sun is shrinking with the rate of.1 per cent per century [E3]: $dlog(R)/dt = 10^{-3}/\tau$, $\tau = 100$ years. The analysis of [E5] however led to a conclusion that only oscillations with a period of 76 years are in question. If the shrinking occurred for the entire Sun rather than only surface layers, the claimed rate for shrinking would mean that gravitational energy would be liberated with a rate $P = GM_{Sun}^2/R \times dlog(R)/dt$, which would give $P \sim 10^{29}$ Watts, which is much higher than the power $P \sim 4 \times 10^{26}$ Watts radiated by Sun by known mechanisms.

   The presence of the classical Z^0 force could make possible considerable deviations from the standard stellar evolution and might be also needed to explain the oscillations of the solar radius. The increase of the gravitational binding energy could be compensated by the increase of the repulsive Z^0 Coulomb energy so that the catastrophic conclusion could be avoided. One could say that gravitational and Z^0 force serve opposite tendencies compensating each other in the "solar homeostasis".

   If the shrinking were real and would continue with the rate claimed in [E3], one would have $R/R_{now} = exp(-10^{-3}t/\tau)$. If the radius in Chilbolton message is by a factor $k < 1$ smaller than in Arecibo message, the proposed interpretation implies that the message must have been sent from a temporal distance $t \simeq log(1/k) \times 10^3\tau \sim 10^5$ years in the geometric future. A more realistic estimate would probably increase the value of t by some powers of 10. If this extremely light hearted argument were taken seriously, a breakthrough in time mirror technology is not to be expected during my lifetime!

2. There is also a second manner to estimate the value of temporal distance of crop circle artists from us. Crabwood formation appeared year and one day later than Chilbolton formation. A possible interpretation is as a message telling that the it takes one day more for Earth to rotate around Sun in the geometric future so that year is by one day longer.

   i) The mass loss of Sun causes the gradual weakening of the gravitational force of Sun causing the increase of the radii of planetary orbits and thus also of orbital periods. The rate for the increase of the orbital period is $dlog(T)/dt \equiv 1/\tau = -1/4 \times dlog(M_{Sun})/dt$. The rate of the solar mass loss is believed to be mostly due to the energy liberated in fusion, and one has in a good approximation $dlog(M)/dt = 10^{-13}/year$. This gives $T(t)/T(now) = exp(t/\tau)$. The lengthening of year by one day requires a time $t \simeq \tau/365 \sim 10^{11}$ years, which is about one percent of the rough estimate for the lifetime of Sun, and of the same order of magnitude as the estimates for the time parameter called the recent age of the Universe. In fact, Sun is estimated to become a red giant within 7.5 billion years making life as we understand it impossible at Earth.

   ii) Also cosmic expansion should affect the orbital radii of the planets. If the Hubble time t and radial coordinate r of Robertson-Walker cosmology with line element $ds^2 = dt^2 - a(t)^2(dr^2/(1+r^2)+r^2d\Omega^2)$ correspond to the coordinates t_{PN} and r_{PN} of the Post-Newtonian approximation, and if cosmic expansion can be treated adiabatically, the prediction is that the sizes of the planetary orbits increase are scaled as $L(a)/L(a_0) = a/a_0$, where a corresponds to M^4_+ light cone proper time appearing as the scaling factor of Robertson-Walker metric and related to the Hubble time t by $(t/t_0) = (a/a_0)^{3/2}$. By Kepler's law one has $T \propto L^{3/2}$ so that the period of the planetary orbit would scale as $T \propto a^{3/2} \propto t$. One day per year lengthening would correspond to $\Delta T/T = 1/365 = \Delta t/t$. For $t = 5 \times 10^9$ years this would give $\Delta t = 17$ million years.

   iii) The estimate above is based on the neglect of perturbations caused by planets to each other's orbits. The multiple gravitational resonances between planets resulting, when the ratios of rotation or precession periods are integer valued, are a route to chaos (in the sense of complexity rather than randomness) in the planetary system. Since also Z^0 force is $1/r^2$ force, this hold true also when classical Z^0 force is taken into account. These resonances can affect dramatically orbital parameters. Numerical simulations lead to the conclusion that the Lyapunov time of planetary system is 5-10 million years [E4]. If this holds true also in TGD Universe, then the parameter t for the future civilization for which year is one day longer than for us, could be as small as million years. In any case it seems that it takes quite a time to develop time mirror technology if this estimate makes sense.

6.4 Have More Advanced Civilizations Performed Genetic Engineering At Earth?

A fascinating possibility that extraterrestrials, intra-terrestrials, or ourselves of the geometric future have performed genetic engineering. There is some support that this might be occurring.

1. The first sensational finding was the outcome of Great Genome Project. The "head-scratching discovery" by the public consortium, as Science termed it, came when the human genome was compared with the genomes of our precedessors [I5, I11]. It was found that human genome contains 223 genes not possessed by invertebrates. Contrary to what one might expect, these 223 genes could make an enormous difference. The reason is that this number is more than two thirds of the number of the 300 genes differentiating between humans and chimpanzees so that these genes could be the main determinant of the dramatic difference between humans and chimpanzees in standard genetics. A possible explanation is that this difference is due to a genetic engineering carried out by a more advanced civilization [K9]. This genetic engineering might have induced the migration of Homo Sapiens from Africa and an explosive evolution of language and culture.

2. The second sensational finding reported towards the end of the year 2003 was that the genome of corals, which are the simplest life forms possessing neurons, seems to resemble much more vertebrate genome than it resembles genomes of flies and worms [I10]. Corals

resemble vertebrates in the sense that they have calcium carbonate skeleton. Corals are multicellular structures consisting of two cell layers analogous to scaled up versions of the lipid layers of cell membrane. Thus coral colonies can be seen as organisms for which the role of cell is taken by corals, and are in a very well special sense at a higher evolutionary level than us. The assumption that corals are intra-terrestrial or extraterrestrial life-forms which have served as gene banks radiating their genes to the simple life forms in environment could explain the mysterious Cambrian explosion in which a large number of animal phyla emerged apparently from nowhere [I16]. This speculative vision is discussed in [K18].

Aliens are not the only candidates for genetic engineers. Also magnetic Mother Gaia could be responsible for the genetic engineering, even the magnetic Mother Gaia of the distance geometric future. There are experimental findings [J1] supporting that electromagnetic radiation can be imprinted by genetic information and that this genetic information can be transferred to the genome of developing embryos of even different species [K19].

Nothing precludes the possibility that genes/supergenes/hyper genes at some level of dark matter hierarchy can also code for genetic self engineering since these activities are after all very similar to other genetically coded bio-chemical activities. The computer analogy would be programs writing programs. The engineering genes would be activated by W MEs inducing plasma oscillation patterns. The claimed effects could be understood if the interaction with genetically imprinted electromagnetic field pattern activates genes inducing genetic self engineering yielding the genetic modifications consistent with the pattern represented by the em radiation.

Magnetic body would receive information about the desired outcome as electromagnetic field patterns emitted by other organisms, most naturally members of the same species. If these modifications are successful, the magnetic body is exposed to this information for long enough time to react and activate W MEs inducing the genetic program inducing the genetic program leading to the suggested genetic modification.

Hyper-genes [K24] integrating groups of organisms to larger wholes would be naturally involved with the mechanism. This mechanism would guarantee a rapid propagation of successful genetic modifications to the entire population and would be much more effective than the slowly occurring selection of random mutations. The possibly existing genes responsible for the genetic self engineering could be also introns and express themselves by activating nuclear RNA and process like reverse transcription.

6.5 Fermi Paradox

The question "Where are they all?" is the best manner to formulate Fermi paradox. Fermi made estimates about the probability of intelligent life in Cosmos and ended up with the conclusion that intelligent civilizations should have already expressed their presence to us. There are many ways to achieve this.

1. The radiation generated by radio-wave communications leaks out to the interstellar space and should serve as a telltale signature about the presence of intelligence. The civilizations might be as willing as us to tell about the existence, and might send to the interstellar space radio-waves telling about them as a life form. We have indeed sent Arecibo message just in this purpose.

   The communications based on Maxwellian radio waves might however represent a rather short period in the development of the civilization. Topological light rays allow precisely targeted communications without weakening and dispersion of the signal and since the signal propagates outside the space-time sheets containing matter, the perturbations caused by the interaction with matter are small. For this kind of communications the leakage of the signals is minimal, and the civilization remains invisible for civilizations which have not yet reached the technological maturity to receive and interpret signals travelling along topological light rays (possibly parallel to magnetic flux tube structures serving as cosmic nervous systems). This is the safest option since civilizations like us might be very dangerous in their eagerness to declare Star Wars.

2. One might argue that high tech civilizations are doomed to produce a lot of entropy and the radiation resulting in this manner could also serve as a telltale signature. The discovery of the

technology based on time mirror mechanism would however mean dramatic reduction in the entropy production. Quite generally, the second law of thermodynamics can be circumvented below p-adic time scale so that also the mad consumer period could be short lasting.

3. The engineering achievements of these civilizations in astrophysical length scales might be one signature. It is however not at all clear whether we are able to see them. Presumably living technology relying on magnetic self-organization of super conducting magnetic flux tube structures serving as an astrophysical "nervous system" is in question. Magnetic flux tubes however quite literally represent dark matter [K7] to us and the established science has not yet even discovered the notion of magnetic body and is still trying to explain dark matter in terms of various X-ons.

4. Star wars thinking would suggest that the civilization evolved to a high level technologically would build space-ships and start the conquering of other planetary systems. Macroscopic quantum coherence of dark matter in astrophysical length scales however provides completely new methods of communication and control, and it is quite possible that the aliens are just patiently waiting that we finally discover that dark matter aliens are here, there, and everywhere. One might hope that this discovery does not require the emergence of the next level of dark matter hierarchy in the terrestrial biological evolution since it might not take place during this week.

5. These civilization hardly see the trouble of transferring tons of material to foreign stellar systems since time mirror mechanism allows telepathic communications by sharing of mental images with civilizations of both geometric future and past. The encounters with UFOs and ETs might be just this kind of virtual meetings but most terrestrial scientists take them as hallucinations. The explosive development of science could be due to the sharing of mental images of more developed civilization but it is difficult for us to even consider the possibility that we have not discovered all this by ourselves.

Time mirror mechanism could make even possible intentional induction of magnetic self-organization creating plasmoid like life forms. The reports about intelligent light balls appear repeatedly but most terrestrial scientists refuse to take seriously these reports. Crop circles might represent an extreme example about an attempt of advanced intelligence to get into a direct communication with us but most scientists receiving monthly salaries refuse to even play with the thought that these formations might not be hoaxes.

On basis of these arguments it seems that Fermi paradox tells much more about us than the surrounding universe. Our view about consciousness and life and physics is so badly wrong that it leads to the conclusions that consciousness is illusion, living beings are deterministic robots, and Earth is the only living planet in the entire Universe. We could test however test the TGD based vision. Perhaps some mad scientist starts some day to build population inverted lasers at energies corresponding to p-adic frequencies and zero point kinetic energy increments in order to receive negative energy signals from future, begins to send phase conjugate waves to the geometric past at these frequencies using p-adic cognitive codes (genetic code in particular, [K18]), and starts to analyze carefully radio-wave patterns at the p-adic frequencies to see whether they contain some structure suggesting that the sender of the signal is intelligent.

6.6 Dark Matter Hierarchy As A Solution Of Fermi Paradox?

The original version of this chapter was written few years before the ideas related to the quantization of Planck constant began to develop [K13]. The original stimulus came from the observation that the radii of the 4 inner planets seem to correspond to the radii of Bohr orbits with a gigantic value of gravitational Planck constant $\hbar_{gr} = GMm/v_0$, $v_0 \simeq 2^{-11}$. The radii for the orbits of outer planets in turn correspond to $v_0 \to v_0/5$ [E2]. The dependence of $\hbar_{gr}$ on masses is fixed by Equivalence Principle and $v_0 = 2^{-11}$ corresponds in TGD framework to a fundamental constant expressible in terms of CP_2 radius, Planck length, and Kähler coupling strength [K33].

The general theory for the quantization of Planck constants [K13] predicts the spectrum of $M^4_\pm$ and CP_2 Planck constants as integer multiples $\hbar(M^4_\pm) = n_a\hbar_0$ and $\hbar(CP_2) = n_b\hbar_0$ of the ordinary Planck constant $\hbar_0$. The Planck constant $\hbar_{eff}$ appearing in the Schrödinger equation using $\hbar_0$ as a unit equals to the ratio n_a/n_b having in principle all positive rational values.

The spectrum of Planck constants reflects a hierarchy of embedding spaces characterized by finite subgroups of SU(2) identified as a subgroup of SL(2, C) in the case of $M^4_\pm$ Planck constant and of SU(3) in the case of CP_2 Planck constant (appearing in the commutation relations of corresponding isometry Lie algebras). The subgroup $G_b \subset SU(2) \subset SU(3)$ defines a covering of $M^4_\pm$ by G_b-related points whereas the subgroup $G_a \subset SU(2) \subset SL(2,C)$ defines covering of CP_2 by G_a-related points. The covariant metric of $M^4_\pm$ factor is scaled up by n_b^2, where n_b is the order of the maximal cyclic subgroup of G_b. Analogous result holds for CP_2.

These copies of embedding spaces are glued together to a tree like structure such that $M^4_\pm$ (CP_2) are identified by isometry if G_b (G_a) is same for the two copies. Each node involves infinitely many branches labelled by G_b (G_a). One can say that two kind of matters in this hierarchy are dark with respect to each other if they reside at different branches of this structure. If G_a (G_b) is same for the two sectors, a phase transition changing the value of Planck constant $\hbar(CP_2)$ ($\hbar(M^4_\pm)$) can occur and corresponds geometrically to a leakage been different sectors via an intermediate state which has 0-dimensional CP_2 projection or 2-dimensional $M^4_\pm$ projection (time like plane remaining invariant under $G_a \subset SO(3)$) containing the quantization axis for angular momentum). The points in the projection correspond to singular orbifold points for the G-covering in question.

Also a spectrum of number theoretic values of Planck constants is predictedn_a and n_b correspond for them to n-polygons constructible using only ruler and compass. The resulting model for planetary orbits predicts that the ratios of planetary masses should be given as ratios q_{ab}/q_{cd} of ratios $q_{ab} = n_a/n_b$ of these preferred integers. This is rather strong a prediction and satisfied within 3 per cent. Also an absolute prediction $GMm/v_0 = n_a/n_b$ (say in the case of Earth-Sun pair) results and is wrong by about 4 per cent: the failure could be understood if the masses in question correspond to dark matter [K33].

Particles mass spectrum does not depend on the values of Planck constants whereas Compton length scales as n_a. For large values of $\hbar_{eff}$ the overlap criterion for the formation of macroscopic quantum phases is satisfied due to the large values of Compton lengths. In the case of gravitational Planck constant the macroscopic quantum phases would have an astrophysical size. Dark matter hierarchy would correspond to a hierarchy of increasingly refined levels of consciousness with an increasing span of long term memory and planned action and utilizing the lower levels of hierarchy as sensory receptors and motor instruments.

In biology an especially important dark matter hierarchy seems to correspond to $\hbar(M^4_\pm, k) = 2^{11k}$, $\hbar(CP_2) = \hbar_0$ and great leaps in evolution could be understood as the emergence of a new level of this kind to the "personal" dark matter hierarchy realized as a hierarchy of magnetic bodies (topologically quantized magnetic fields associated with the system) [K11]. The group G_a would most naturally act as symmetry group of dark magnetic body transforming to each other the flux tubes of the magnetic body representing topological quantized dipole type magnetic field having a full rotational symmetry before topological quantization. n_a would give the number of flux tubes.

If one accepts the model for the hierarchy of EEGs, the duration of life cycle identified as a cyclotron time scale for a typical biologically important ion gives a reasonable guess for the highest level of dark matter hierarchy involved. For instance, from the requirement that EEG photons have energy above thermal energy, the time scale of ordinary EEG would correspond to $n_a = 2^{11k}$, $k = 4$, and the duration of our life cycle to $k = 7$. In meditative states referred often to as cosmic consciousness the value of k might be much higher.

In this conceptual framework the answer to the question "Where are they?" would be based on the identification of "them" as conscious entities at higher levels of dark matter hierarchy and living at different branches of the embedding space. If all goes well, civilization would sooner or later achieve Omega point at which it becomes so convinced about the existence of this hierarchy that it initiates systematic attempts to build communications with higher levels of the hierarchy and perhaps "moves" more or less permanently to this branch of embedding space which would naturally explain Fermi paradox.

7 What Ufos Are?

The second key question concerns the interpretation of UFOs. Interpretation as plasmoids might be equivalent with interpretation as living flying saucers able to reduce their inertial and gravitational mass and using time mirror mechanism (see **Fig.** `http://tgdtheory.fi/appfigures/`

timemirror.jpg or **Fig. 9** in the appendix of this book) to extract energy from environment.

7.1 Ufos As Plasmoids?

One of the most important findings about UFOs is their butterfly like behavior. They can accelerate very rapidly and change their direction of motion instantaneously. Since this occurs without generation of shock waves, the only conclusion seems to be that their inertial and gravitational masses are very light.

Persinger has proposed a model explaining the experiences about encounters of extraterrestrials as hallucinations caused by the perturbations of Earth's magnetic field induced by the liberation of the tectonic energy at the lines of tectonic activity [J6]. The model is based on well-established statistics about the effects of the perturbations of Earth's magnetic field on consciousness collected in mental hospitals. The lines of the tectonic activity are also accompanied by well established luminous phenomena which suggests that the model could be naturally combined with the explanation of UFOs as this kind of luminous phenomena.

This suggests that UFOs might be plasmoids. These primitive life-forms could use time mirror mechanism to receive metabolic energy and tectonic activity would be excellents source of metabolic energy. Plasmoids, being extremely light structures, could easily follow the energy beam flowing from the spot of tectonic activity, and the random variation of the beam direction could explain the random butterfly like motion of UFOs often observed and very difficult to understand if UFOs are structures built of steel and copper. This identification does not of course mean that plasmoids could not be living, intelligent space-ships. The lightness and ability to draw energy from the environment would make plasmoids ideal for this purposed.

7.2 Ufos Made Of Copper And Steel?

There is some evidence for "metallic" UFOs too. In particular, the claimed Roswell case involving a "traffic accident" of UFO and dead bodies of aliens suggests that aliens and UFOs are real. TGD based model [K40] for the strange antigravity effects observed in rotating magnetic systems [H6] leads to a mechanism which might be behind flying saucers. The basic idea is that the space-time sheet of rotating magnet is connected to the space-time sheet carrying Earth's gravitational field by join along boundaries bonds/flux tubes, one can visualize them as threads connecting the rotating system to the environment. Along these threads the gravitational flux created by the magnet flows to Earth's space-time sheet and these threads mediate the gravitational interaction.

Rotation causes the entanglement of the threads and when the rotational speed becomes high enough, the threads begin to split. This means that the ends of the split threads become carriers of negative and positive gravitational mass. Effectively the gravitational mass of the magnet system remains to the Earth's space-time sheet and the mass of magnet system itself decreases and angular momentum conservation implies an acceleration of the spinning motion (pirouette effect). If the inertial mass is equal to the gravitational mass as Equivalence Principle requires, a system which is light as a feather results!

This mechanism might make possible flying saucers. For instance, the rotating system could apply time mirror mechanism to generate the needed very fast motion making possibly mass loss. It could also accelerate and change direction of motion very quickly. The strange properties of UFOs suggest that if they are really flying saucers, a reduction of the inertial mass is indeed involved. Thus one might think of the possibility that plasmoid like structure and a more rigid structure accompany each other in some cases. The rotating magnet system involves also plasma near its outer boundary and would in this case be due to acceleration of ions in radial electric field generate by the rotating magnet. Plasmoid like structures indeed involve magnetic flux tubes and this suggests that they could rotate rapidly and in this manner reduce their gravitational and inertial mass.

7.3 Are Flying Saucers Necessarily Living Systems?

The following arguments suggest that flying saucers are necessarily living systems.

1. As explained earlier, the study of field equations leads to the classification of basic phases of matter by the dimension D of CP_2 projection of the space-time sheet. $D = 2$ would naturally

correspond to magnetic flux tube structure associated with non-rotating magnetic system. This phase is simple and analogous to a ferro-magnet. As already found by Faraday, a radial electric field accompanied by a non-vanishing vacuum charge density is generated when a constant magnetic field is put into rotation. The non-vanishing charge density requires a 3-dimensional CP_2 projection. The conclusion is that rotation induces a phase transition $D = 2 \to 3$.

2. The phase transition implies a qualitative change in the structure of the magnetic fields and could thus explain the generation of magnetic walls observed in the rotating magnetic system [H6]. What is fascinating that $D = 3$ phase corresponds to the living matter in the proposed classification. This would conform with the idea that the ADP-ATP machinery responsible for the metabolism is a molecular Searl machine. Hence the strange effects observed in rotating magnetic systems might reveal the fundamentals of the dead $\to$ alive phase transition. Also this suggests that plasmoids could be seen as flying saucers which are living just because they are flying saucers.

3. The increase of the dimension of CP_2 projection could generate flux tubes and wormhole contacts leading to the transfer of charge between different space-time sheets. The possibly resulting flow of gravitational flux to larger space-time sheets might help to explain the claimed antigravity effects.

8 Figures And Illustrations

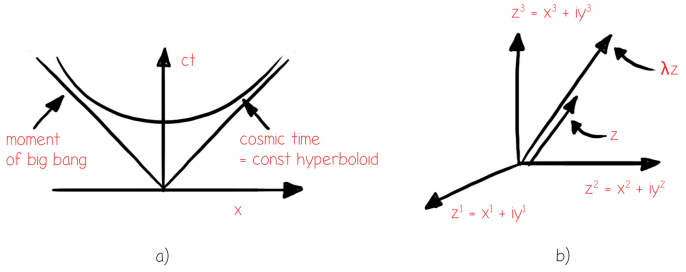

Figure 1: Space-times can be regarded as 4-dimensional surfaces in 8-dimensional space $H = M^4_+ \times CP_2$ obtained by replacing points of future light cone of Minkowski space with CP_2.

REFERENCES

Mathematics

[A1] Gaussian Mersenne. Available at: `https://primes.utm.edu/glossary/xpage/GaussianMersenne.html`.

Condensed Matter Physics

[D1] Pepper DM. Nonlinear Optical Phase Conjugation. *Opt Eng*, 21(2), March 1982.

[D2] Zeldowich BYa Shkunov VV. Optical Phase Conjugation. *Sci Am*, 1985.

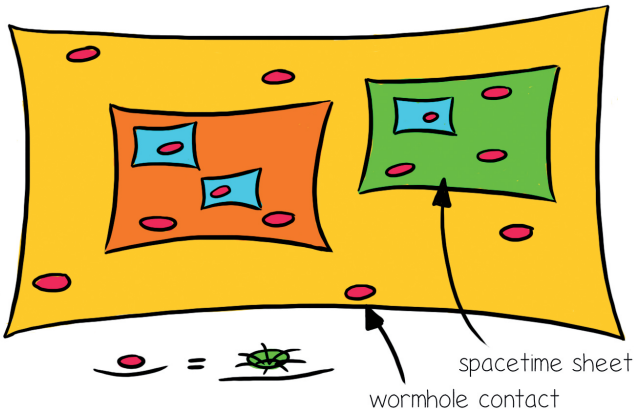

Figure 2: Material objects correspond to the sheets of the many-sheeted space-time. Note that sheets are extremely near to each other.

Cosmology and Astro-Physics

[E1] Age of the universe. Available at: `https://en.wikipedia.org/wiki/Age_of_the_universe`.

[E2] Nottale L Da Rocha D. Gravitational Structure Formation in Scale Relativity, 2003. Available at: `https://arxiv.org/abs/astro-ph/0310036`.

[E3] Boornazian AA Eddy JA. Secular decrease in the solar diameter. *Bulletin of the American Astronomical Soc*, 11(437):1863–1953, 1979.

[E4] Ito T Malhotra R, Holman M. Chaos and stability of the solar system. *Proc Natl Acad Sci USA*, 98:12342–12343, 2001. Available at: `https://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=60054`.

[E5] Gilliland RL. Solar radius variations over the past 265 years. *Astrophys J*, 248:1155, 1981.

Physics of Earth

[F1] Frank LA et al. Plasma velocity distributions in the near-Earth plasma sheet: A first look with the Geotail spacecraft. *J Geophys Res*, 101:10627–10637, 1996. Available at: `https://www-pi.physics.uiowa.edu/www/cpi/cpi-nuggets.html`.

Fringe Physics

[H1] Chilbolton crop circle. Available at: `https://www.cropcircleresearch.com/articles/arecibo.html`.

[H2] Chilbolton crop circle. Available at: `https://claudescommentary.com/special/chilbolton/`.

[H3] P. Vigay's homeopage about Crop Circle Research. Available at: `https://www.cropcircleresearch.com/articles/alienface.html`.

[H4] The homeopage of Martin Keitel. Available at: `https://www.ioon.net/martian/`.

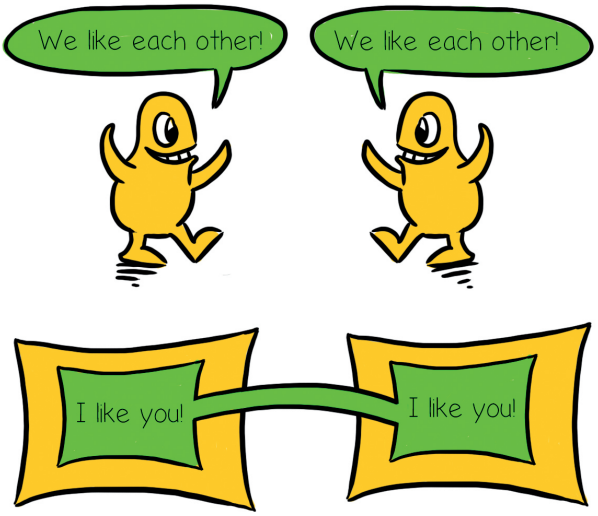

Figure 3: The space-time sheets condensed on larger space-time sheets having no flux tubes can be connected by flux tubes. This forces to generalize the notion of sub-system and makes possible sharing of mental images.

[H5] Kozyrev NA. *Prichinnaya ili nesimmetrichnaya mekhanika v lineinom priblizhenii. Causal or asymmetrical mechanics in linear approximation.* . GAO AN SSSR, Leningrad, 1958.

[H6] Godin SM Roshchin VV. An Experimental Investigation of the Physical Effects in a Dynamic Magnetic System. *New Energy Technologies*, 1, 2001.

Biology

[I1] Nanobacterium. Available at: `https://en.wikipedia.org/wiki/Nanobacterium`.

[I2] Nanobe. Available at: `https://en.wikipedia.org/wiki/Nanobe`.

[I3] Virus. Available at: `https://en.wikipedia.org/wiki/Virus`.

[I4] King C. Biocosmology, 2003. Available at: `https://www.dhushara.com/book/biocos/biocos.pdf`.

[I5] International Human Sequencing Consortium. Initial sequencing and analysis of the human genome. *Nature*, 2001.

[I6] Baterman P Cremesti RE. Problems with the search for the origin of life, 1998. Available at: `https://tinyurl.com/ptf885f`.

[I7] Levich E. *Phys Rep*, 3, 1987.

[I8] Gariaev PP et al. The spectroscopy of bio-photons in non-local genetic regulation. *J Non-Locality and Remote Mental Interactions*, (3), 2002. Available at: `https://www.emergentmind.org/gariaevI3.htm`.

[I9] Kajander EO et al. Comparison of Staphylococci and Novel Bacteria-Like Particles from Blood. *Zbl Bakt Suppl*, 26, 1994.

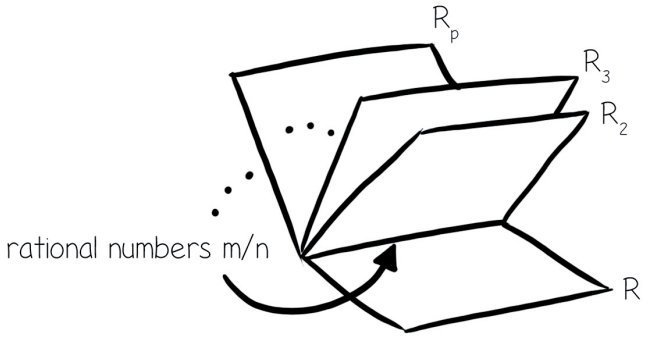

Figure 4: Generalization of the number concept: real and p-adic number fields correspond to the pages of book and the rim of book corresponds to rational numbers common to all of them.

[I10] Kortschak RD et al. EST Analysis of the Cnidarian Acropora millepora Reveals Extensive Gene Loss and Rapid Sequence Divergence in the Model Invertebrates. *Current Biol*, pages 2190–2195, 2003. Available at: `https://tinyurl.com/py9buk9`.

[I11] Celera Genomics. *Science*, 291(5507), 2001.

[I12] Javor GT. *Origins*, 14:7–20.

[I13] Sanduloviciu M Lozneanu E. Minimal-cell system created in laboratory by self-organization. *Chaos , Solitons & Fractals*, 18(2):335, 2003. See also *Plasma blobs hint at new form of life.* New Scientist vol. 179, No. 2413 p. 20 September 2003, page 16.

[I14] Dolan MF Margulis L. *Early Life.* Jones and Bartlett Publ. MA., 2002.

[I15] Folk RL. Nanno-bacteria; surely not figments but what heaven are they? *Natural Sci* . Available at: `https://naturalSCIENCE.com`, 1, 1997.

[I16] Gould SJ. *Wonderful Life.* Penguin Books, 1991.

Neuroscience and Consciousness

[J1] A method of changing biological object's hereditary signs and a device for biological information directed transfer. Patent N1828665. Application N3434801, invention priority as of 30.12. 1981, registered 13.10.1992.

[J2] DelaWarr G Day L. *New Worlds Beyond the Atom.* Vincent Stuart Publishers Ltd., London, 1956.

[J3] Benor DJ. *Spiritual Healing: scientific validation of a healing revolution Vol. I.* Vision publications, Southfield MI, 2001.

[J4] McMoneagle J. *Remote Viewing Secrets.* Hampton Roads Publishing Company, Inc., 2000.

[J5] Germine M. Scientific Validation of Planetary Consciousness. *J Non-Locality and Remote Mental Interactions*, 1(3), 2002. Available at: `https://www.emergentmind.org/germineI3.htm`.

[J6] Persinger M. The tectonic strain theory as an explanation for UFO phenomena, 1999. Available at: `https://www.laurentian.ca/www/neurosci/tectonicedit.htm`.

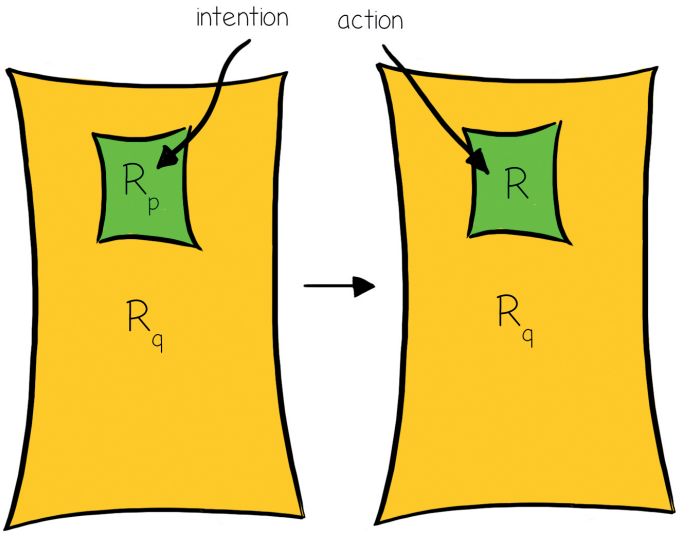

Figure 5: The transformation of p-adic space-time sheet to a real one in quantum jump correspond to the transformation of intention to action.

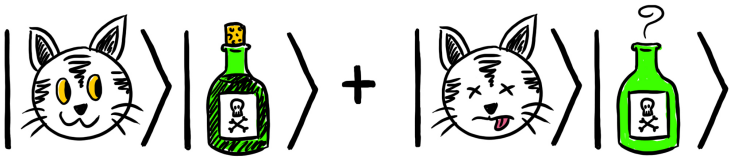

Figure 6: Quantum entangled systems lose their identify. Schrödinger cat entangled with the poisson bottle is neither living nor dead or is both simultaneously.

[J7] Klein S. Libet's Research on Timing of Conscious Intention to Act: A Commentary. *Conscious & Cognition*, 11.

[J8] Dibble WEJr Tiller WA. New experimental data revealing an unexpected dimension to materials science and engineering. *Mat Res Innovat*, 5:21–34, 2001.

[J9] Dibble WEJr Tiller WA. Anomalous Temperature Oscillation Behavior Near a Source in a "Conditioned" Space: part I, The Spatial Variation, 2002. Available at: `https://tillerfoundation.com/newpapers.htm`.

[J10] Kohane MJ Tiller WA, Dibble WEJr. *Conscious Acts of Creation: the Emergence of a New Physics*, volume 17. Pavior Publishing, 2001. Available at: `https://www.pavior.com/`.

[J11] Tiller WA. Towards a Quantitative Science and Technology that Includes Human Consciousness. *Vision-In-Action*, 4, 2003. Available at: `https://www.via-visioninaction.org`.

Books related to TGD

[K1] Pitkänen M. DNA as Topological Quantum Computer. In *Quantum - and Classical Computation in TGD Universe. `https://tgdtheory.fi/tgdhtml/Btgdcomp.html`*. Available at: `https://tgdtheory.fi/pdfpool/dnatqc.pdf`, 2015.

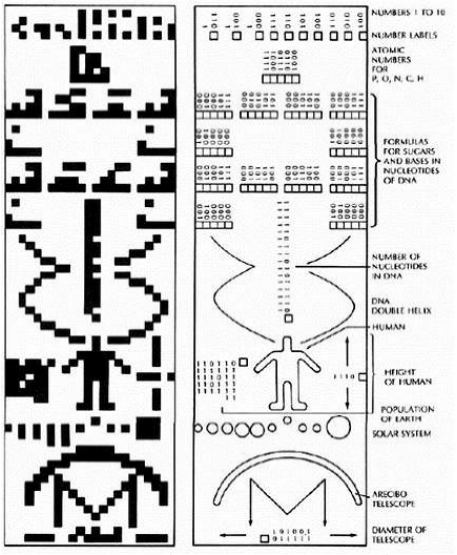

Figure 7: Arecibo message provides information about us.

[K2] Pitkänen M. Basic Extremals of Kähler Action. In *Physics in Many-Sheeted Space-Time: Part I. https://tgdtheory.fi/tgdhtml/Btgdclass1.html*. Available at: https://tgdtheory.fi/pdfpool/class.pdf, 2023.

[K3] Pitkänen M. *Bio-Systems as Conscious Holograms.* Online book. Available at: https://www.tgdtheory.fi/tgdhtml/holography.html., 2023.

[K4] Pitkänen M. Bio-Systems as Conscious Holograms. In *TGD Universe as a Conscious Hologram. https://tgdtheory.fi/tgdhtml/Bholography.html*. Available at: https://tgdtheory.fi/pdfpool/hologram.pdf, 2023.

[K5] Pitkänen M. *Bio-Systems as Self-Organizing Quantum Systems.* Online book. Available at: https://www.tgdtheory.fi/tgdhtml/bioselforg.html., 2023.

[K6] Pitkänen M. Classical TGD. In *Topological Geometrodynamics: Overview: Part I:https://tgdtheory.fi/tgdhtml/Btgdview1.html*. Available at: https://tgdtheory.fi/pdfpool/tgdclass.pdf, 2023.

[K7] Pitkänen M. Cosmic Strings. In *Physics in Many-Sheeted Space-Time: Part II. https://tgdtheory.fi/tgdhtml/Btgdclass2.html*. Available at: https://tgdtheory.fi/pdfpool/cstrings.pdf, 2023.

[K8] Pitkänen M. Crop Circles and Life at Parallel Space-Time Sheets. In *Magnetospheric Consciousness. https://tgdtheory.fi/tgdhtml/Bmagnconsc.html*. Available at: https://tgdtheory.fi/pdfpool/crop1.pdf, 2023.

[K9] Pitkänen M. Crop Circles and Life at Parallel Space-Time Sheets. In *Magnetospheric Consciousness. https://tgdtheory.fi/tgdhtml/Bmagnconsc.html*. Available at: https://tgdtheory.fi/pdfpool/crop2.pdf, 2023.

[K10] Pitkänen M. Dark Forces and Living Matter. In *Bio-Systems as Self-Organizing Quantum Systems. https://tgdtheory.fi/tgdhtml/BbioSO.html*. Available at: https://tgdtheory.fi/pdfpool/darkforces.pdf, 2023.

[K11] Pitkänen M. Dark Matter Hierarchy and Hierarchy of EEGs. In *TGD and EEG: Part I. https://tgdtheory.fi/tgdhtml/Btgdeeg1.html*. Available at: https://tgdtheory.fi/pdfpool/eegdark.pdf, 2023.

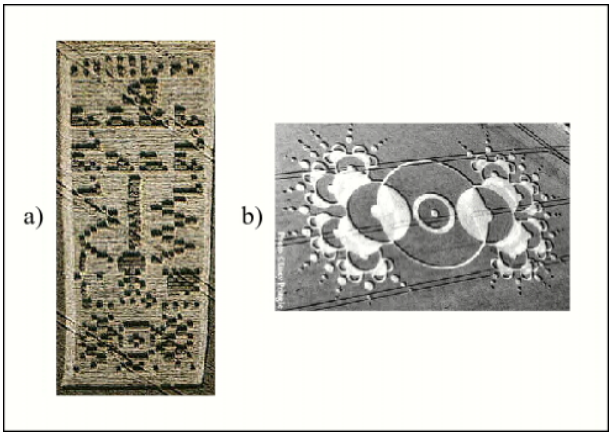

Figure 8: Chilbolton crop formation of figure a) is made using the same format as Arecibo message and can be interpreted as providing information about the constructors of the formation. Figure b) is the counterpart of radio antenna used to generate the message. A possible interpretation is as magnetosphere which suggests that the conscious entity responsible for the generation of crop circles is entity magnetosphere, brain of Mother Gaia.

[K12] Pitkänen M. Dark Nuclear Physics and Condensed Matter. In *TGD and Nuclear Physics. https://tgdtheory.fi/tgdhtml/Bnucl.html*. Available at: https://tgdtheory.fi/pdfpool/exonuclear.pdf, 2023.

[K13] Pitkänen M. Does TGD Predict a Spectrum of Planck Constants? In *Dark Matter and TGD: https://tgdtheory.fi/tgdhtml/Bdark.html*. Available at: https://tgdtheory.fi/pdfpool/Planck, 2023.

[K14] Pitkänen M. Evolution in Many-Sheeted Space-Time: Part I. In *Evolution in TGD Universe. https://tgdtheory.fi/tgdhtml/Btgdevolution.html*. Available at: https://tgdtheory.fi/pdfpool/prebio1.pdf, 2023.

[K15] Pitkänen M. Evolution in Many-Sheeted Space-Time: Part II. In *Evolution in TGD Universe. https://tgdtheory.fi/tgdhtml/Btgdevolution.html*. Available at: https://tgdtheory.fi/pdfpool/prebio2.pdf, 2023.

[K16] Pitkänen M. General Theory of Qualia. In *TGD Inspired Theory of Consciousness: Part I. https://tgdtheory.fi/tgdhtml/Btgdconsc1.html*. Available at: https://tgdtheory.fi/pdfpool/qualia.pdf, 2023.

[K17] Pitkänen M. *Genes and Memes*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/genememe.html., 2023.

[K18] Pitkänen M. Genes and Memes. In *Genes and Memes: Part I. https://tgdtheory.fi/tgdhtml/Bgenememe1.html*. Available at: https://tgdtheory.fi/pdfpool/genememec.pdf, 2023.

[K19] Pitkänen M. Homeopathy in Many-Sheeted Space-Time. In *TGD Universe as a Conscious Hologram. https://tgdtheory.fi/tgdhtml/Bholography.html*. Available at: https://tgdtheory.fi/pdfpool/homeoc.pdf, 2023.

[K20] Pitkänen M. *Hyper-finite Factors and Dark Matter Hierarchy*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/neuplanck.html., 2023.

[K21] Pitkänen M. Macro-Temporal Quantum Coherence and Spin Glass Degeneracy. In *TGD Universe as a Conscious Hologram. https://tgdtheory.fi/tgdhtml/Bholography.html*. Available at: https://tgdtheory.fi/pdfpool/macro.pdf, 2023.

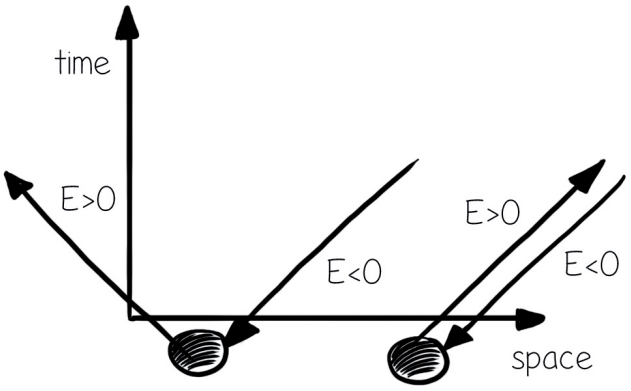

Figure 9: Time mirror mechanism

[K22] Pitkänen M. Macroscopic Quantum Coherence and Quantum Metabolism as Different Sides of the Same Coin: Part I. In *TGD Universe as a Conscious Hologram. https://tgdtheory.fi/tgdhtml/Bholography.html*. Available at: https://tgdtheory.fi/pdfpool/metab.pdf, 2023.

[K23] Pitkänen M. *Magnetospheric Consciousness*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/magnconsc.html., 2023.

[K24] Pitkänen M. Many-Sheeted DNA. In *Genes and Memes: Part I. https://tgdtheory.fi/tgdhtml/Bgenememe1.html*. Available at: https://tgdtheory.fi/pdfpool/genecodec.pdf, 2023.

[K25] Pitkänen M. *Mathematical Aspects of Consciousness Theory*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/mathconsc.html, 2023.

[K26] Pitkänen M. *p-Adic length Scale Hypothesis*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/padphys.html., 2023.

[K27] Pitkänen M. Physics as a Generalized Number Theory. In *Topological Geometrodynamics: Overview: Part I. https://tgdtheory.fi/tgdhtml/Btgdview1.html*. Available at: https://tgdtheory.fi/pdfpool/tgdnumber.pdf, 2023.

[K28] Pitkänen M. Quantum Control and Coordination in Bio-Systems. In *Bio-Systems as Self-Organizing Quantum Systems. https://tgdtheory.fi/tgdhtml/BbioSO.html*. Available at: https://tgdtheory.fi/pdfpool/qcococII.pdf, 2023.

[K29] Pitkänen M. *Quantum Hardware of Living Matter*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/bioware.html., 2023.

[K30] Pitkänen M. Quantum Model for Hearing. In *TGD and EEG: Part II. https://tgdtheory.fi/tgdhtml/Btgdeeg2.html*. Available at: https://tgdtheory.fi/pdfpool/hearing.pdf, 2023.

[K31] Pitkänen M. Quantum Model for Nerve Pulse. In *TGD and EEG: Part I. https://tgdtheory.fi/tgdhtml/Btgdeeg1.html*. Available at: https://tgdtheory.fi/pdfpool/nervepulse.pdf, 2023.

[K32] Pitkänen M. *Quantum TGD*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/tgdquantum.html., 2023.

[K33] Pitkänen M. TGD and Astrophysics. In *Physics in Many-Sheeted Space-Time: Part II. https://tgdtheory.fi/tgdhtml/Btgdclass2.html*. Available at: https://tgdtheory.fi/pdfpool/astro.pdf, 2023.

[K34] Pitkänen M. *TGD and EEG*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/tgdeeg.html, 2023.

[K35] Pitkänen M. *TGD and Fringe Physics*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/freenergy.html., 2023.

[K36] Pitkänen M. TGD and Nuclear Physics. In *TGD and Nuclear Physics. https://tgdtheory.fi/tgdhtml/Bnucl.html*. Available at: https://tgdtheory.fi/pdfpool/padnucl.pdf, 2023.

[K37] Pitkänen M. *TGD Based View About Living Matter and Remote Mental Interactions*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/tgdlian.html, 2023.

[K38] Pitkänen M. *TGD Inspired Theory of Consciousness*. Online book. Available at: https://www.tgdtheory.fi/tgdhtml/tgdconsc.html., 2023.

[K39] Pitkänen M. The Geometry of the World of the Classical Worlds. In *Topological Geometrodynamics: Overview: Part I:https://tgdtheory.fi/tgdhtml/Btgdview1.html*. Available at: https://tgdtheory.fi/pdfpool/tgdgeom.pdf, 2023.

[K40] Pitkänen M. The Notion of Free Energy and Many-Sheeted Space-Time Concept. In *TGD and Fringe Physics. https://tgdtheory.fi/tgdhtml/Bfreenergies.html*. Available at: https://tgdtheory.fi/pdfpool/freenergy.pdf, 2023.

[K41] Pitkänen M. Three new physics realizations of the genetic code and the role of dark matter in bio-systems. In *Genes and Memes: Part II. https://tgdtheory.fi/tgdhtml/Bgenememe2.html*. Available at: https://tgdtheory.fi/pdfpool/dnatqccodes.pdf, 2023.

[K42] Pitkänen M. *Topological Geometrodynamics: an Overview*. Online book.Available at: https://www.tgdtheory.fi/tgdhtml/tgdview.html., 2023.

[K43] Pitkänen M. Wormhole Magnetic Fields. In *Bio-Systems as Self-Organizing Quantum Systems. https://tgdtheory.fi/tgdhtml/BbioSO.html*. Available at: https://tgdtheory.fi/pdfpool/wormc.pdf, 2023.

Articles about TGD

[L1] Pitkänen M. Macro-temporal quantum coherence, quantum spin glass degeneracy, and number theoretic information concept. Available at: https://www.emergentmind.org/journal.htm, 2003.

[L2] Pitkänen M. Time, Space-Time, and Consciousness. Available at: https://www.emergentmind.org/journal.htm, 2003.

[L3] Pitkänen M. CMAP representations about TGD, and TGD inspired theory of consciousness and quantum biology. Available at: https://www.tgdtheory.fi/tgdglossary.pdf., 2014.