Homeopathy in Many-Sheeted Space-time

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Contents

Abstract

The claimed mechanisms of homeopathic healing and the method of manufacturing homeopathic potencies are not the only paradoxical aspects of homeopathy. Also the reported frequency imprinting and entrainment, codes based on field patterns, and associative learning of water look mysterious in the framework of standard physics.

1. Frequency imprinting and entrainment, and scaling laws

Frequency imprinting and entrainment at preferred frequencies are believed to be fundamental for homeopathy and acupuncture.

Homeopathy seems to involve two kinds of scaling laws which seem to be closely related. What I call scaling law of homeopathy states that homeopathic frequencies appear in pairs (f_h, f_l) of high and low frequencies such that their ratio is given by $f_h/f_l \simeq 2 \times 10^{11}$. TGD approach explains this ratio predicts a generalization of the law. $v = Lf_l$ scaling law tells in TGD framework how the frequencies associated with generalized EEG code for the velocities of physiological waves and their frequencies $f_h = cf_l/v$. The general model for motor control by magnetic body predicts this scaling law.

The hierarchy of Planck constants explains this scaling law and generalizes it. The two frequencies correspond to f_l associated with dark photon with $h_{eff} = n \times h$ and to f_h associated with ordinary photon giving $f_h/f_l = n$. Bio-photons would result in energy conserving decays of dark photons to ordinary photons.

2. Basic inputs from TGD

The model for DNA baryon leads to the proposal that genetic code as well as DNA-, RNA- and amino-acid sequences should have representation in terms of nuclear strings. The model for dark baryons indeed leads to an identification of these analogs and the basic numbers of genetic code including also the numbers of amino-acids coded by a given number of codons are predicted correctly. Hence it seems that genetic code is universal rather than being an accidental outcome of the biological evolution.

The findings of Pollack about exclusions zones and fourth phase or water provide additional ideas. In TGD framework exclusion zones would correspond to dark $H_{3/2}O$ phase of water with every fourth hydrogen atom or proton taken to the dark flux tubes. This makes the exclusion zone negatively charged. The magnetic body of this kind of region would define fundamental representation of the magnetic body of the invader molecule. Not only cyclotron frequencies, but possibly also braiding would be represented, even 2- braiding involving reconnections. This leads to the idea that exclusion zones are primitive life forms having magnetic body containing dark matter. Most importantly, are representation of genetic code in terms of dark proton sequences would be realized at the flux tubes of the magnetic body.

3. How immune system might have evolved?

Organism or prebiotic life form living in water must recognize the invader molecule and here reconnection of the flux tubes of magnetic bodies is here the key mechanism: it would provide basic mechanism of attention and recognition. This requires that the strength of magnetic fields at flux tubes are same and organism could vary it by varying the thickness of the flux tube carrying monopole flux. This would also involve cyclotron resonance taking place simultaneously. If dark ELF photons are involved the cyclotron resonances can have energies visible and UV range characterizing bio-photons. This energy range corresponds also to excitation energies of various bio-molecules.

A further element comes from the observation that dark proton sequences could give rise to dark DNA. These sequences would reside at the flux tubes of the magnetic body associated with the exclusion zone. They would define dark variants of proteins and amino-acids. The key idea is that dark variants of amino-acid sequences would have coded not only for the braiding of the magnetic body of the invader bu also for the 2-braiding (temporal development of braiding) of the magnetic flux tube patterns defining invader molecule as a dynamical process: dark proteins would mimic physically the braiding of invader molecule's magnetic body.

Dark DNA sequences would have coded this braiding symbolically and their translation to dark amino-acids would transform symbolic representation to a concrete physical one. The emergence of ordinary DNA and amino-acids would have realized the same at biochemical level and amino-acid sequences representing the invader would serve as antigene attaching to the invader molecule. Not only the pattern produced in protein folding but also the temporal pattern of protein folding would be coded by DNA.

4. Model for the homeopathy

The model of homeopathy must explain the effectiveness of homeopathic remedies manufactured by a repeated dilution and succussion. This can be understood if part of chemical involved is transformed to dark matter and is also represented by water clusters or dark super-nuclei formed from protons. This minimal representation involves thermally stable dark cyclotron frequencies. If inherently dark atoms and molecules with essentially same energy spectrum as ordinary ones are possible, also the mimicry of vibrational and rotational spectrum is possible by clusters of dark water molecules.

One must also understand why homeopathic remedies are manufactured from molecules which basically cause the symptoms to be cured. This brings strongly in mind the functioning of immune system: when the organism is exposed to the substance causing the health problem, immune system develops resistance. Maybe something similar happens in homeopathy in the sense that the homeopathic remedy representing the substance induces resistance. A representation carrying information about the biologically important aspects of the substance would be therefore needed.

This suggests that the manufacturing of the homeopathic remedy generates replicating primitive life forms analogous to the exclusion zones. The repeated mechanical agitation could feed to the system metabolic energy and induce the formation of new exclusion zone like regions mimicking the magnetic body original invader molecule or the already existing representations of it. Even quantal evolution at the level of dark DNA could take place. The final outcome would be population of primitive life forms representing the invader. This representation would in turn induce generation of immune response.

The claimed mechanisms of homeopathic healing and the method of manufacturing homeopathic potencies are not the only paradoxical aspects of homeopathy. Also the reported frequency imprinting and entrainment, codes based on field patterns, and associative learning of water look mysterious in the framework of standard physics.

1. Frequency imprinting and entrainment

Frequency imprinting and entrainment at preferred frequencies are believed to be fundamental for homeopathy and acupuncture. The data suggest that water builds representations for the chemicals it contains as space-time sheets containing water in liquid crystal form. These space-time sheets reproduce relevant part for the spectrum of rotational frequencies of the molecule in rigid rotor approximation. Also the mimicry of vibrational spectrum using sound waves can be considered possible. Besides LC water blobs also magnetic mirrors consisting of magnetic flux tube plus parallel MEs pop up naturally in the original model of frequency imprinting and entrainment.

The basic objection is that if the space-time sheets are in thermal equilibrium, the scenario partially fails in the case of fundamentally important rotational and conformational spectra which are in microwave region. TGD however suggests that also inherently dark variants of elementary particles, atoms, ions, and even molecules are possible. In this case various vibrational and rotational frequencies would define a hierarchy of dark energies which can be above thermal threshold. In particular, rotational and conformational microwave spectra of bio-molecules have dark counterparts with energies above the thermal threshold. Otherwise only cyclotron energies and plasma oscillation energies can be above thermal threshold at sufficiently high levels of dark matter hierarchy.

2. Scaling laws

Homeopathy seems to involve two kinds of scaling laws which seem to be closely related. What I call scaling law of homeopathy states that homeopathic frequencies appear in pairs (f_h, f_l) of high and low frequencies such that their ratio is given by $f_h/f_l \simeq 2 \times 10^{11}$. TGD approach explains this ratio predicts a generalization of the law. $v = Lf_l$ scaling law tells in TGD framework how the frequencies associated with generalized EEG code for the velocities of physiological waves and their frequencies $f_h = cf_l/v$. The general model for motor control by magnetic body predicts this scaling law.

The hierarchy of Planck constants explains this scaling law and generalizes it. The two frequencies correspond to f_l associated with dark photon with $h_{eff} = n \times h$ and to f_h associated with ordinary photon giving $f_h/f_l = n$. Bio-photons would result in energy conserving decays of dark photons to ordinary photons.

3. Dark nuclear strings as analogs of as analogs of DNA-, RNA- and amino-acid sequences and baryonic realization of genetic code

A speculative picture proposing a connection between homeopathy, water memory, and phantom DNA effect is discussed and on basis of this connection a vision about how the tqc hardware represented by the genome is actively developed by subjecting it to evolutionary pressures represented by a virtual world representation of the physical environment. The speculation inspired by this vision is that genetic code as well as DNA-, RNA- and amino-acid sequences should have representation in terms of nuclear strings. The model for dark baryons indeed leads to an identification of these analogs and the basic numbers of genetic code including also the numbers of amino-acids coded by a given number of codons are predicted correctly. Hence it seems that genetic code is universal rather than being an accidental outcome of the biological evolution.

4. Findings of Pollack and identification of prebiotic life forms

The findings of Pollack about exclusions zones and fourth phase or water provide more detailed view about what might happen. In TGD framework exclusion zones correspond to dark $H_{3/2}O$ phase of water with every fourth hydrogen atom or proton taken to the dark flux tubes. This makes the exclusion zone negatively charged. The magnetic body of this kind of region would define fundamental representation of the magnetic body of the invader molecule. Not only cyclotron frequencies, but possibly also braiding would be represented, even 2- braiding involving reconnections. This leads to the idea that exclusion zones are primitive life forms having magnetic body containing dark matter. Most importantly, are representation of genetic code in terms of dark proton sequences would be realized at the flux tubes of the magnetic body.

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The model should also explain the associative learning and field codes. The presence of dark matter hierarchy leads to a model for how magnetic body performs motor control using dark photons with universal energy spectrum corresponding to that for bio-photons and with wavelengths which for cyclotron photons are inversely proportional the mass of the ion. Dark photons can induce resonant communications between magnetic bodies and also excitations of biomolecules. In the original model I proposed that also dark plasmoids and their quantal plasma oscillation patterns are involved and probably this is the case. Magnetic bodies would receive sensory input from the biological body and experiences it as a kind of somatosensory representation along entire magnetic body. It would be the magnetic bodies at higher levels of dark matter hierarchy which learn rather than mere water.

Context sensitive field codes emerge naturally as codes involved with all bio-control, in particular gene expression. Spatio-temporal field patterns would correspond to the outcomes of 4-D quantum self-organization made possible by ZEO where most probable 3-surfaces are pairs of space-like 3-surfaces at the opposite ends of causal diamonds defining spatio-temporal field patterns - time evolutions of magnetic bodies. Morphogenesis would represent highest level for this kind of temporal patterns coded basically by DNA.

7. Some applications

The model of the magnetic body and the mechanism of motor control based on plasma oscillations of plasmoids can be tested by finding whether it allows to understand various enigmatic findings. Priore's machine which is a device claimed to induce a cure of cancer by somehow stimulating the immune system defines one such application. The findings of Sue Benford about intentionally produced tracks and dots in nuclear emulsions and microwave hearing and closely related taos hum define further applications. There is experimental evidence that electromagnetic stimulation can be used to transfer genetic information imprinted in field patterns between organisms belonging to different species. The idea about genes responsible for genetic self engineering and responding to field patterns representing foreign genes pops up naturally in dark matter inspired vision.

The general model for the magnetic body allows also to sharpen the model of remote mental interactions. In fact, these effects would be only a scaled-up exogenous versions of the effects appearing endogenously in cellular length scales and also in astrophysical length scales in communications between magnetic bodies and corresponding biological bodies.

The appendix of the book gives a summary about basic concepts of TGD with illustrations. There are concept maps about topics related to the contents of the chapter prepared using CMAP realized as html files. Links to all CMAP files can be found at `http://tgdtheory.fi/cmaphtml.html` [L9]. Pdf representation of same files serving as a kind of glossary can be found at `http://tgdtheory.fi/tgdglossary.pdf` [L10]. The topics relevant to this chapter are given by the following list.

- Magnetic body [L15]
- Basic Mechanisms associated with magnetic body [L4]
- Bio-anomalies [L5]
- Biophotons [L7]
- Cell membrane anomalies [L8]
- DC currents of Becker [L12]
- ELF effects on brain [L13]

- Pollack's observations [L17]
- Quantum antenna hypothesis [L19]
- Quantum gravity and biology [L20]
- Quantum metabolism [L21]
- Water memory and homeopathy [L22]
- Dark proton strings and genetic code [L11]
- Bio-catalysis from primitive immune system [L6]

1 General View About Homeostasis

For the benefit of the reader a general view about homeostasis a la TGD is first described before the construction of a model for homeopathy. First the general picture prior to the ideas about dark matter hierarchy is discussed and then the modifications implied by dark matter hierarchy are considered briefly.

1.1 Super-Conducting Part Of The Ionic Flow Circuitry

The observations described in [J5] provide important clues about the general structure of the super-conducting part of the ionic flow circuitry assumed to be realized as a fractal structure of magnetic flux tubes. The following scenario is consistent with the basic observations.

1.1.1 Magnetic circulation

Magnetic circulation is analogous to blood circulation and emerges during the development of the organism. Magnetic flux tubes form the super-conducting part of a many-sheeted ionic flow circuitry. Supra currents flow along magnetic flux tubes and are transformed to dissipating Ohmic currents when they flow to the atomic space-time sheets.

According to [J5], the frequencies associated with the acupuncture meridian lines remain in a good accuracy invariant during the life cycle of the organism [J5]. If the ELF frequencies correspond to magnetic transition frequencies, they characterize the thicknesses of the magnetic flux tubes carrying the ions and at least part of the magnetic flux tube circuitry could be closely related with the acupuncture meridian lines. There are very many ions and the magnetic frequency scale varies by a factor of order 100 over the periodic table. Homeopathy demonstrates that also ELF frequencies below those associated with atomic ions are important and this leads to the conclusion that also the magnetic transitions for space-time sheets containing water in liquid crystal form contribute to the ELF spectrum. The work of Mae Wan-Ho suggests a close correlation of flux tube circuitry with collagen circuitry [I39]. The DC current circuitry discovered by Becker [J4] could correspond to the dissipative part of the circuitry.

According to [J5], the endogenous frequencies vary only by ± 2 per cent. This would mean that endogenous magnetic flux tube thickness varies only by ± 1 per cent.

1.1.2 Frequency entrainment suggests magnetic homeostasis

Super-conducting magnetic flux tubes inside water and inside body body contain large number of ions, molecules, etc.. and there is large variety of magnetic transition frequencies which could be controlled by varying the magnetic flux tube thickness to stay in resonance with the exogenous frequency.

The phenomenon of frequency entrainment supports the notion of magnetic homeostasis. Endogenous frequencies indeed tend to follow the variation of an exogenous stimulating frequency initially sufficiently near to the endogenous frequency up to ± 30 per cent relative change after which they jump back to their endogenous values. The entrainment of the endogenous frequencies to external frequencies suggest that the thickness of the magnetic flux tubes in water and living matter is subject to a bio–control and that it makes sense to speak about magnetic homeostasis.

The above data would mean that the thickness of the magnetic flux tube can change at most ± 15 per cent. The observed variation of the high-to-low frequency ratios along meridians deviation of $\pm .15$ per cent. This would mean that the thicknesses of various magnetic flux tubes are with high accuracy scaled by a same factor in the endogenous magnetic homeostasis.

Self-organization by quantum jumps might automatically lead to the selection of preferred values of the magnetic flux tube thickness guaranteeing entrainment in healthy organism. The precise mechanism inducing the variation of the magnetic flux tube thickness remains however unidentified at this moment. The return of the entrained frequencies to their endogenous values does not seem to occur with the normal rate for electromagnetically hypersensitive persons [J5]: perhaps em hypersensitivity means that the mechanism controlling magnetic flux tube thickness does not function properly.

1.1.3 Why magnetic homeostasis?

There are good reasons why for the magnetic homeostasis.

1. Magnetic homeostasis with parallel MEs makes it possible for the system to entrain to the frequencies of various chemical transitions occurring in living matter. This would make possible endogenous spectroscopies allowing the organism to consciously (not necessarily at level of entire organism) detect various chemical concentrations by magnetic quantum phase transitions induced at these frequencies. Also the entrainment of neurons to external frequencies could rely on this mechanism.

2. Magnetic transitions could participate bio–control. "Stimulation of chakras" would translate to resonant generation of magnetic phase transitions at super-conducting magnetic flux tubes. If magnetic transitions affect the structure and properties of the bio–molecules, this in turn can induce strong control effects at the atomic space-time sheets. For instance, if super-conducting enzyme molecule suffers a magnetic transition at super-conducting space-time sheet, its enzymatic properties could change dramatically. Magnetic transitions at resonance frequencies at super-conducting space-time sheets could induce protein conformations somehow. They do not directly affect net supra currents essential for ionic flow equilibrium. Spin flip could however induce change of the direction of the electric dipole moment and induce chirality changes, etc.. Conformations of enzymes could change and their catalytic properties could be affected dramatically.

3. Also non-magnetic transitions induced by MEs parallel to the magnetic flux tubes could occur coherently for BE condensates of atoms and even molecules at super-conducting space-time sheets and optimize the effectiveness of the bio-chemical control. A possible explanation for the necessity of the immune system is that quantum coherence of protein Bose-Einstein condensates is reduced if organism contains alien proteins with same function so that the rates for transformations of the protein (say enzyme) conformations at super-conducting space-time sheets are reduced.

4. Magnetic transitions for the space-time sheets containing water in liquid-crystal form and having size smaller than the transversal thickness of the magnetic flux tube have spectrum extending to $1/f = 1000$ years. This means that all biological rhythms relevant for life at the level of single organism could be coded to these structures. In particular, the representation of long term memories (not at the geometric now but at the moment of the actual event) might involve this kind of structures.

1.1.4 Are wormhole magnetic fields involved?

"Wormhole magnetic fields" are pairs of magnetic flux tube space-time sheets with vanishing net energy (in TGD framework space-time sheets with negative energy are possible because space-time is 4-surface rather than an abstract Riemann space) and carrying opposite magnetic fields. Wormhole contacts, whose throats carry opposite classical em charges, connect the two space-time sheets, and if they rotate, they generate opposite currents at the two space-time sheets involved in turn giving rise to magnetic fields of same magnitude but opposite sign. No elementary particles

are required to generate these magnetic fields. Vacuum polarization effect is in question in a well defined sense.

At least the positive energy space-time sheet could contain supra phases of ions and an open question is whether super-conducting magnetic flux tube circuit consists of ordinary magnetic flux tubes only or whether it contains also parts which are wormhole magnetic fields. Wormhole magnetic fields could be regarded as a simulation of ordinary magnetic structures and homeopathy might involve also the generation of wormhole magnetic fields mimicking the magnetic structures associated with the homeopathic remedy. Wormhole magnetic fields might replicate and diffuse from homeopathic potency to body without any external energy feed and could be regarded as a life form of their own.

There is an obvious analogy between wormhole magnetic field and DNA double strand: similar analogy holds true for double -sheeted MEs which could also be present. Both double-sheeted MEs and wormhole magnetic fields would be structures carrying pure information.

1.2 How Water Represents?

The general model for how water can represent in its own dynamical structure the chemicals is inspired by various experimental findings (especially by the findings challenging the notions of ionic channels and pumps) is roughly the following.

1. The magnetic flux tube structure is fractal and thus contains flux tubes inside flux tubes and gives rise to what might be called magnetic circulation analogous to blood circulation. The magnetic field of Earth is important but not necessarily the only part of the structure. The thickness of the flux tube, and thus also magnetic transition frequency scale, is under bio-control. Also the length of flux tube is variable and under control.

2. MEs parallel to the magnetic flux tubes are also involved. The ends of magnetic flux tube could act effectively as laser mirrors and MEs would thus define zigzag path in space-time between the ends of the magnetic flux tube. Similar structures are involved with the model of long term memory and the structures in question could quite generally give rise to conscious memory in the time scale determined by the frequency involved. The characteristic frequencies associated with MEs are given by $f = c/L$, where L is the length of ME. There are thus *two branches* in the spectrum of important characteristic frequencies: magnetic transition frequencies in ELF range and the high frequency branch of the frequencies associated with MEs with lengths not above than the size of organism. For length scale of .1 meters the frequency scale of ME frequencies is of order GHz.

3. Positive/negative energy MEs could be even classical correlates for photon emission/absorption. Quite generally, MEs with typical length $L = c/f$ are presumably necessary for a complete TGD based description of atomic and molecular transitions at given transition frequency f. One can even consider the possibility that p-adic ME in presence of charged particle could transform to real ME and charged particle such that energy momentum conservation is satisfied. In this manner intention would be transformed to action at elementary particle level. One could also think that MEs at these frequencies could perform bio-control and also detect radiation emitted by various molecules.

4. Frequency imprinting and entrainment are generic phenomena. Both endogenous and exogenous frequencies can be entrained by varying the thickness and length of the magnetic flux tubes. This suggest that bio-system is performing kind of endogenous spectroscopy by detecting important bio-chemicals at magnetic flux tubes and even elsewhere. In ELF part of spectrum NMR or its generalizations to other than spin flip transitions would be involved. Also the sensing of important em frequencies as such could be performed routinely by bio-system in this manner. An interesting possibility is that also p-adic variants of MEs are involved so that this process could be seen as mimicry by singing in the same tune.

5. Weak magnetic fields affect the super currents running in the circuitry and this in turn affects dramatically the ionic concentrations at the atomic space-time sheets so that chemical control becomes possible. Magnetic transitions at super-conducting space-time sheets can affect the catalytic properties of enzymes and thus make possible more refined quantum level chemical

control. Also *other* than magnetic transitions could occur coherently (rate proportional to number of ions squared) at super-conducting space-time sheets and even atomic space-time sheets and be induced by MEs at the high frequency portion of the spectrum. Perhaps the rates for the transitions inducing protein conformations affecting the catalytic properties of the protein could be optimized in this manner. The performance of this kind of bio-control at super-conducting space-time sheets would be like performing surgery inside a specialized hospital instead of doing it on the street.

The above considerations do not answer the question about the role of the atomic space-time sheets in the representations of frequencies provided by MEs and magnetic flux tubes. What this role might be is suggested by the fact that the matter at the atomic space-time sheets should have the role of an amplifier of em fields associated with MEs.

1. The generation of space-time sheets containing water in liquid crystal form with a rotational frequency spectrum mimicking that of the homeopathic potency is a further aspect of this mimicry and could amplify the otherwise weak signal provided by chemical by amplifying the em fields associated with MEs. The water domain could be also seen as a mental image (sub-self) about the chemical at atomic space-time sheet. In principle all the rigid body aspects of the molecule can be mimicked in this manner. Mimicking water domains can also control the transitions of the bio-molecules or vice versa.

2. Not only rotational spectrum but also vibrational spectrum (such as conformal vibrations of molecules) can be mimicked since any system near equilibrium reduces to a collection of harmonic oscillators: now sound waves propagating in LC water blobs would provide the representation. It is known that the water in cell interior and near to the cell membrane transforms routinely between sol and gel (LC) states in response to various stimuli: this transformation would have interpretation as a formation of a conscious representation for something, perhaps some event or object outside the cell.

3. Note that by scaling law $f_h/f_l = 2 \times 10^{11}$, the characteristic neuronal frequency $f_l = 1$ kHz corresponds to $f_h = 2 \times 10^5$ GHz and to a ME with a length of 1.5 micro-meters, which roughly corresponds to the thickness of the magnetic flux tube. Thus kHz frequency is maximal if ME is required to extend outside the magnetic flux tube. Perhaps this ME could be involved with the sensory representations at the cell level. Note that an alternating voltage at kHz frequency is used also to generate Kirlian effect. For human vision the wave lengths of photons are in the range of $10^{-6} - 10^{-7}$ meters and corresponding ELF length scale is $10^4 - 10^5$ meters if scaling law is assumed.

4. The requirement that LC water blob has size not larger than about one micro-n implies that that the lowest ELF frequency corresponds to a time period of about $T = 1000$ years so that all time scales relevant for human consciousness are covered and MEs with frequencies relevant to human long term memories can be amplified by intracellular LC water space-time sheets. If the scaling law $f_h/f_{EEG} = 2 \times 10^{11}$ is taken literally, one obtains $f_h = 20$ Hz at the upper bound: this corresponds to the lowest audible frequency which suggests that also sound waves serve representative purposes.

5. Fractality suggests that LC water space-time sheets form in turn liquid crystals in larger length scale give rise to secondary representations and that there exists entire hierarchy of these representations.

1.3 The Role Of Micro-Waves In Homeostasis

Plasmoids (or plasmoids) consisting of closed magnetic flux tube structures carrying supra currents plus atomic space-time sheets associated with them, are good candidates for primitive electromagnetic life-forms, in particular plasmoids identified as UFOs. It has been found that plasmoids indeed satisfy the basic definitions of a life form [I43]. Ordinary bio-matter is assumed to self-organize around these structures and nerve circuit represents a good example of a structure resulting in this manner.

Also the magnetic life forms need energy feed to self-organize and stay awake. The basic metabolic mechanism would be the same as in the case of living matter [K21]. Energetic super-conducting ions must be somehow driven from the magnetic flux tubes to the atomic space-time sheets, where they collide with atoms, ionize them, and generate visible light in the atomic transitions giving thus rise to the observed luminous phenomena interpreted as UFOs. The ions would eventually "drop" back to super-conducting space-time sheet and liberate the zero point kinetic energy as a quantum of metabolic energy defining what is often referred to as a universal energy currency. Essentially identical energetic cycle of Karma would be realized also in living matter but involve a complex molecular organization and many-sheeted current circuitry responsible for the control of homeostasis. For the proton the quantum is predicted to be of order .5 eV liberated also when a single molecule of ATP is used.

The realization of this primitive metabolic cycle requires the breaking of super-conductivity: some mechanism must generate join along boundaries bonds serving as bridges connecting magnetic flux tubes with atomic space-time sheets along their boundaries so that supra current leakage becomes possible. The gap energy of super-conductors, typically measured in 10^{-4} eV as a unit (corresponding to temperature of order Kelvin), would naturally correspond to the energy needed to build up this bond (note that the temperature at the magnetic flux tubes would be much lower). Interestingly enough, a gap energy would 10^{-5} eV corresponds to the frequency ~ 3 GHz. This suggests that micro-wave photons could induce these bridges, break super-conductivity, and induce energy feed and self-organization. A similar breaking of super-conductivity might be also involved with the driving of the super-conducting ions to the atomic space-time sheets in the living matter. Proteins could generate the needed micro-wave photons by coherently occurring conformational transitions. Also rotational transitions of clusters of water molecules could emit micro-waves and perhaps mimic and amplify the micro-waves generated by proteins.

The clusters of water molecules forming liquid crystals can mimic the conformational and rotational spectrum of various molecules, and that the ability to reproduce the rotational frequency spectrum of the medicine molecule is an essential element of homeopathic healing. The level of self-organization of water would thus be measured by how complex mimicry it is able to perform. Why rotational micro-wave energy spectrum is so important for healing, could be understood as follows. The many-sheeted current circuitry, involving atomic space-time sheets and magnetic flux tubes and also other space-time sheets, is extremely complex control structure [K32, K33]. The continual regeneration of bridges between, say, atomic space-time sheets and magnetic flux tubes by micro-waves emitted by proteins is necessary to sustain this circuitry. An important category of diseases is due to the failure to generate the bridges between super-conducting and atomic space-time sheets so that this control circuitry suffers shortcuts. Perhaps the genetic expression of some proteins responsible for the micro-waves generating particular bridges fails.

The medicine or its homeopathic counterpart would help to generate (or even re-establish the generation of) the micro-wave spectrum responsible for the generation of the lacking bridges in the circuitry. A further piece to the puzzle comes from the scaling law of homeopathy. The law states that high and low frequencies accompany each other, the frequency ratio being $f_{high}/f_{low} \simeq 2\times 10^{11}$ in the simplest situation (the ratio can actually vary). The TGD based interpretation is that ELF MEs are responsible for quantum entanglement in macroscopic, even astrophysical, length scales. Micro-wave MEs propagating effectively as mass-less particles along ELF MEs in turn induce self-organization by serving effectively as "food" of the plasmoidic life forms at the receiving end. This mechanism is behind both the endo- and exogenous realizations of intentions as actions, that is ordinary motor actions and phenomena like remote healing and psychokinesis. Also sensory representations at the personal magnetic canvas and magnetosphere rely on this mechanism, and in this case life-forms are mental images getting at least partially their metabolic energy from brain.

1.4 How The Vision About Dark Matter Hierarchy Affects ThePicture?

The picture discussed in previous subsections is essentially that before the ideas about dark matter hierarchy emerged. The basic implication of the dark matter hierarchy is that there is no need to assume that temperatures at different space-time sheets are widely different since the scaling of $\hbar$ can scale up the energies above thermal threshold. The simplest model of dark hydrogen atom however predicts that the energies of the hydrogen atom are scaled down by $1/r^2$, $r = \hbar/\hbar_0$,

which means that inherently dark atoms and molecules would not be thermally stable at room temperatures.

In topological condensation of ordinary atoms and molecules at dark space-time sheets cyclotron energies and plasma oscillation energies are scaled up and can be above thermal threshold. This leads to a very restrictive model. For instance, the conformal and rotational spectra of bio-molecules correspond to microwave frequencies and would be below thermal threshold and thus of no importance. This would also reduce the importance of liquid crystals known to be of crucial importance for the functioning of living matter. There is also a feeling that the role of fermionic bio-ions such as Na^+, K^+, and Cl^- should be more important than this picture allows.

One can however consider a modification of the notion of dark atom in which the dark energy spectra are essentially same as the ordinary ones. This would mean that the original vision about water blobs as being able to mimic molecules using their rotational and vibrational spectra is modified only by replacing these structures with their dark variants. Of course, at this stage only experiment can decide whether atoms and molecules can be inherently dark. In the following the two models of dark atom are discussed to give an overall view about what is involved.

1.4.1 An alternative model for inherently dark atoms

The attempts to understand dark matter hierarchy led to an alternative model of dark atoms in which the energy spectra of dark atoms and molecules are nearly the same as their ordinary counterparts.

1. The original model for dark atoms relies on the scaling of Planck constant by $r = 2^{k_d}$ at the k_d^{th} level of the dark matter hierarchy. In the case of hydrogen atom the model predicts that the energies of hydrogen atom proportional to $1/r^2$ so that dark atoms would not be thermally stable at room temperature. In practice this would exclude dark atoms and molecules as biologically interesting inherently dark systems. The topological condensation of ordinary atoms and molecules at r-sheeted (now in the sense of "Riemann surfaces" over M^4) dark magnetic flux quanta is however possible and means scaling up of the cyclotron energy by r making possible cyclotron Bose-Einstein condensates at high temperatures identifiable as dark quantum plasmas. The same scaling occurs to the energy of dark plasma oscillations so that their energies can be above thermal threshold. Dark plasmoids and plasma oscillations are indeed fundamental in the TGD based model of quantum control in living matter.

2. One must be however very cautious in drawing conclusions since the model for the dark matter is not precise enough to exclude the possibility that the notion of dark atom and molecules makes also sense. For instance, dark atoms having ordinary size and ordinary energy spectrum could be possible if the principal quantum number n is fractionized to $n \to n/r$. The fractionization could make sense if the atomic space-time sheet is r-folded and atoms become radial anyons. The corresponding Bohr orbits would close in the radial direction only after r turns. The formation of dark atoms could be interpreted as a transition to chaos by period r-folding in radial and angular degrees of freedom. This option would differ from the first one in that radial scaling in M^4 by a factor r^2 is replaced by a radial r-folding so that the M^4 projection of dark atom has the same size as in the case of ordinary atom.

   This picture is favored by the requirement that four-momenta and angular momenta remain invariant in the transition to the dark matter phase but does not conform with the first model of dark atoms which assumes that n is integer. This model was formulated before the realization of the r-fold Riemann surface like structure of dark space-time sheets following from the conservation of angular momentum.

3. Since dark atom would define a r-fold covering of M^4, one expects a degeneracy of states corresponding to the phase factors $exp(ikn2\pi/r)$, $k = 0, ..., r-1$, where n labels the sheets of the r-fold covering of M^4. The nuclei and electrons of $N \leq r$ dark atom could form many-particle states separately and fermionic statistics becomes effectively para-statistics for the resulting N-atoms. Note that the N electrons and nuclei would be in identical states in ordinary sense of the word since Bohr orbits must be identical: kind of fermionic Bose-Einstein condensates become thus possible.

4. The quantum transitions of N-atoms for $N = r$ would give rise to dark counterparts of the photons emitted in the ordinary atomic transitions. For $N \leq r$ the energies of dark photons would be N times higher than the energies liberated in the ordinary transitions. The claims of Mills [D4] about the scaling up of the binding energy of the hydrogen ground state by a square k^2 of an integer in plasma state might be understood as being due to the formation of dark $N = k^2$-atoms emitting dark photons with k^2-fold energies de-cohering to ordinary photons. The plasma phase would contain a fraction which is in dark plasma state. The chemistry of bio-molecules identified as N-molecules would definitely differ from the ordinary chemistry.

   The fractionization $n \to n/r$ of integer n labelling vibrational modes and cyclotron states would be unavoidable. Single particle cyclotron states having $E = \hbar(k)\omega$ of the earlier picture would in this framework correspond to single particle states having $n = r$ or to $N = r$-ion states. Fermionic $N = r$-states are expected to have a special role since these configurations are analogous noble gas atoms with full shells of electrons and to magic nuclei with full cells of nucleons. Most biologically important ions are fermions and $N = r$ states would give rise to what might be regarded as fermionic analogs of Bose-Einstein condensates. For bosonic ions there is no restriction to the occupation numbers of r single particle states involved.

5. The phase $q = exp(i2\pi/r)$ brings unavoidably in mind the phases defining quantum groups and playing also a key role in the model of topological quantum computation [K44]. Quantum groups indeed emerge from the spinor structure in the "world of classical worlds" realized as the space of 3-surfaces in $M^4 \times CP_2$ and being closely related to von Neumann algebras known as hyper-finite factors of type II_1 [K45]. Unfortunately, the integer n characterizing the phase cannot be identified as r. Could it be that quantum groups emerge in two different manners in TGD framework?

   If so, living matter could perhaps be understood in terms of quantum deformations of the ordinary matter, which would be characterized by the quantum phases $q = exp(i2\pi/r)$. Hence quantum groups, which have for long time suspected to have significance in elementary particle physics, might explain the mystery of living matter and predict an entire hierarchy of new forms of matter.

1.4.2 Are both options for dark matter realized?

For $N = r$ molecules which dark photons emitted in the rotational and conformational transitions would be above thermal threshold. It is of course quite possible that both options are realized. The fact that also fermionic ions (such as Na^+, K^+, Cl^-) are important for living system suggests that this is the case. This would also provide a justification for the hypothesis that microtubular conformations represent bits and allow conformational dynamics to serve as metabolic controller by providing microwave dark photons with energies above thermal threshold.

As demonstrated in [K25], the notion of N-particle leads to an amazingly elegant model for the lock and key mechanism of bio-catalysis as well as the understanding of the DNA replication based on the spontaneous decay and completion of fermionic $N < r$-particles to r-particles. Optimal candidates for the N-particles are N-hydrogen atoms associated with bio-molecules appearing as letters in the "pieces of text" labelling the molecules. Lock and key would correspond to conjugate names in the sense that N_1 and N_2 for the letters in the name and its conjugate satisfy $N_1 + N_2 = r$: as the molecules combine, a full fermion shell represented by r- fermion is formed.

2 TGD Based Model For Homeopathy

Homeopathy is regarded by skeptics as a fringe science, kind of promised land of crackpots. My own views about homeopathy changed after I heard the excellent lecture of Cyril Smith in Liege about frequency imprinting and entrainment as mechanisms of homeopathy [J5]. After that I learned about the work of Benveniste [I20, I21] and encountered once again the pattern which I had encountered so many times before. When empirical discovery does not fit the dogmas of the reductionistic science, it is simply forgotten and the unlucky experimentalist is labeled as a swindler or crackpot.

2.1 Basic Claims About Homeopathy

The basic assumption of homeopathy is that the homeopathic remedy manufactured from the substance causing the illness also heals the illness. The preparation of the homeopathic remedy occurs by a repeated dilution so that for instance 1 part of homeopathic remedy already obtained is diluted in 99 parts of water. The dilution can be continued arbitrarily many times, say 30 times so that the ratio of substance to water is 10^{-60}: obviously no molecules of the original substance can be present anymore in the probabilistic sense if one accepts the standard view about space-time.

The notion of water memory [I20] crucial for the explanations of acupuncture and homeopathy has received a considerable empirical support quite recently [I6]. It seems that basic mechanisms of both homeopathy and acupuncture are frequency imprinting and entrainment. Somehow water learns the some fundamental frequencies characterizing the molecules of the homeopathic remedy during the manufacturing process and when it has learned these frequencies it acts as the desired healing effect. Even more: just this frequency imprinting of water without any need for the remedy could be enough to achieve the healing effect.

2.2 Frequency Signatures For The Homeopathic Remedies And Endogenous Frequencies In Acupuncture

The homeopathic remedies seem to be characterized by frequencies varying in the range containing at least the range $10^{-3} - 10^{9}$ Hz suggesting that electromagnetic fields at specific frequencies characterize the homeopathic remedy. These frequencies can be imprinted into water and also erased. The imprinting of frequencies is induced by the presence of the homeopathic potency or by irradiating pure water by using either the ELF or far infrared frequencies associated with the potency. Very importantly, the removal of Earth's magnetic field erases the imprinted frequencies [J5].

The frequencies appear as pairs (f_h, f_l) of high and low frequencies in the sense that the imprinting of f_h implies the imprinting of f_l and vice versa [J5]. The first branch is at GHz range: in particular the frequencies 2.664 GHz, 1.42 GHz (21 cm line of hydrogen) and 384 MHz have unexpected properties. The second branch of frequencies is in the ELF range, in particular Schumann frequency 7.8 Hz accompanies 384 MHz. The ratio of high and low frequencies is in good approximation constant and equal to $f_h/f_l = 2 \times 10^{11}$: this result gives strong constraint on possible models.

The studies of acupuncture support the existence of certain highly coherent endogenous frequencies [J5] associated with the acupuncture meridians at which em radiation has strong effects. Also these frequencies appear as pairs and the ratio $f_h/f_l \simeq 2 \times 10^{11}$ is constant over all acupuncture meridians with a deviation of $\pm.15$ per cent. The fact that these frequencies can entrain to exogenous frequencies suggests a mechanism of homeopathy based on entrainment and mimicry. It would be the characteristic frequencies associated with the homeopathic potency molecule, which would help to achieve the healing effect rather than the chemical structure of the potency molecule.

Quite generally, frequency imprinting and entrainment could be a basic representational mechanism in living matter. The important chemicals present in living matter would be represented by their frequencies and water wold construct representations. These representations can explain why bio-system can recognize also chemicals usually not present in organism (such as poisonous molecules).

2.3 What Could Be The Mechanism Behind The Homeopathic Healing

Both the claimed healing using the agent causing the disease and the manufacturing process seemingly removing every trace of the remedy are paradoxical enough to induce strongly emotional reactions in the average skeptic. The notions of many-sheeted space-time (see **Fig.** `http://tgdtheory.fi/appfigures/manysheeted.jpg` or **Fig.** 9 in the appendix of this book) and dark matter hierarchy however suggest a rational explanation for these claims. Several mechanisms can be imagined and I have indeed done this before finding the most convincing option.

2.3.1 Bose-Einstein condensation of molecules of homeopathic remedy to magnetic flux tubes as a basic mechanism

The manufacturing of the homeopathic remedy could induce dropping of some fraction of the homeopathic remedy to magnetic flux tubes of the Earth's magnetic field.

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.

This assumption conforms with the crucial role of the Earth's magnetic field in the erasure of the imprinted frequencies. Also the importance of 7.8 Hz Schumann frequency [J5] can be understood.

If the molecules in question are bosons or if they combine with some other particles to form bosons in water environment, they can form Bose-Einstein condensates in cyclotron states. At $k_d = 40$ level of dark matter hierarchy they cyclotron energy scale would be above the thermal threshold for cyclotron frequencies above 1 Hz: the charge/mass ratio corresponds to that for DNA.Note that the hypothesis is $h_{eff} = nh$, where n is product of distinct Fermat primes and power 2^{k_d}.

2.3.2 Could protonic super nuclei perform mimicry of ions?

One of the first discoveries in the process leading to the understanding of dark matter was the direct evidence for the fact that one fourth of protons of water is in dark phase [D9, D8, D16, D5] in time scale of atto-second (these protons are not visible using neutron diffraction or electron scattering). This phase could correspond to some level of dark matter hierarchy.

The simplest model for the dark phase [K13] is as "super nuclei" formed by closed protonic strings (for the analogous model of nuclei see [K41]) with nearby protons connected by color bonds with exotic dark quark and anti-quark at ends of the bond. These protonic strings can develop also exotic em charge when the quark and anti-quark at the ends of the bond are replaced by u and $\overline{d}$ or d and $\overline{u}$. Thus a protonic super-nucleus containing A protons with a proper exotic charge can mimic ion with mass number A and charge Z.

Dark protonic super-nuclei could perform mimicry of those characteristics of molecules which are crucial for the macroscopic quantum coherence. Frequency imprinting and entrainment would be based on the formation of protonic super-nuclei plus magnetic homeostasis allowing to vary the value of the magnetic field around the nominal value $B_E = .5$ Gauss in such a manner that entrainment is achieved for almost any ELF frequency.

Conservation of the magnetic flux implies that the variation of field strength corresponds to the variation of the thickness of the magnetic flux tube. Magnetic homeostasis could therefore be regarded also as a motor action of the magnetic body containing dark matter and to some extent behaving like an intelligent conscious system. The magnetic flux quanta assignable to the homeopathic potency would carry the information about the molecules of the homeopathic remedy. Also p-adic scaling of flux tube dimensions by scaling factor which is power of $\sqrt{2}$ can be considered.

2.3.3 Could also clusters of water molecules perform mimicry?

Dark protons are not the only option. The original proposal was that clusters of water molecules are ideal for mimicking cyclotron, rotational, and vibrational spectra of molecules. The recent view about dark matter suggests that the internal properties of particles are unaffected in the dropping to r-fold magnetic flux tubes so that only cyclotron energy spectrum is scaled by r and can be thermally stable. Hence water molecule clusters could also mimic molecules. Without magnetic homeostasis the accuracy of the mimicry would not be very impressive since mass number would be a multiple of 18. For heavy molecules the relative accuracy would be $\Delta f_c/f_c = 18/A$ and could be compensated by the control of magnetic field strength.

2.3.4 Homeopathic healing mechanism as sweeping of harmful molecules to magnetic flux quanta?

Also the homeopathic healing mechanism could be understood. Usually the immune system prevents the access of the harmful molecule or organism to the system by chemical means. Also in the homeopathic healing similar elimination mechanism would work but now magnetic body would perform the elimination. One can imagine several mechanisms. The harmful molecules could be simply dropped to the magnetic flux quanta. The dropping of these molecules would liberate zero point kinetic energy (which brings in mind the old saying "the disease that does not kill you, strengthens you!"), and if the process involves emission of photons with frequencies f_h and f_l, the rate of the process would be enhanced by the presence of the Bose-Einstein condensates of dark photons of frequency f_l emitted in cyclotron transitions by the standard mechanism of induced emission. It would not matter whether the Bose-Einstein condensate of ELF photons causing the induced dropping is generated by the molecules of homeopathic remedy or by the protonic super-nuclei mimicking them.

2.3.5 Stealing of the magnetic bodies of molecules

If magnetic bodies of harmful molecules are responsible for the harmful effects, then it would be enough to steal magnetic bodies of the harmful molecules and provide clusters of water molecules with them. The shaking of the water in the manufacturing of the homeopathic remedy would facilitate this process. This option allows to understand the fact that the presence of biomolecules can be mimicked by using suitable patters of low frequencies identifiable as cyclotron frequencies. The domains of water with size scale of 10 nm proposed by Smith could be the thieves of the magnetic coats defining the biological role of the molecule. This option is definitely the most elegant and minimal one and seems to explain what is known about homeopathic action and water memory.

2.4 TGD Counterparts For The Propagation And Diffusion Of Coherence

Cyril Smith [J5] assigns the endogenous frequency pairs (f_h, f_l) with the coherent domains of water with size of 75 nm interacting with external em fields as coherent units. The origin of the scaling law $f_h/f_l = 2 \times 10^{11}$ claimed by Smith has been discussed in previous section. These coherent domains are predicted by the theory of Giudice and Preparata [D6]. On basis of empirical data Smith associates two kinds of dynamical phenomena to the coherence regions: diffusion of coherence with low velocity and propagation of coherence with light velocity.

On dimensional grounds one expects that for a coherent domain of size L dispersion relation for the low velocity excitations (not only diffusion of coherence) could be given by the scaling law $v \sim Lf$. According to Smith the observed diffusion velocities are of order few m/s $\sim m/s$ and of the same order of magnitude as nerve pulse conduction velocity and phase velocities for EEG waves. From this the size of coherent domains for the high frequency branch would be of the same order as that predicted for the coherence domains of water. For the low energy branch the size of the coherence domains would be of order .1 m.

The $v = K$ relationship proposed by Smith is of the same form as the scaling law discussed in the previous section and representing the coding of generalized EEGs to the velocities of physiological waves. In TGD framework the counterparts of these domains would be various linear structures, say space-time sheets formed by water in liquid crystal form. The propagation of coherence with light velocity would correspond to the propagation of the classical signal inside ME whereas the diffusion of coherence would basically correspond to the phase velocity assignable to ME in direction along the linear structure and fixed by the boundary condition so that it obeys the generalization of the scaling law from its original form $v = Lf_l$ to $v = Lf_l/n_h$. f_h would be given by $f_h = (c/v) \times f_l$.

2.5 Frequency Imprinting And De-Imprinting

In the following a more detailed comparison of TGD based model with the data discussed in [J5] is carried out. The effect of several methods allowing frequency imprinting and erasure could

be understood if imprinting involves the variation of thickness of magnetic flux tubes carrying super-conducting ions.

2.5.1 Some facts about imprinting

I learned the basic facts about frequency imprinting from Cyril Smith's excellent lecture in Liege.

1. Cyril Smith represents detailed empirical data about n-alkane imprinting. In this case ELF frequencies were in Hz range and the ratio of the high and low frequencies was roughly 2×10^{11} as also in other experiments. This is consistent with the assumption that cyclotron frequencies serve as a representation of of the molecule.

2. Smith has studied also frequency memory of bulk water (no potency present) in ELF frequency range $.001 - .01$ Hz. Bulk water showed resonances between 200 MGz and 2GHz with a mean frequency ratio of about 2×10^{11} as also in case of n-alkanes. If very low ELF frequencies correspond to magnetic transition frequencies in Earth's magnetic field, then the atomic numbers of the space-time sheets involved must be quite high: 10^{-3} Hz corresponds to $A = 3 \times 10^5$ and thermal stability of cyclotron energies requires at least $k_d = 53$ level of the dark matter hierarchy.

3. ELF frequency imprinting by frequency f_l was also found to induce splitting $f \to f \pm f_l$ of other inherent ELF frequencies associated with water. A similar splitting was observed in high energy branch. The explanation is that the resulting MEs interact with the MEs associated with these frequencies and induce amplitude modulation. Interaction could be due to MEs inside MEs mechanism.

4. There might be a connection with the work of Gariaev's group [I24] demonstrating that the irradiation of DNA with a coherent light generates radiation at radio frequencies discussed in [K21]. The method inducing these radio frequencies is based on the use of two orthogonally polarized laser beams interacting with DNA in liquid crystal state and can be also used to detect imprinted frequencies [J5].

2.5.2 Frequency imprinting of "clean" water

Typical example of imprinting involves the transfer of imprinted frequencies through the glass of a vial containing "clean" (no chemical impurities nor imprinted frequencies) water immersed to the imprinted water serving as the frequency source. Higher ELF frequencies are transferred quickly whereas the transfer of the low frequencies can take hours or even days [J5]. The vial could be also in the proximity of the frequency source (homeopathic potency, imprinted water, or oscillator). The succussion of the vial or a brief application of the field of a strong permanent magnet allows the transfer of frequencies. The transfer of frequencies of body to a vial of "clean" water is possible by a direct contact, say by holding the vial in hand. Succussion also helps the transfer.

Several questions relate to the dynamics of the magnetic flux sheet structures.

1. Do the flux structures exist already before imprinting or are they dynamical? Can one even speak about the growth of these structures from source to the imprinted system? The general model for quantum control and communications between magnetic and biological body predicts that magnetic body is dynamical and grows during the development of individual. Thus flux quanta could penetrate/diffuse/grow from the imprinted water to the interior of the glass seal. This means also the transfer of the magnetic transition frequencies.

2. High frequencies are reported to penetrate quicker than slow frequencies [J5]. If magnetic flux quanta penetrate to the imprinted system and homeostatic variations of the flux tube area keeping the flux constant are possible, the question transforms to a new form. Why thin magnetic flux tubes carrying strong magnetic fields and high frequencies penetrate quicker than the thick magnetic flux tubes carrying weak magnetic fields? Naive geometric intuition suggests an answer here. There are several possibilities: simple dimensional analytic argument $T \propto 1/f$ or equivalently $T \propto 1/f_c$. If the time of transfer is proportional to the p-adic time scale one would have $T \propto T(k) \propto 1/\sqrt{f_c}$ (this would mean a variation by factor of 10^6 in the range $10^{-3} - 10^9$ Hz).

There is also a list of question about the imprinting using arbitrary frequency source and frequency.

1. Does the magnetic body of the source represent the frequency of the source somehow? Is this magnetic body connected to the Earth's magnetic body? Is the presence of water really necessary? Are dark proton super-nuclei present also now and do they originate from the magnetic body of Earth? Is it really possible to imprint arbitrary frequencies?

2. The frequencies should be assignable to dark photons. Hence the question arises whether the emission of ordinary photons is accompanied by emission of dark photons represented by r-folded MEs. Are ordinary photons transformed with some rate to dark photons by the reversal of coherence phase transition. Is this phase transition de-coherence phase transition for phase conjugates of dark photons?

3. Do the magnetic flux quanta perhaps form closed flux tube structures connecting the source and imprinted water? This is actually suggested by the reported Aharonov-Bohm effect [J5], which would be due to the modification of vector potential along a closed magnetic flux circuit.

2.5.3 Erasing the frequency imprinting

According to [J5], the removal of Earth's magnetic field by surrounding the imprinted water by a metallic container removes the imprinting provides very strong support for the fundamental role of Earth's magnetic field. This however forces to consider critically the idea about r-folded dark magnetic flux quanta since the removal of also the r-fold dark variants of its flux quanta. This is frustrating but one must humbly accept the fact that the model for dark matter at space-time level is far from being final, and it is rather easy to end up to the garden of endlessly branching paths.

Also heating is reported lead to both appearance and disappearance of imprinted frequencies [J5]. The thermal instability conforms with the assumption that dark matter with large value of Planck constant and ordinary matter can be in thermal equilibrium: in the original framework it was assumed that larger space-time sheets are at so low temperatures that cyclotron energies are above thermal threshold.

The effect of the heating could have several explanations.

1. The simplest implication of heating is that cyclotron energies in question remain below thermal threshold and cannot anymore affect the behavior of the bio-matter. Heating can induce de-coherence phase transition of photons to ordinary ones so that the Bose-Einstein condensates of photons crucial for the effectiveness of homeopathic potency are lost temporarily. This could be tested by heating the homeopathic potency and finding whether its effect disappears. The re-appearance of imprinted frequencies seems more difficult to understand, at least if they correspond to cyclotron energies below thermal threshold.

2. Heating could also affect magnetic flux quanta, say decompose $r = 2^{k_d}$-folded flux quanta to 2 flux quanta at level $k_d - 1$ for which cyclotron photons have sub-thermal energies. Heating can induce split flux tubes between space-time sheets of ordinary matter and magnetic flux quanta.

According to [J5] it is also possible to hide imprinted frequencies by succussing the vial on one side of an oscillator output coil. My guess for "hide" is that the imprinted frequencies are not lost permanently and can be re-established. If the Bose-Einstein condensates of dark photons are lost temporarily but the dark protonic super-nuclei or water molecule clusters responsible for the mimicry remain intact, the frequencies would be indeed "hidden".

2.5.4 The effect of dilution to the imprinted frequencies

The effect of dilution can alter the imprinted frequency [J5].

1. First example

In the first example $f = 1$ Hz was imprinted by succussion. Then the solution was diluted serially by a dilution factor $D \equiv 1/p = 10$. $f = 1$ Hz remained but after a succussion it disappeared

and was replaced by 10 Hz. More generally, the imprinted frequency does not follow in a continuous manner the dilution factor but changes in a stepwise manner. The fact that cyclotron frequencies of DNA sequences are around 1 Hz whereas 10 Hz corresponds to alpha band containing the cyclotron frequencies of most bosonic ions [K12] might have some significance in this special case.

One can imagine two different explanations for the replacement of 1 Hz frequency with 10 Hz frequency.

1. The protonic super-nuclear (closet string like structures) having 1 Hz as cyclotron frequency would contain 300 dark protons. It could happen that these strings are unstable against the decay to super-nuclei with 30 dark protons expected to be present since frequencies in alpha band are certainly present at magnetic flux tubes of Earth. The analog of induced emission due to presence of 10 Hz dark photons would increase the rate for the decay process induced by succussion.

2. Frequency imprinting could increase the area of some flux quanta of Earth's magnetic field by a factor of 10 and thus lower the value of the magnetic field and cyclotron frequency from 10 Hz to 1 Hz so that ions in alpha band could be responsible for the frequency imprinting. The increase of the thickness by factor 10 could involve the p-adic scaling up of the thickness of the flux sheet by a factor 8 ($k = 169 \to 175$ or $k = 151 \to 157$) followed by a continuous increase of the thickness by a factor 5/4. Succussion could bring the magnetic flux return to the ordinary stable state corresponding to ~ 10 Hz cyclotron frequency for bosonic ions. For this option the effectiveness of homeopathic potency is not lost unlike for option 1).

2. Second example

In the second example 1 Hz is stable for a dilution factor $D = 1.4$ but for a dilution factor 1.5 it changes to 1.5 Hz.

1. The instability of $A = 300$ super-nuclei against decay to $A = 200$ perhaps mimicking some important ion (actually Gold ion Au^+ for $B_E = .5$ Gauss) could be in question. In this case the homeopathic efficiency of the potency is lost.

2. 1.5 is so near to $\sqrt{2} \simeq 1.414$ that one cannot avoid the question whether some kind of 2-adic effects are involved. The transition could reduce the thickness of the flux sheet by a factor $1/\sqrt{2}$, say in $k = 169 \to 168$ or $k = 151 \to 150$ p-adic transition. The efficiency of the homeopathic potency would not be lost. The stable magnetic field strengths for flux quanta would be piecewise constant functions of D reduced by a $1/\sqrt{2}$-factor at $D/D_0 = \sqrt{2}^n$: this for sufficiently small values of D. If the energy of the magnetic flux tube is invariant in the scaling then also its length varies as $L \propto D$ for small enough values of D. Similar plateau effects suggesting underlying 2-adicity [K31] have been found to be associated with the intensity of sensation as a function of stimulus [J13]. If the intensity of sensation is coded to ELF frequency this effect could perhaps be understood.

3. Other strange findings

Also other strange findings are reported in [J5]: for instance, no frequency at all was imprinted for the dilution factors in the range 13-19 when starting from an imprinted frequency of 1 Hz. If these findings represent reality, the rate for the formation of the mimicking structures depends on the density of existing representatives and this range of dilution factors would represent kind of a transition zone between two kinds of situations allowing stable imprinting.

The rate for the formation of mimicking structures is enhanced by the presence of Bose-Einstein condensates of photons (the analog of induced emission). Destructive interference effects for dark photons from Bose-Einstein condensates of disjoint flux quanta could however reduce this effect. For sufficiently large values of D the destructive interference effects of photons from different flux quanta would not be significant. For small values of D the flux quanta could fuse to form single structure guaranteeing the absence of destructive interference effects. There could however exist a transition region in which destructive interference are important and reduce the rate for the formation of mimicking structures: perhaps this region corresponds to D in the range 13-19.

2.5.5 Biological Aharonov-Bohm type effects

Even the vector potential of a vanishing magnetic field can affect the state of living matter and water. An example is provided by a ferrite toroidal coil containing its magnetic field inside the toroid [J5]. This can be understood as follows.

Suppose that there exist closed flux tubes or more general flux quanta connecting the frequency source and the vial containing the imprinted water. The non-vanishing vector potential of the ferrite toroid in the exterior of the toroidal coil affects the vector potential along these flux tubes and thus also the wave functions of the super-conducting ionic BE condensates at the closed flux tubes. The condition for this is that the closed magnetic flux tubes traversing from the source of frequencies to the vial of the clean water are linked with the toroidal coil so that magnetic flux through the surface bounded by the closed magnetic flux tube equals to the magnetic flux carried by the coil.

The vector potential A appearing in the quantization conditions for the magnetic flux

$$\oint (p - eA)dl = n \times 2\pi$$

for a linked loop is affected by the toroidal magnetic field since the loop integral is changed by the toroidal magnetic flux. This means that the momentum p of the super-conducting ion changes for this kind of magnetic flux loops going from the frequency source to the clean water. Thus ionic supra-currents change so that the ionic concentrations and homeostasis at the atomic space-time sheets are affected in case of living matter. Both the source and vial of clean water are "magnetically entangled" in this kind of situation. An interesting question is what effects this kind of a toroid placed between two living organisms could induce. Note that for two toroidal coils with opposite current directions these effects should cancel out.

2.5.6 Does a critical dilution factor exist?

The dilution ratios used correspond to powers of 10: $p = 1/10^k$, $k = 1, 2, 3, ...$ This is a mere convenient convention. There should however exist some critical dilution ratio p below which the rate for the formation mimicking molecules, be they water molecule clusters stealing the magnetic bodies of molecule or protonic super nuclei, is too low.

Similar critical ratios are encountered in the percolation of liquid to a porous substance: when the volume fraction of the wetted pores is overcritical the entire material gets wet. The strong mixing of the water could be seen as a manner to optimize the potentiation. It could also enhance the rate of dropping of protons to the magnetic flux quanta.

1. For instance, suppose that diluted potency generates at each step of the process dark super-nuclei (dark protonic strings with mass number A and charge Z) mimicking the already existing super-nuclei mimicking the original molecules. If the presence of the already existing super-nuclei enhances the rate of this process as it does in induced emission so that Bose-Einstein condensation is the end step of the generation of the super-nuclei, a lower bound for the dilution factor emerges.

2. In the case of water molecule clusters stealing magnetic bodies, the critical dilution ratio would have much simpler interpretation since the rate for the loss of magnetic bodies is proportional the density of actual molecules. If so then the long sequence of dilutions would not have considerable effect. Situation could change if the magnetic bodies can replicate. This kind of replication must take place in cell division but whether it can happen under much more primitive conditions is unclear.

2.6 A Possible Realization Of Water Memory

The Benveniste's discovery of water memory [I20, I21] initiated quite dramatic sequence of events. The original experiment involved the homeopathic treatment of water by human antigene. This meant dilution of the water solution of antigene so that the concentration of antigene became extremely low. In accordance with homeopathic teachings human basophils reacted on this solution.

The discovery was published in Nature and due to the strong polemic raised by the publication of the article, it was decided to test the experimental arrangement. The experimental results were

reproduced under the original conditions. Then it was discovered that experimenters knew which bottles contained the treated water. The modified experiment in which experimenters did not possess this information failed to reproduce the results and the conclusion was regarded as obvious and Benveniste lost his laboratory among other things. Obviously any model of the effect taking it as a real effect rather than an astonishingly simplistic attempt of top scientists to cheat should explain also this finding.

The model based on the notion of field body and general mechanism of long term memory allows to explain both the memory of water and why it failed under the conditions described.

1. Also molecules have magnetic field bodies acting as intentional agents controlling the molecules. Nano-motors do not only look co-operating living creatures but are such. The field body of the molecule contains besides the static magnetic and electric parts also dynamical parts characterized by frequencies and temporal patterns of fields. To be precise, one must speak both field and relative field bodies characterizing interactions of molecules. Right brain sings-left brain talks metaphor might generalize to all scales meaning that representations based on both frequencies and temporal pulse with single frequency could be utilized.

2. The effects of complex bio-molecule to other bio-molecules (say antigene on basofil) in water could be characterized to some degree by the temporal patterns associated with the dynamical part of its field body and bio-molecules could recognize each other via these patterns. This would mean that symbolic level in interactions would be present already in the interactions of bio-molecules. Cyclotron frequencies are most natural candidates for the frequency signatures and the fact that frequencies in 10 kHz range are involved supports this view.

3. The original idea was that water molecule clusters are able to mimic the bio-molecules themselves -say their vibrational and rotational spectra could coincide with those of molecules in reasonable approximation. A more natural idea is that they can mimic their field bodies. Homeopathy could rely on extremely simple effect: water molecule clusters would steal the magnetic bodies of the molecules used to manufacture the homeopathic remedy. The shaking of the bottle containing the solution would enhance the probability for bio-molecule to lose its magnetic body in this manner. For instance, water could produce fake copies of say antigenes recognized by basofils and reacting accordingly if the reaction is based on interaction with the magnetic body of the antigene.

4. The basic objection against this picture is that it does not explain why the repeated dilution works. Rather, it seems that dilution of molecules reduces also the density of mimicking pseudo-molecules. Even more, the potency of the homeopathic remedy is claimed to increase as the dilution factor increases. Also alcohol is used instead of water so that also alcohol must allow homeopathic mechanism. (I am grateful for Ulla Matfolk for questions which made me to realize these objections).

   (a) The only way out seems to be that the magnetic bodies or water molecule clusters having these magnetic bodies can replicate. The shaking of the remedy could provide the needed metabolic energy so that the population of magnetic bodies grows to a limiting density determined by the metabolic energy feed. In principle it would be possible to infect unlimited amount of water by these pseudo-molecules. When in bottle the population would be in dormant state but in the body of the patient it would wake up and form a population of molecular actors and stimulate the immune system to develop immune response to the real molecule.

   (b) The potency of the homeopathic remedy is claimed to increase with the increased dilution factor. This would suggest that the continued dilution and shaking also increases the density of pseudo molecules, perhaps by feeding to the system metabolic energy or by some other mechanism.

   (c) Also magnetic bodies must replicate in cell replication and their role as intentional agents controlling bio-matter requires that this replication serves as a template for biochemical replication. On can indeed interpret the images about cell replication in terms of replication of dipole type magnetic field. This process is very simple and could have preceded biological replication. The question is therefore whether water is actually

a living system in presence of a proper metabolic energy feed. Also the water's ability near critical point for freezing to form nice patterns correlating with sound stimuli might be due to the presence of the molecular actors.

(d) This picture fits nicely with the vision that evolution of water in this kind of life form might have happened separately and that pre-biotic chemical life forms have formed symbiosis with living water [K16]. In the model of DNA as topological quantum computer [K14] the asymptotic self organization patterns of water flow in the vicinity of lipid layers indeed define quantum computer programs by inducing the braiding of the magnetic flux tubes connecting DNA nucleotides to lipids so that this symbiosis would have brought in new kind of information processing tool.

5. The magnetic body of the molecule could mimic the vibrational and rotational spectra using harmonics of cyclotron frequencies. Cyclotron transitions could produce dark photons, whose ordinary counterparts resulting in de-coherence would have large energies due to the large value of $\hbar$ and could thus induce vibrational and rotational transitions. This would provide a mechanism by which molecular magnetic body could control the molecule. Note that also the antigenes possibly dropped to the larger space-time sheets could produce the effect on basofils.

6. There is a considerable experimental support for the Benveniste's discovery that bio-molecules in water environment are represented by frequency patterns, and several laboratories are replicating the experiments of Benveniste as I learned from the lecture of Yolene Thomas in the 7: th European SSE Meeting held in Röros [J9]. The scale of the frequencies involved is around 10 kHz and as such does not correspond to any natural molecular frequencies. Cyclotron frequencies associated with electrons or dark ions accompanying these macromolecules would be a natural identification if one accepts the notion of molecular magnetic body. For ions the magnetic fields involved would have a magnitude of order.03 Tesla if 10 kHz corresponds to scaled up alpha band. Also Josephson frequencies would be involved if one believes that EEG has fractally scaled up variants in molecular length scales.

Consider now the argument explaining the failure to replicate the experiments of Benveniste.

1. The magnetic bodies of water molecules need metabolic energy for communications with their "biological body" using the fractally scaled analog of EEG. There is no obvious source for this energy in water. The model for protein folding and DNA as topological quantum computer assumes that magnetic flux tubes connecting subject person and target of directed attention serve as correlates for directed attention at the molecular level [K14, K2]. This should be true also in macroscopic scales so that the experimentalist and the bottle containing the treated water should be connected by magnetic flux tubes. If experimenter has directed his attention to the bottle of water, the resulting magnetic flux tubes could allow a transfer of metabolic energy as a radiation along massless extremals parallel to the flux tubes and defining TGD counterparts of Alfven waves. Experimenter's strong motivation to replicate experiments would help to realize the transfer of the metabolic energy. Experimenters not knowing, which bottles were treated did not have these flux tube bridges to the bottles, and were not able to provide the needed metabolic energy, and the magnetic bodies of antigenes failed to generate the cyclotron radiation making them visible to the basofil.

2. If this interpretation is correct, then Benveniste's experiment would demonstrate besides water memory also psychokinesis and direct action of desires of experimenters on physics at microscopic level. Furthermore, the mere fact that we know something about some object or direct attention to it would mean a concrete interaction of our magnetic body with the object. The so called phenomenon of psi track [J20] provides additional support for this conclusion.

2.7 Could Virtual DNAs Allow A Controlled Development Of The Genome?

The fundamental question in the evolution biology is the question about the interaction between genome (G), phenotype (P), and environment (E).

1. The standard dogma is that the information transfer from G to P is unidirectional and that environment acts on G by inducing random mutations of G, from which E selects the lucky survivors as those with the best ability to reproduce. Lamarckism [I3, I10, I22] represents a deviation from standard dogma by assuming direct information transfer from E to G.

2. Genetic expression is controlled by environment, at least by silencing [I3], which is like selecting only few books to be read from a big library. Cell differentiation represents basic example of selective gene expression. DNA methylation and transposition are accepted to reflect information transfer from E to G, perhaps via P. These modifications are believed to be short lasting and not transferred to the offspring since it is difficult to imagine a mechanism transferring the mutations to the germ cells. There is however also evidence that epigenetic information transfer takes place [I44]: this transfer would be selective expression of genes of germ cells rather than that of modified genes.

3. There are findings challenging the dogmas of static genome and random mutations. The cells of the immune system remodel their genes coding for antibodies capable of recognizing large variety of antigens. There is quite recent finding [I28] revealing major genetic differences between blood and tissue cells. There are also mutations due to jumping genes - mobile elements of DNA known as LINE-1 elements usually regarded as junk DNA whose portion from genome increases as one climbs up along the evolutionary ladder. In mice jumping genes are limited to brain and germ cells: this is easy to understand since in organs like heart and lungs this kind of mutations would be fatal. Second recent discovery is that there is a high diversity of human brain cells believed to be due to the jumping genes [I8]. That brain cells would be producing with a high rate junk DNA is not an idea which would make me shout "Eureka!"

4. The question remains whether the $G \to P - E$ actually could complete to a closed loop $G \to P - E - G$ so that genome could directly respond to the changing physical environment and could transfer the successful response to the next generation [I10].

2.7.1 Could genome be developed like computer hardware?

In TGD framework the sequence $G \to P - E$ is replaced with a closed loop $G - P - M - E$ to which E is attached at P by bidirectional arrow (organisms do also modify their environment actively). Magnetic body thus controls genome and receives information from cell membrane (P). The hierarchy of genomes (super-genome, hyper-genome, ...) corresponding to the different levels of dark matter hierarchy allows this loop to be realized in different scales rather only at the level of single cell.

The question is whether the magnetic body of organism or higher level magnetic bodies could modify genomes, super-genomes, and hyper-genomes directly, perhaps by generating mutations of the genome in a short time scale; by monitoring how genetically modified organism survives in the environment; and -if the outcome of the experiment is successful - replacing the corresponding portion of DNA with the modified DNA both in ordinary germ cells. One can even ask whether the abstract model of the external environment provided by the internal chemical milieu might be mimicked by water magnetic bodies of water molecule clusters and provide a virtual world testing ground for a search of favorable mutations.

In DNA as a TQC vision essentially the development of a new computer hardware would be in question, and should take place in a controlled manner and involve an experimentation before going to the market rather than by random modifications taking place in computer CPUs. Second basic aspect of DNA as TQC paradigm is that water and bio-molecules live in symbiosis in the sense that self organization patterns of the cellular water flow define the TQC programs. The following first guess for how the development of computer hardware might be achieved is just a first guess but might have something to do with reality.

1. What would be needed is a mechanism generating rapidly modifications of DNA. The mutations should be carried out using a kind of virtual DNA mimicking all the essential aspects of the symbolic dynamics associated with DNA. The magnetic bodies of DNA consisting of flux tubes connecting the nucleotides of DNA strands to cell membrane satisfy these conditions

since A, T, G, C is coded to exotic light quarks u, d and anti-quarks $\overline{u}$, $\overline{d}$ at the ends of flux tubes [K14]. DNA nucleotides could be replaced with clusters of water molecules but also other options can be imagined. Note that it does not matter when one speaks of mimicry of RNA or DNA molecules.

2. If the proposed model of the phantom DNA and homeopathy has something to do with reality, this kind of virtual DNA exists and is generated in phantom DNA effect as magnetic bodies of DNA, including of course the magnetic flux tubes connecting the nucleotides to the cell membrane or conjugate strand of DNA.

3. The crucial additional assumption would be that also the reversal of phantom DNA effect is possible and corresponds to the analog of DNA replication in which nucleotides attach to the virtual conjugate nucleotides of the virtual DNA strand or RNA strand in turn transformed to DNA strand be reverse transcription. The hypothesis would have rather strong implications for the genetic engineering since homeopathic remedies of genetically engineered DNA sequences could be transferred to cell nuclei just by drinking them.

4. Phantom DNA sequences could form populations and - as far as their properties as a hardware of topological quantum computer are involved - evolve under selection pressures of the virtual world defined by the nuclear, cellular and extracellular water. A competition of components of TQC hardware developed by the higher level magnetic body to realize optimally TQC programs needed for survival would be in question. The simplest mutation of phantom DNA would replace the quark pairs at the ends the (wormhole-) magnetic flux tube with a new one and could occur in very short time scale. Also basic editing operations like cutting and pasting would be possible for these competing phantom DNA sequences. The winners in the competition would be transformed to actual DNA sequences by utilizing the reverse phantom DNA (or RNA -) effect and be inserted to genome. The genetic machinery performing cutting, gluing, and pasting of real DNA in a controlled manner exists. What is needed is the machinery monitoring who is the winner and making the decision to initiate the modification of the real DNA.

5. The transfer of the mutations to germ cells could be achieved by allowing the population of the virtual DNA sequences to infect the water inside germ cells. The genetic program inducing the modification of DNA by using the winner of the TQC hardware competition should run automatically.

6. One open question is whether the nuclear, cellular or perhaps also extracellular water should represent the physical environment and - if answer is affirmative - how it achieves this. As a matter fact, considerable fraction of water inside cells is in gel phase and it might be that the intercellular water, which naturally defines a symbolic representation of environment, is where the virtual evolution takes place. Internal chemical milieu certainly reflects in an abstract manner the physical environment and the ability of the water molecule clusters to mimic bio-molecules would make the representation of the chemical environment possible. Also sudden changes of external milieu would be rapidly coded to the changes in internal milieu which might help to achieve genetic re-organization. The craziest dream is water based simulation of both genes, proteins, and molecules representing external world running at dark space-time sheets.

2.7.2 Dark nuclear strings as analogs of DNA-, RNA- and amino-acid sequences and baryonic realization of genetic code?

The minimal option is that virtual DNA sequences have flux tube connections to the lipids of the cell membrane so that their quality as hardware of TQC can be tested but that there is no virtual variant of transcription and translation machinery. One can however ask whether also virtual amino-acids could be present and whether this could provide deeper insights to the genetic code.

1. Water molecule clusters are not the only candidates for the representatives of linear molecules. An alternative candidate for the virtual variants of linear bio-molecules are dark nuclei consisting of strings of scaled up dark variants of neutral baryons bound together by color bonds

having the size scale of atom, which I have introduced in the model of cold fusion and plasma electrolysis both taking place in water environment [L1], [L1]. Colored flux tubes defining braidings would generalize this picture by allowing transversal color magnetic flux tube connections between these strings.

2. This seems to work! The states of dark nucleons formed from three quarks can be naturally grouped to multiplets in one-one correspondence with 64 DNAs, 64 RNAS, and 20 amino-acids and there is natural mapping of DNA and RNA type states to amino-acid type states such that the numbers of DNAs/RNAs mapped to given amino-acid are same as for the vertebrate genetic code.

The basic idea is simple. Since baryons consist of 3 quarks just as DNA codons consist of three nucleotides, one might ask whether codons could correspond to baryons obtained as open strings with quarks connected by two color flux tubes. This representation would be based on entanglement rather than letter sequences. The question is therefore whether the dark baryons constructed as string of 3 quarks using color flux tubes could realize 64 codons and whether 20 amino-acids could be identified as equivalence classes of some equivalence relation between 64 fundamental codons in a natural manner.

The following model indeed reproduces the genetic code directly from a model of dark neutral baryons as strings of 3 quarks connected by color flux tubes.

1. Dark nuclear baryons are considered as a fundamental realization of DNA codons and constructed as open strings of 3 dark quarks connected by two colored flux tubes, which can be also charged. The baryonic strings cannot combine to form a strictly linear structure since strict rotational invariance would not allow the quark strings to have angular momentum with respect to the quantization axis defined by the nuclear string. The independent rotation of quark strings and breaking of rotational symmetry from SO(3) to SO(2) induced by the direction of the nuclear string is essential for the model.

   (a) Baryonic strings could form a helical nuclear string (stability might require this) locally parallel to DNA, RNA, or amino-acid) helix with rotations acting either along the axis of the DNA or along the local axis of DNA along helix. The rotation of a flux tube portion around an axis parallel to the local axis along DNA helix requires that magnetic flux tube has a kink in this portion. An interesting question is whether this kink has correlate at the level of DNA too. Notice that color bonds appear in two scales corresponding to these two strings. The model of DNA as topological quantum computer [K14] allows a modification in which dark nuclear string of this kind is parallel to DNA and each codon has a flux tube connection to the lipid of cell membrane or possibly to some other bio-molecule.

   (b) The analogs of DNA -, RNA -, and of amino-acid sequences could also correspond to sequences of dark baryons in which baryons would be 3-quark strings in the plane transversal to the dark nuclear string and expected to rotate by stringy boundary conditions. In this case all dark baryons would be free to rotate. Thus one would have nuclear string consisting of short baryonic strings not connected along their ends.

2. The new element as compared to the standard quark model is that between both dark quarks and dark baryons can be charged carrying charge $0, \pm 1$. This is assumed also in nuclear string model and there is empirical support for the existence of exotic nuclei containing charged color bonds between nuclei.

3. The net charge of the dark baryons in question is assumed to vanish to minimize Coulomb repulsion:

$$\sum_q Q_{em}(q) = -\sum_{flux\ tubes} Q_{em}(flux\ tube) \ . \tag{2.1}$$

This kind of selection is natural taking into account the breaking of isospin symmetry. In the recent case the breaking cannot however be as large as for ordinary baryons (implying large mass difference between Δ and nucleon states).

4. One can classify the states of the open 3-quark string by the total charges and spins associated with 3 quarks and to the two color bonds. Total em charges of quarks vary in the range $Z_B \in \{2,1,0,-1\}$ and total color bond charges in the range $Z_b \in \{2,1,0,-1,-2\}$. Only neutral states are allowed. Total quark spin projection varies in the range $J_B = 3/2, 1/2, -1/2, -3/2$ and the total flux tube spin projection in the range $J_b = 2, 1, -1, -2$. If one takes for a given total charge assumed to be vanishing one representative from each class (J_B, J_b), one obtains $4 \times 5 = 20$ states which is the number of amino-acids. Thus genetic code might be realized at the level of baryons by mapping the neutral states with a given spin projection to single representative state with the same spin projection. The problem is to find whether one can identify the analogs of DNA, RNA and amino-acids as baryon like states.

1. States in the quark degrees of freedom

One must construct many-particle states both in quark and flux tube degrees of freedom. These states can be constructed as representations of rotation group SU(2) and strong isospin group SU(2) by using the standard tensor product rule $j_1 \times j_2 = j_1 + j_2 \oplus j_1 + j_2 - 1 \oplus ... \oplus |j_1 - j_2|$ for the representation of SU(2) and Fermi statistics and Bose-Einstein statistics are used to deduce correlations between total spin and total isospin (for instance, $J = I$ rule holds true in quark degrees of freedom). Charge neutrality is assumed and the breaking of rotational symmetry in the direction of nuclear string is assumed.

Consider first the states of dark baryons in quark degrees of freedom.

1. The tensor product $2 \otimes 2 \otimes 2$ is involved in both cases. Without any additional constraints this tensor product decomposes as $(3 \oplus 1) \otimes 2 = 4 \oplus 2 \oplus 2$: 8 states altogether. This is what one should have for DNA and RNA candidates. If one has only identical quarks *uuu* or *ddd*, Pauli exclusion rule allows only the 4-D spin 3/2 representation corresponding to completely symmetric representation -just as in standard quark model. These 4 states correspond to a candidate for amino-acids. Thus RNA and DNA should correspond to states of type uud and ddu and amino-acids to states of type *uuu* or ddd. What this means physically will be considered later.

2. Due to spin-statistics constraint only the representations with $(J, I) = (3/2, 3/2)$ (Δ resonance) and the second $(J, I) = (1/2, 1/2)$ (proton and neutron) are realized as free baryons. Now of course a dark -possibly p-adically scaled up - variant of QCD is considered so that more general baryonic states are possible. By the way, the spin statistics problem which forced to introduce quark color strongly suggests that the construction of the codons as sequences of 3 nucleons - which one might also consider - is not a good idea.

3. Second nucleon like spin doublet - call it 2_{odd} - has wrong parity in the sense that it would require $L = 1$ ground state for two identical quarks (*uu* or *dd* pair). Dropping 2_{odd} and using only $4 \oplus 2$ for the rotation group would give degeneracies $(1, 2, 2, 1)$ and 6 states only. All the representations in $4 \oplus 2 \oplus 2_{odd}$ are needed to get 8 states with a given quark charge and one should transform the wrong parity doublet to positive parity doublet somehow. Since open string geometry breaks rotational symmetry to a subgroup SO(2) of rotations acting along the direction of the string and since the boundary conditions on baryonic strings force their ends to rotate with light velocity, the attractive possibility is to add a baryonic stringy excitation with angular momentum projection $L_z = -1$ to the wrong parity doublet so that the parity comes out correctly. $L_z = -1$ orbital angular momentum for the relative motion of *uu* or *dd* quark pair in the open 3-quark string would be in question. The degeneracies for spin projection value $J_z = 3/2, ..., -3/2$ are $(1, 2, 3, 2)$. Genetic code means spin projection mapping the states in $4 \oplus 2 \oplus 2_{odd}$ to 4.

2. States in the flux tube degrees of freedom

Consider next the states in flux tube degrees of freedom.

1. The situation is analogous to a construction of mesons from quarks and antiquarks and one obtains the analogs of π meson (pion) with spin 0 and ρ meson with spin 1 since spin statistics forces $J = I$ condition also now. States of a given charge for a flux tube correspond to the tensor product $2 \otimes 2 = 3 \oplus 1$ for the rotation group.

2. Without any further constraints the tensor product $3 \otimes 3 = 5 \oplus 3 \oplus 1$ for the flux tubes states gives 8+1 states. By dropping the scalar state this gives 8 states required by DNA and RNA analogs. The degeneracies of the states for DNA/RNA type realization with a given spin projection for $5 \oplus 3$ are $(1, 2, 2, 2, 1)$. $8\times$ 8 states result altogether for both *uud* and *udd* for which color bonds have different charges. Also for *ddd* state with quark charge -1 one obtains $5 \oplus 3$ states giving 40 states altogether.

3. If the charges of the color bonds are identical as the are for *uuu* type states serving as candidates for the counterparts of amino-acids bosonic statistics allows only 5 states ($J = 2$ state). Hence 20 counterparts of amino-acids are obtained for *uuu*. Genetic code means the projection of the states of $5 \oplus 3$ to those of 5 with the same spin projection and same total charge.

3. Analogs of DNA, RNA, amino-acids, and of translation and transcription mechanisms

Consider next the identification of analogs of DNA, RNA and amino-acids and the baryonic realization of the genetic code, translation and transcription.

1. The analogs of DNA and RNA can be identified dark baryons with quark content *uud*, *ddu* with color bonds having different charges. There are 3 color bond pairs corresponding to charge pairs $(q_1, q_2) = (-1, 0), (-1, 1), (0, 1)$ (the order of charges does not matter). The condition that the total charge of dark baryon vanishes allows for *uud* only the bond pair $(-1, 0)$ and for *udd* only the pair $(-1, 1)$. These thus only single neutral dark baryon of type *uud resp. udd*: these would be the analogous of DNA and RNA codons. Amino-acids would correspond to *uuu* states with identical color bonds with charges $(-1, -1)$, $(0, 0)$, or $(1, 1)$. *uuu* with color bond charges (-1, -1) is the only neutral state. Hence only the analogs of DNA, RNA, and amino-acids are obtained, which is rather remarkable result.

2. The basic transcription and translation machinery could be realized as processes in which the analog of DNA can replicate, and can be transcribed to the analog of mRNA in turn translated to the analogs of amino-acids. In terms of flux tube connections the realization of genetic code, transcription, and translation, would mean that only dark baryons with same total quark spin and same total color bond spin can be connected by flux tubes. Charges are of course identical since they vanish.

3. Genetic code maps of $(4\oplus2\oplus2)\otimes(5\oplus3)$ to the states of 4×5. The most natural map takes the states with a given spin to a state with the same spin so that the code is unique. This would give the degeneracies $D(k)$ as products of numbers $D_B \in \{1, 2, 3, 2\}$ and $D_b \in \{1, 2, 2, 2, 1\}$: $D = D_B \times D_b$. Only the observed degeneracies $D = 1, 2, 3, 4, 6$ are predicted. The numbers $N(k)$ of amino-acids coded by D codons would be

$$[N(1), N(2), N(3), N(4), N(6)] = [2, 7, 2, 6, 3] \ .$$

   The correct numbers for vertebrate nuclear code are $(N(1), N(2), N(3), N(4), N(6)) = (2, 9, 1, 5, 3)$. Some kind of symmetry breaking must take place and should relate to the emergence of stopping codons. If one codon in second 3-plet becomes stopping codon, the 3-plet becomes doublet. If 2 codons in 4-plet become stopping codons it also becomes doublet and one obtains the correct result $(2, 9, 1, 5, 3)$!

4. Stopping codons would most naturally correspond to the codons, which involve the $L_z = -1$ relative rotational excitation of *uu* or *dd* type quark pair. For the 3-plet the two candidates for the stopping codon state are $|1/2, -1/2\rangle \otimes \{|2, k\rangle\}$, $k = 2, -2$. The total spins are $J_z = 3/2$ and $J_z = -7/2$. The three candidates for the 4-plet from which two states are thrown out are $|1/2, -3/2\rangle \otimes \{|2, k\rangle, |1, k\rangle\}$, $k = 1, 0, -1$. The total spins are now $J_z = -1/2, -3/2, -5/2$. One guess is that the states with smallest value of J_z are dropped which would mean that $J_z = -7/2$ states in 3-plet and $J_z = -5/2$ states 4-plet become stopping codons.

5. One can ask why just vertebrate code? Why not vertebrate mitochondrial code, which has unbroken $A - G$ and $T - C$ symmetries with respect to the third nucleotide. And is it

possible to understand the rarely occurring variants of the genetic code in this framework? One explanation is that the baryonic realization is the fundamental one and biochemical realization has gradually evolved from non-faithful realization to a faithful one as kind of emulation of dark nuclear physics. Also the role of tRNA in the realization of the code is crucial and could explain the fact that the code can be context sensitive for some codons.

4. Understanding the symmetries of the code

Quantum entanglement between quarks and color flux tubes would be essential for the baryonic realization of the genetic code whereas chemical realization could be said to be classical. Quantal aspect means that one cannot decompose to codon to letters anymore. This raises questions concerning the symmetries of the code.

1. What is the counterpart for the conjugation $ZYZ \to X_cY_cZ_c$ for the codons?
2. The conjugation of the second nucleotide Y having chemical interpretation in terms of hydrophobia-hydrophily dichotomy in biology. In DNA as TQC model it corresponds to matter-antimatter conjugation for quarks associated with flux tubes connecting DNA nucleotides to the lipids of the cell membrane. What is the interpretation in now?
3. The A-G, T-C symmetries with respect to the third nucleotide Z allow an interpretation as weak isospin symmetry in DNA as TQC model. Can one identify counterpart of this symmetry when the decomposition into individual nucleotides does not make sense?

Natural candidates for the building blocks of the analogs of these symmetries are the change of the sign of the spin direction for quarks and for flux tubes.

1. For quarks the spin projections are always non-vanishing so that the map has no fixed points. For flux tube spin the states of spin $S_z = 0$ are fixed points. The change of the sign of quark spin projection must therefore be present for both $XYZ \to X_cY_cZ_c$ and $Y \to Y_c$ but also something else might be needed. Note that without the symmetry breaking $(1, 3, 3, 1) \to (1, 2, 3, 2)$ the code table would be symmetric in the permutation of 2 first and 2 last columns of the code table induced by both full conjugation and conjugation of Y.
2. The analogs of the approximate $A - G$ and $T - C$ symmetries cannot involve the change of spin direction in neither quark nor flux tube sector. These symmetries act inside the A-G and T-C sub-2-columns of the 4-columns defining the rows of the code table. Hence this symmetry must permute the states of same spin inside 5 and 3 for flux tubes and 4 and 2 for quarks but leave 2_{odd} invariant. This guarantees that for the two non-degenerate codons coding for only single amino-acid and one of the codons inside triplet the action is trivial. Hence the baryonic analog of the approximate $A - G$ and $T - C$ symmetry would be exact symmetry and be due to the basic definition of the genetic code as a mapping states of same flux tube spin and quark spin to single representative state. The existence of full 4-columns coding for the same amino-acid would be due to the fact that states with same quark spin inside $(2, 3, 2)$ code for the same amino-acid.
3. A detailed comparison of the code table with the code table in spin representation should allow to fix their correspondence uniquely apart from permutations of n-plets and thus also the representation of the conjugations. What is clear that Y conjugation must involve the change of quark spin direction whereas Z conjugation which maps typically 2-plets to each other must involve the permutation of states with same J_z for the flux tubes. It is not quite clear what X conjugation correspond to.

5. Some comments about the physics behind the code

Consider next some particle physicist's objections against this picture.

1. The realization of the code requires the dark scaled variants of spin 3/2 baryons known as Δ resonance and the analogs (and only the analogs) of spin 1 mesons known as ρ mesons. The lifetime of these states is very short in ordinary hadron physics. Now one has a scaled up variant of hadron physics: possibly in both dark and p-adic senses with latter allowing arbitrarily small overall mass scales. Hence the lifetimes of states can be scaled up.

2. Both the absolute and relative mass differences between Δ and N *resp.* ρ and π due to color magnetic hyper-fine splitting are large in ordinary hadron physics and this makes the decays of Δ and ρ possible kinematically. This is due to color magnetic spin-spin splitting proportional to the color coupling strength $\alpha_s \sim .1$, which is large. In the recent case α_s could be considerably smaller - say of the same order of magnitude as fine structure constant 1/137 - so that the mass splittings could be so small as to make decays impossible. The masses of different states should not differ much: eV scales is suggestive.

   The color magnetic spin interaction energy give rise to hyperfine splitting of quark in perturbative QCD is of form $E_c \propto \hbar gB/m$, where m is mass parameter which is of the order of baryon mass. Magnetic flux scales as $\hbar$ by flux quantization and if flux tube thickness scales as $\hbar^2$, one has $B \propto 1/\hbar$. Mass splittings would not depend on $\hbar$, which does not make sense. Mass splitting becomes small for large $\hbar$ if the area of flux quantum scales as $\hbar^{2+n}$, $n > 0$ so that color magnetic hyper-fine splitting scales as $1/\hbar^n$ from flux conservation. The magnetic energy for a flux tube of length L scaling as $\hbar$ and thickness $S \propto \hbar^{2+n}$ has order of magnitude g^2B^2LS and does not depend on $\hbar$ for $n = 1$. Maybe this could provide first principle explanation for the desired scaling.

   The size scale of DNA would suggest that single DNA triplet corresponds to 3 Angstrom length scale. Suppose this corresponds to the size of dark nucleon. If this size scales as $\sqrt{\hbar}$ as p-adic mass calculations suggest, one obtains a rough estimate $\hbar/hbar_0 = 2^{38}$. The proton-Δ mass difference due to hyper-fine splitting would be scaled down to about $2^{-38} \times 300$ MeV $\sim 10^{-9}$ eV, which is completely negligible in the metabolic energy scale.5 eV. If the size of dark nucleon scales as $\hbar$ the mass difference is about 12 eV which corresponds to the energy scale for the ionization energy of hydrogen. Even this might be acceptable.

3. Dark hadrons could have lower mass scale than the ordinary ones if scaled up variants of quarks in p-adic sense are in question. Note that the model for cold fusion that inspired the idea about genetic code requires that dark nuclear strings have the same mass scale as ordinary baryons. In any case, the most general option inspired by the vision about hierarchy of conscious entities extended to a hierarchy of life forms is that several dark and p-adic scaled up variants of baryons realizing genetic code are possible.

4. The heaviest objection relates to the addition of $L_z = -1$ excitation to $S_z = |1/2, \pm 1/2\rangle_{odd}$ states which transforms the degeneracies of the quark spin states from $(1, 3, 3, 1)$ to $(1, 2, 3, 2)$. The only reasonable answer is that the breaking of the full rotation symmetry reduces $SO(3)$ to $SO(2)$. Also the fact that the states of massless particles are labeled by the representation of $SO(2)$ might be of some relevance. The deeper level explanation in TGD framework might be as follows. The generalized imbedding space is constructed by gluing almost copies of the 8-D imbedding space with different Planck constants together along a 4-D subspace like pages of book along a common back. The construction involves symmetry breaking in both rotational and color degrees of freedom to Cartan sub-group and the interpretation is as a geometric representation for the selection of the quantization axis. Quantum TGD is indeed meant to be a geometrization of the entire quantum physics as a physics of the classical spinor fields in the "world of classical worlds" so that also the choice of measurement axis must have a geometric description.

The conclusion is that genetic code can be understand as a map of stringy baryonic states induced by the projection of all states with same spin projection to a representative state with the same spin projection. Genetic code would be realized at the level of dark nuclear physics and biochemical representation would be only one particular higher level representation of the code. A hierarchy of dark baryon realizations corresponding to p-adic and dark matter hierarchies can be considered. Translation and transcription machinery would be realized by flux tubes connecting only states with same quark spin and flux tube spin. Charge neutrality is essential for having only the analogs of DNA, RNA and amino-acids and would guarantee the em stability of the states.

2.7.3 Crying and screaming cells and magnetic bodies expressing their emotions

By using nanotechnological methods James Gimzewski [J1], his student Andrew Pelling and collaborators discovered that the cell walls of bacterium Saccharomyces cerevisiae perform periodic

motion with amplitude about 3 nm in the frequency range.8-1.6 kHz (one octave) [I34]. Or more concretely, bacteria produce sounds audible to humans with average frequency of 1 kHz in a range of one octave. The frequency has strong temperature dependence, which suggests a metabolic mechanism. From the temperature dependence one deduces the activation energy to be 58 kJ/mol, which is consistent with the cell's metabolism involving molecular motors such as kinesin, dynein, and myosin. The magnitude of the forces observed (10 nN) suggests concerted nanomechanical activity is operative in the cell.

From less formal popular articles [I11] one can learn that it is difficult to avoid the impression that intelligent communication is in question. Dying cells produce a characteristic screaming sound. One can also distinguish between normal cells and cancel cells on basis of the sound they produces as well as between mammalian and bacterial cells.

What might be the explanation of these findings in TGD framework?

1. It is known that the region of frequencies audible to human ear is from about 20 Hz to 2×10^4 Hz. This is more or less same as the range of frequency range of sferics, the em noise in atmosphere [F1]. This suggests a strong coupling between electromagnetic oscillations and sound as also the fact that biological structures are piezo-electrets transforming em oscillations to sounds and vice versa.

2. The activation energy per mole corresponds to.6 eV per molecule which is at the upper range for the variation range the energy associated with the fundamental metabolic energy quantum identified as the change of zero point kinetic as proton is transferred from atomic space-time sheet to much larger space-time sheet or vice versa.That metabolic energy is needed to produce the sounds supports the view that the sounds are produced intentionally.

3. If one takes seriously the notion of magnetic body as intentional agent controlling biological body, one is led to ask which must sound a totally crazy question in reductionistic ears: could magnetic body express its emotions in terms of frequencies of cyclotron transitions transformed to sound via genetic expression using piezo electric mechanism? Could it be that the photons involved are dark photons with large value of Planck constant so that their energy is above thermal energy. Could one propose a materialistic scientist to consider anything more irritating that singing and crying magnetic bodies!

4. Suppose that the homeopathic mechanism is based on replication of pseudomolecules with same magnetic body as that of solvent molecules and that neutral dark nuclear strings realize analogs of DNA, RNA, and amino-acids and realizing genetic code exactly in its vertebrate nuclear form and appearing also in the TGD based model of cold fusion and biological transmutations. If so, then homeopathic mechanism (recognition of molecules) could involve also the transformation of cyclotron radiation to sound at the level of "biological bodies" of molecules.

5. If this picture makes sense then also our speech as a self expression of the magnetic body might involve genetic code mapping sequences of DNA codons to temporal patterns of cyclotron radiation in turn transformed to speech by above mechanism. This would require a realization of genetic code at level of dark matter: could it be that dark nuclear code could define universal quantum level realization of language? The findings of Peter Gariaev and others and structural resemblance of intronic portion of genome with language and their report that DNA sequences are coded to temporal patterns of the rotation angle of the polarization of laser light (in turn inducing genetic expression).

2.8 Direct Empirical Evidence For Dark DNA?!

Sciencedaily tells about extremely interesting finding related to DNA (`http://www.sciencedaily.com/releases/2015/07/150722101813.htm#.Va_mQDnzazA.email`. The finding is just what breakthrough discovery should be: it must be something impossible in the existing world view.

What has been found [L24] (`http://www.nature.com/nature/journal/vaop/ncurrent/full/nature14580.html`) is that knock-out (removing parts of gene to prevent transcription to mRNA) and knock-down of gene (prevent protein translation) seem to have different consequences. Removing parts of gene need not have the expected effect at the level of proteins! Does this mean

that somehow DNA as a whole can compensate the effects caused by knock-out but not those by knock-down? This explanation is natural in the standard conceptual framework and is proposed in the article.

Could this be explained by assuming that genome is a hologram as Gariaev et al (http://www.wavegenetics.jino-net.ru) [I24, I1] have first suggested? Also TGD leads to a vision about living system as a conscious hologram [K5]. Small local changes of genes could be compensated. Somehow the entire genome would react like brain to a local brain damage: other regions of brain take the duties of the damaged region. Could the idea about DNA double strand as nano-brain having left and right strands instead of hemispheres"help here. Does DNA indeed act as a macroscopic quantum unit? The problem is that transcription is local rather than holistic process. Something very simple should lurk behind the compensation mechanism.

2.8.1 Could transcription transform dark DNA to dark mRNA?

Also the TGD based notion of dark DNA comes in mind [K20, L1] (http://www.tgdtheory.fi/public_html/hologram/hologram.html#homeoc, http://www.tgdtheory.fi/public_html/neuplanck/neuplanck.html#nuclstring). Dark DNA consists of dark proton sequences for which states of single DNA proton correspond to those of DNA, mRNA, aminoacids, and tRNA. Dark DNA is one of the speculative ideas of TGD inspired quantum biology getting support from Pollack's findings (https://www.youtube.com/watch?v=i-T7tCMUDXU [L16], [K50]). Ordinary biomolecules would only make their dark counterparts visible: dark biomolecules would serve as a template around which ordinary biomolecules such as DNA strands are formed in TGD Universe. All basic biomolecules of genetics would be pairs of ordinary biomolecule and its dark proton analog.

Although ordinary DNA is knocked out of ordinary gene, dark gene would still exist! If dark DNA actually serves as template for the transcription to mRNA, everything is still ok after knock-out! Could it be that we do not understand even transcription correctly? Could it actually occur at the level of dark DNA and mRNA?! Dark mRNA would attach to dark DNA after which ordinary mRNA would attach to the dark mRNA. One step more!

Damaged DNA could still do its job! DNA transcription would would have very little to do with bio-chemistry! If this view about DNA transcription is correct, it would suggest a totally new manner to fix DNA damages. These damages could be actually at the level of dark DNA, and the challenge of dark genetic engineering would be to modify dark DNA to achieve a proper functioning.

2.8.2 Could dark genetics help to understand the non-uniqueness of the genetic code?

Also translation could be based on pairing of dark mRNA and dark tRNA. This suggests a fresh perspective to some strange and even ugly looking features of the genetic code. Are DNA and mRNA always paired with their dark variants? Do also amino-acids and anticodons of tRNA pair in this manner with their dark variants? Could the pairings at dark matter level be universal and determined by the pairing of dark amino-acids with the anticodons of dark RNA? Could the anomalies of the code be reduced to the non-uniqueness of the pairing of dark and ordinary variants of basic bio-molecules (pairings RNA–dark RNA, amino-acid– dark amino-acid, and amino-acid–ordinary amino-acid in tRNA).

1. There are several variants of the genetic code differing slightly from each other: correspondence between DNA/mRNA codons and amino-acids is not always the same. Could dark-dark pairings be universal? Could the variations in dark anticodon - anticodon pairing and dark amino-acid-amino-acid pairing in tRNA molecules explain the variations of the genetic code?

2. For some variants of the genetic code a stop codon can code for amino-acid. The explanation at the level of tRNA seems to be the same as in standard framework. For the standard code the stop codons do not have tRNA representatives. If stop codon codes for amino-acids, the stop codon has tRNA representation. But how the mRNA knows that the stop codon is indeed stop codon if the tRNA associated with it is present in the same cell?

   Could it be that stop codon property is determined already at the level of DNA and mRNA? If the dark variant of genuine stop codon is missing in DNA and therefore also in mRNA

the translation stops if it is induced from that at the level of dark mRNA. Could also the splicing of mRNA be due to the splitting of dark DNA and dark mRNA? If so genes would be separated from intronic portions of DNA in that they would pair with dark DNA. Could it be that the intronic regions do not pair with their dark counterparts. They would be specialized to topological quantum computations in the TGD inspired proposal [K14].

Start codon (usually AUG coding met) serves as a start codon defining the reading frame (there are 3 possible reading frames). Dark DNA would naturally begin from this codon.

3. Also two additional amino-acids Pyl and Sec appear in Nature. Gariaev et al have proposed that the genetic code is context dependent so that the meaning of DNA codon is not always the same. This non-universality could be reduced to the non-uniqueness of dark amino-acid–amino-acid pairing in tRNA if genetic code is universal.

2.8.3 Could dark genetics help to understand wobble base pairing?

Wobble base pairing (`https://en.wikipedia.org/wiki/Wobble_base_pair`) is second not-so-well understood phenomenon. In the standard variant of the code there are 61 mRNAs translated to amino-acids. The number of tRNA anticodons (formed by the pairs of amino-acid and RNA molecules) should be also 61 in order to have 1-1 pairing between tRNA and mRNA. The number of ordinary tRNAs is however smaller than 61 in the sense that the number of RNAs associated with them is smaller than 45. tRNA anticodons must be able to pair with several mRNA codons coding for given amino-acid. This is possible since tRNA anticodons can be chosen to be representative for the mRNA codons coding a given amino-acid in such that all mRNA codons coding for the same amino-acid pair with at least one tRNA anticodon.

1. This looks somewhat confusing but is actually very simple: genetic code can be seen as a composite of two codes: first 64 DNAs/mRNAs to are coded to $N < 45$ anticodons in tRNA, and then these N anticodons are coded to 20 amino-acids. One must select N anticodon representatives for the mRNAs in the 20 sets of mRNA codons coding for a given amino-acid such that each amino-acid has at least one anticodon representative. A large number of choices is possible and the wobble hypothesis of Crick pose reduce the number of options.

2. The wobble hypothesis of Crick states that the nucleotide in the third codon position of RNA codon of tRNA has the needed non-unique base pairing: this is clear from the high symmetries of the third basis. There is exact U-C symmetry and approximate A-G symmetry with respect to the third basis of RNA codon (note that the conjugates of RNA codons are obtained by A$\leftrightarrow$U and C$\leftrightarrow$G permutations).

3. The first two basis in the codon pair in 1-1 manner to the second and third basis of anticodon. The third basis of anticodon corresponds to the third letter of mRNA codon. If it is A or C the correspondence is assumed to be 1-to-1: this gives 32 tRNAs. If the first basis of anticodon is G or U the 2 mRNA basis can pair with it: they would be naturally A for G and C for U by symmetry. One would select A from A-G doublet and C from U-C double. This would give 16 anticodons: 48 anticodons altogether, which is however larger than 45. Furthermore, this would not give quite the correct code since A-G symmetry is not exact.

   Smaller number of tRNAs is however enough since the code has almost symmetry also with respect to A and C exchange not yet utilized. The trick is to replace in some cases the first basis of anticodon with Inosine I, which pairs with 3 mRNA basis. This replacement is possible only for those amino-acids for which the number of RNAs coding the amino-acid is 3 or larger (the amino-acids coded by 4 or 6 codons).

4. It can be shown at least 32 different tRNAs are needed to realize genetic code by using wobble base pairing. Full A-C and G-U symmetry for the third basis of codon would give 16+16=32 codons. One can ask whether tRNA somehow realizes this full symmetry?

How dark variants of could help to understand wobble base pairing? Suppose for a moment that the visible genetics be a shadow of the dark one and fails to represent it completely. Suppose the pairing of ordinary and dark variants of tRNA anticodons *resp.* amino-acids and that translation

proceeds at the level of dark mRNA, dark anticodons, and dark amino-acids, and is made visible by its bio-chemical shadow. Could this allow to gain insights about wobble base pairing? Could the peculiarities of tRNA serve for some other - essentially bio-chemical - purposes?

The basic idea would be simple: chemistry does not determine the pairing but it occurs at the level of the dark mRNA codons and dark tRNA anticodons. There would be no need to reduce wobble phenomenon to biochemistry and the only assumption needed would be that chemistry does not prevent the natural dark pairing producing standard genetic code apart from the modifications implied by non-standard dark amino-acid–amino-acid pairing explaining for different codes and the possibility that stop codon can in some situation pair with dark mRNA.

One can consider two options.

1. The number of dark tRNAs is 64 and the pairings between dark mRNA and dark anticodons and dark anticodons and dark amino-acids are 1-to-1 and only the pairing between dark RNA codons and anticodons in tRNA is many-to-1.

2. The model of dark genetic code [K20] suggests that there are 40 dark proton states, which could serve as dark analogs of tRNA. This number is larger than 32 needed to realize the genetic code as a composite code. I have cautiously suggested that the proposed universal code could map dark mRNA states of the same total spin (there is breaking of rotational symmetry to that around the axis of dark proton sequences) to dark tRNA/dark amino-acid states with the same total spin projection. The geometric realization would in terms of color flux tubes connecting the dark protons of corresponding dark proton sequences. Also in ordinary nuclei the nucleons are proposed to be connected by color flux tubes so that they form nuclear strings [L1] and dark proton sequences would be essentially dark variants of nuclei.

One should understand the details of the dark mRNA–tRNA anticodon correspondence. One can also ask whether the dark genetic code and the code deduced from the icosahedral model for music harmony [K36] [L14] are mutually consistent. This model implies the decomposition of 60+4 DNA codons to 20+20+20+4 codons, where each "20" corresponds to one particular icosahedral Hamilton's cycle with characteristic icosahedral symmetries. "4" can be assigned to tetrahedron regarded either disjoint from icosahedron or glued to it along one of its faces. This allows to understand both the standard code and the code with two stop codons in which exotic amino-acids Pyl and Sec appear. One should understand the compositeness $64 \to 40 \to 20$ of the dark genetic code and and whether it relates to the icosatetrahedral realization of the code.

I have proposed [K22] (`http://www.tgdtheory.fi/public_html/hologram/hologram.html#molephoto`) that dark variants of transcription, translation, etc.. can occur and make possible kind of R&D laboratory so that organisms can test the consequences of variations of DNA. If ordinary translation and transcription are induced from their dark variants it would not be surprising and if dark biomolecules could also appear as unpaired variants, these processes could occur as purely dark variants. Organisms could indeed do experimentation in the virtual world model of biology and pairing with ordinary bio-molecules would make things real.

There is now evidence for this picture. It has been discovered [J11] (`http://www.sciencemag.org/content/350/6256/94`) that brain cells have a mosaic like distribution of genomes (`http://www.sciencedaily.com/releases/2015/10/151001153931.htm`) . In standard framework this mosaic should be created by random mutations. The mechanism of mutation is reported to involve transcription rather than DNA replication. The mutation would take place for DNA when its is copied to RNA after opening of the DNA double strand. The mutations would have occurred during the period when neurons replicate and the mutation history can be read by studying the distributions of changes in the genome.

This brings in mind the finding that removing a part of gene does not affect transcription. In both cases it is dark DNA, which would serve as a template for transcription rather than ordinary DNA. This suggests that the dark DNA is not changed in these modifications and mRNA is determined by the dark DNA, which would serve as a template for transcription rather than ordinary DNA. If this were the case also for neurons, the mutations of neuronal genes should not affect the gene transcription at all, and there would be no negative (or positive) effects on brain function. This seems too conservative. The mutations should have some more active role.

One can consider also different interpretation. The mutations of DNA could be induced by the dark DNA. As dark DNA changes, ordinary DNA associated with it is forced to change too - sooner or later. Especially so when the genome is in a state in which mutations can take place easily. Neurons during to replication stage could have such quantum critical genomes.

Evolution would not be mere selection by a survival of random mutations by external environment in the time scale much longer than lifetime of individual - but a controlled process, which can occur in time scale shorter than lifetime and differently inside parts of say brain. This is what the idea TGD inspired biology suggests. The modified DNA could be dark DNA and and serve as template for transcription and also induce transformation of ordinary DNA associated with it.

Whether this change can be transferred to the germ cells to be transferred to the offspring remains of course an open question. For instance, one can imagine that dark DNA strands (magnetic flux tubes) can penetrate germ cell membranes and replace the earlier dark DNA sections and induce change of ordinary DNA. Or is a more delicate mechanism involving dark photons in question. With inspiration coming from the findings reported by Peter Gariaev [I24] I have proposed a model of remote DNA replication suggesting that DNA can be replicated remotely if the needed nucleotides are present [K52]: the information about DNA could be transferred as dark photons, which can be transformed to ordinary photons identified as bio-photons. Could Lysenko have been at least partially right despite that he was a swindler basing his views on ideology?

In any case, TGD inspired biology allows to imagine a controlled evolution of DNA in analogy to that what occurs in R&D departments of modern technological organizations. The notion of dark DNA suggests that biological systems indeed have a "R&D department" in which new variants of DNA studied as "dark DNA" sequences realised as dark proton sequences - same about dark RNA, and amino-acids and even tRNA. The possibility to transcribe RNA from dark DNA would mean that the testing can be carried in real life situations.

There indeed exists evidence that traumatic - and thus highly emotional - memories may be passed down through generations in genome [J3] (`http://tinyurl.com/oja8v94`). Could the modifications of brain DNA represent long term memories as the above described experiment suggests? Could the memories be transferred to the germ cells using the mechanism sketched above?

3 Further Experimental Findings Related To Water Memory

In this section I discuss further experimental findings giving support for both TGD based view about water memory and TGD based vision about living cell.

3.1 Genes And Water Memory

After long time I had opportunity to read a beautiful experimental article about experimental biology. Yolene Thomas, who worked with Benveniste, kindly sent the article to me. The freely loadable article is *Electromagnetic Signals Are Produced by Aqueous Nanostructures Derived from Bacterial DNA Sequences* by Luc Montagnier, Jamal Aissa, Stephane Ferris, Jean-Luc Montagnier, and Claude Lavall'e published in the journal Interdiscip. Sci. Comput. Life Sci. (2009) [I32].

3.1.1 Basic findings at cell level

I try to list the essential points of the article. Apologies for biologists: I am not a specialist.

1. Certain pathogenic micro-organisms are objects of the study. The bacteria Mycoplasma Pirum and E. Choli belong to the targets of the study. The motivating observation was that some procedures aimed at sterilizing biological fluids can yield under some conditions the infectious micro-organism which was present before the filtration and absent immediately after it. For instance, one filtrates a culture of human lymphocytes infected by M. Pirum, which has infected human lymphocytes to make it sterile. The filters used have 100 nm and 20 nm porosities. M. Pirum has size of 300 nm so that apparently sterile fluids results. However if this fluid is incubated with a mycoplasma negative culture of human lymphocytes,

mycoplasma re-appears within 2 or 3 weeks! This sounds mysterious. Same happens as 20 nm filtration is applied to a a minor infective fraction of HIV, whose viral particles have size in the range 100-120 nm.

2. These findings motivated a study of the filtrates and it was discovered that they have a capacity to produce low frequency electromagnetic waves with frequencies in good approximation coming as the first three harmonics of kHz frequency, which by the way plays also a central role in neural synchrony. What sounds mysterious is that the effect appeared after appropriate dilutions with water: positive dilution fraction varied between 10^{-7} and 10^{-12}. The uninfected eukaryotic cells used as controls did not show the emission. These signals appeared for both M. Pirum and E. Choli but for M. Pirum a filtration using 20 nm filter canceled the effect. Hence it seems that the nano-structures in question have size between 20 and 100 nm in this case.

   A resonance phenomenon depending on excitation by the electromagnetic waves is suggested as an underlying mechanism. Stochastic resonance familiar to physicists suggests itself and also I have discussed it while developing ideas about quantum brain [K39]. The proposed explanation for the necessity of the dilution could be kind of self-inhibition. Maybe a gel like phase which does not emit radiation is present in sufficiently low dilution but is destroyed in high dilutions after which emission begins. Note that the gel phase would not be present in healthy tissue. Also a destructive interference of radiation emitted by several sources can be imagined.

3. Also a cross talk between dilutions was discovered. The experiment involved two tubes. Donor tube was at a low dilution of E. Choli and "silent" (and carrying gel like phase if the above conjecture is right). Receiver tube was in high dilution (dilution fraction 10^{-9}) and "loud". Both tubes were placed in mu-metal box for 24 hours at room temperature. Both tubes were silent after his. After a further dilution made for the receiver tube it became loud again. This could be understood in terms of the formation of gel like phase in which the radiation does not take place. The effect disappeared when one interposed a sheath of mu-metal between the tubes. Emission of similar signals was observed for many other bacterial specials, all pathogenic. The transfer occurred only between identical bacterial species which suggests that the signals and possibly also frequencies are characteristic for the species and possibly code for DNA sequences characterizing the species.

4. A further surprising finding was that the signal appeared in dilution which was always the same irrespective of what was the original dilution.

3.1.2 Experimentation at gene level

The next step in experimentation was performed at gene level.

1. The killing of bacteria did not cancel the emission in appropriate dilutions unless the genetic material was destroyed. It turned out that the genetic material extracted from the bacteria filtered and diluted with water produced also an emission for sufficiently high dilutions.

2. The filtration step was essential for the emission also now. The filtration for 100 nm did not retain DNA which was indeed present in the filtrate. That effect occurred suggests that filtration destroyed a gel like structure inhibiting the effect. When 20 nm filtration was used the effect disappeared which suggests that the size of the structure was in the range 20-100 nm.

3. After the treatment by DNAse enzyme inducing splitting of DNA to pieces the emission was absent. The treatment of DNA solution by restriction enzyme acting on many sites of DNA did not suppress the emission suggesting that the emission is linked with rather short sequences or with rare sequences.

4. The fact that pathogenic bacteria produce the emission but not "good" bacteria suggests that effect is caused by some specific gene. It was found that single gene - adhesin responsible for the adhesion of mycoplasma to human cells- was responsible for the effect. When the cloned

gene was attached to two plasmids and the E. Choli DNA was transformed with the either plasmid, the emission was produced.

3.1.3 Some consequences

The findings could have rather interesting consequences.

1. The refinement of the analysis could make possible diagnostics of various diseases and suggests bacterial origin of diseases like Alzheimer disease, Parkinson disease, Multiple Sclerosis and Rheumatoid Arthritis since the emission signal could serve as a signature of the gene causing the disease. The signal can be detected also from RNA viruses such as HIV, influenza virus A, and Hepatitis C virus.

2. Emission could also play key role in the mechanism of adhesion to human cells making possible the infection perhaps acting as a kind of password.

The results are rather impressive. Some strongly conditioned skeptic might have already stopped reading after encountering the word "dilution" and associating it with a word which no skeptic scientist in his right mind should not say aloud: "homeopathy" ! By reading carefully what I wrote above, it is easy to discover that the experimenters unashamedly manufactured a homeopathic remedy out of the filtrate! And the motivating finding was that although filtrate should not have contained the bacteria, they (according to authors), or at least the effects caused by them, appeared within weeks to it! This is of course impossible in the word of skeptic.

The next reaction of the skeptic is of course that this is fraud or the experimenters are miserable crackpots. Amusingly, one of the miserable crackpots is Nobelist Luc Montagnier, whose research group discovered AIDS virus.

3.1.4 How TGD could explain the findings?

Let us leave the raging skeptics for a moment and sketch possible explanations in TGD framework.

1. Skeptic would argue that the filtration allowed a small portion of infected cells to leak through the filter. Many-sheeted space-time suggests a science fictive variant of this explanation. During filtration part of the infected cells is "dropped" to large space-time sheets and diffused back to the original space-time sheets during the next week. This would explain why the micro-organisms were regenerated within few weeks. Same mechanism could work for ordinary molecules and explain homeopathy. This can be tested: look whether the molecules return back to the diluted solution in the case of a homeopathic remedy.

2. If no cells remain in the filtrate, something really miraculous looking events are required to make possible the regeneration of the effects serving as the presence of cells. This even in the case that DNA fragments remain in the filtrate.

   (a) The minimum option is that the presence of these structures contained only the relevant information about the infecting bacteria and this information coded in terms of frequencies was enough to induce the signatures of the infection as a kind of molecular conditioning. Experimentalists can probably immediately answer whether this can be the case.

   (b) The most radical option is that the infecting bacteria were actually regenerated as experimenters claim! The information about their DNA was in some form present and was transcribed to DNA and/or RNA, which in turn transformed to proteins. Maybe the small fragment of DNA (adhesin) and this information should have been enough to regenerate the DNA of the bacterium and bacterium itself. A test for this hypothesis is whether the mere nanoparticles left from the DNA preparation to the filtrate can induce the regeneration of infecting molecules.

The notion of magnetic body carrying dark matter quantum controlling living matter forms the basic element of TGD inspired model of quantum biology and suggests a more concrete model. The discovery of nanotubes connecting cells with distance up to 300 μ [I15] provides experimental support for the notion.

1. If the matter at given layer of the onion-like structure formed by magnetic bodies has large $\hbar$, one can argue that the layer corresponds to a higher evolutionary level than ordinary matter with longer time scale of memory and planned action. Hence it would not be surprising if the magnetic bodies were able to replicate and use ordinary molecules as kind of sensory receptors and motor organs. Perhaps the replication of magnetic bodies preceded the replication at DNA level and genetic code is realized already at this more fundamental level somehow. Perhaps the replication of magnetic bodies induces the replication of DNA as I have suggested.

2. The magnetic body of DNA could make DNA a topological quantum computer [K14]. DNA itself would represent the hardware and magnetic bodies would carry the evolving quantum computer programs realized in terms of braidings of magnetic flux tubes. The natural communication and control tool would be cyclotron radiation besides Josephson radiation associated with cell membranes acting as Josephson junctions. Cyclotron frequencies are indeed the only natural frequencies that one can assign to molecules in kHz range. There would be an entire fractal hierarchy of analogs of EEG making possible the communication with and control by magnetic bodies.

3. The values of Planck constant would define a hierarchy of magnetic bodies which corresponds to evolutionary hierarchy and the emergence of a new level would mean jump in evolution. Gel like phases could serve as a correlate for the presence of the magnetic body. The phase transitions changing the value of Planck constant and scale up or down the size of the magnetic flux tubes. They are proposed to serve as a basic control mechanism making possible to understand the properties and the dynamics of the gel phases and how biomolecules can find each other in the thick molecular soup via a phase transition reducing the length of flux tubes connecting the biomolecules in question and thus forcing them to the vicinity of each other.

Consider now how this model could explain the findings.

1. Minimal option is that the flux tubes correspond to "larger space-time sheets" and the infected cells managed to flow into the filtrate along magnetic flux tubes from the filter. This kind of transfer of DNA might be made possible by the recently discovered nanotubes already mentioned.

2. Maybe the radiation resulted as dark photons invisible for ordinary instruments transformed to ordinary photons as the gel phase assignable with the dark matter at magnetic flux tube network associated with the infected cells and corresponding DNA was destroyed in the filtration.

   This is not the only possible guess. A phase conjugate cyclotron radiation with a large value of Planck constant could also allow for the nanostructures in dilute solute to gain metabolic energy by sending negative energy quanta to a system able to receive them. Indeed the presence of ambient radiation was necessary for the emission. Maybe that for sufficiently dilute solute this mechanism allows to the nanostructures to get metabolic energy from the ambient radiation whereas for the gel phase the metabolic needs are not so demanding. In the similar manner bacteria form colonies when metabolically deprived. This sucking of energy might be also part of the mechanism of disease.

3. What could be the magnetic field inducing the kHz radiation as a synchrotron radiation?

   (a) For instance, kHz frequency and its harmonics could correspond to the cyclotron frequencies of proton in magnetic field which field strength slightly above that for Earth's magnetic field (750 Hz frequency corresponds to field strength of B_E, where $B_E = .5$ Gauss, the nominal strength of Earth's magnetic field). A possible problem is that the thickness of the flux tubes would be about cell size for Earth's magnetic field from flux quantization and even larger for dark matter with a large value of Planck constant. Of course, the flux tubes could make themselves thinner temporarily and leak through the pores.

(b) If the flux tube is assumed to have thickness of order 20-100 nm, the magnetic field for ordinary value of $\hbar$ would be of order.1 Tesla from flux quantization and in the case of DNA the cyclotron frequencies would not depend much on the length of DNA fragment since the it carries a constant charge density. Magnetic field of order.2 Tesla would give cyclotron frequency of order kHZ from the fact that the field strength of.2 Gauss gives frequency of about.1 Hz. This correspond to a magnetic field with flux tube thickness ~ 125 nm, which happens to be the upper limit for the porosity. Dark magnetic flux tubes with large $\hbar$ are however thicker and the leakage might involve a temporary phase transition to a phase with ordinary value of $\hbar$ reducing the thickness of the flux tube. Perhaps some genes (adhesin) plus corresponding magnetic bodies representing DNA in terms of cyclotron frequencies depending slightly on precise weight of the DNA sequence and thus coding it correspond to the frequency of cyclotron radiation are the sought for nano-structures.

4. While developing a model for homeopathy based on dark matter I ended up with the idea that dark matter consisting of nuclear strings of neutrons and protons with a large value of $\hbar$ and having thus a zoomed up size of nucleon could be involved. The really amazing finding was that nucleons as three quark systems allow to realize vertebrate code in terms of states formed from entangled quarks [L1], [L1] described also in this chapter! One cannot decompose codons to letters as in the case of the ordinary genetic code but codons are analogous to symbols representing entire words in Chinese. The counterparts of DNA, RNA, and amino-acids emerge and genetic code has a concrete meaning as a map between quantum states.

   Without any exaggeration this connection between dark hadronic physics and biology has been one of the greatest surprises of my professional life. It suggests that dark matter in macroscopic quantum phase realizes genetic code at the level of nuclear physics and biology only provides one particular (or probably very many as I have proposed) representations of it. If one takes this seriously one can imagine that genetic information is represented by these dark nuclear strings of nanoscopic size and that there exists a mechanism translating the dark nuclei to ordinary DNA and RNA sequences and thus to biological matter. This would explain the claimed regeneration of the infected cells.

5. Genetic code at dark matter level would have far reaching implications. For instance, living matter - or rather, the magnetic bodies controlling it - could purposefully perform genetic engineering. This forces me to spit out another really dirty word, "Lamarckism" ! We have of course learned that mutations are random. The basic objection against Lamarckism is that there is no known mechanism which would transfer the mutations to germ cells. In the homeopathic Universe of TGD the mutations could be however performed first for the dark nucleon sequences. After this these sequences would diffuse to germ cells just like homeopathic remedies do, and after this are translated to DNA or RNA and attach to DNA.

The findings of both Montagnier and Gariaev suggests that also the representation of genetic code in terms of dark photons is involved. How genetic code could be represented in terms of frequencies? The TGD based model of music harmony [L14] [K36] (see `http://tinyurl.com/zg3aaj7`) relies on the idea that 12-note scale is representable as a closed non-self-intersecting curve (Hamilton's cycle) at icosahedron having 12 vertices. The harmony assignable to a given Hamilton's cycle is characterized in terms of 3-chords assignable to the 20 faces (triangles) of the icosahedron once the 12-note scale is represented as a particular Hamilton's cycle.

Remarkably, the number of amino-acids is also 20! One indeed ends up with a model in which 20+20+20=60 DNA codons are represented by 3-chords for a triplet of harmonies defined by Hamilton's cycles predicting correctly the numbers of DNAs coding for a given amino-acid for vertebrate code. One must however assume that also tetrahedral harmony is present to get 64 DNA codons rather than only 60. TActually two variants of the code are predicted and altogether one obtains the standard 20 amino-acids plus two additional ones identified as Pyl and Sec known to be realized in living matter.

In music realization DNA codons can be represented as 3 dark photons or phonons with appropriate frequency ratios. This representation could explain the findings of Montagnier and Gariaev.

There is also a connection with TGD inspired theory of consciousness. Music both expresses and induces emotions. The proposal is that the representation of DNA codons in terms of triplets of sounds or dark photons defines molecular level representation of emotions. There is large number of different harmonies and they could represent different moods.

3.2 Water Electric As Protocell

Ulla Matfolk sent to me some interesting material at the web page of Dr. Mae-Wan Ho which provides further insights into the model of cell. The articles are "Water electric" [D14] and "Making Fuel from Water" [D12]. The articles summarize an experimental discovery which could be called Pollack-Zheng effect [D17, D15]. Both articles relate closely to what might be called the holy grail of artificial photosynthesis. The unreasonable effectiveness of photosynthesis in the sense that the waste of energy during the process is extremely small, makes artificial photosynthesis an excellent candidate for the final solution of energy problems as far energy sources and minimization of wastes are considered. In the following I comment only the first paper in detail from TGD viewpoint.

How photosynthesis manages to be so effective is one of the mysteries of biology. TGD based view about metabolic energy involves two ideas.

1. TGD predicts a hierarchy of metabolic energy quanta [K3, K21]. The basic quanta come as $E(k) = 2^k E_0$, where k is positive or negative integer and $E_0 \simeq .5$ eV holds true. For instance, 2 eV metabolic energy quantum corresponding to red light corresponds to $k = 3$. This is actually oversimplification since there is a cascade of quanta $E(k,n) = (1 - 2 < sup > -n < /sup >)E(k)$ converging to $E(k)$ for each p-adic length scale. These energies correspond to energies liberated when electron or proton drops to a larger space-time sheet at the limit when second space-time becomes very large and the particle starts from rest and remains to rest: this is second idealization as also the particle in a box geometry. The idea is that these universal metabolic energy quanta preceded the metabolism based on chemical storage of energy and that the primary step in photosynthesis is kicking of proton or electron to a smaller space-time sheet.

2. Second idea relies on the hierarchy of Planck constants.

   (a) The rate of dissipation - that this the energy wasted per unit time - is inversely proportional to $\hbar$ in the first naive guess and means that macroscopically quantum coherent dark matter dissipates very little. Could photon kick charged dark particles to smaller space-time sheet where they dissipate very little? Or could photosynthesis capture ordinary or dark photons of sunlight to some layer of the onion like structure formed by the magnetic body of the organism, where it kicks particles to smaller space-time sheets. This light could correspond to bio-photons liberated as the biological body of the organism dies.

   (b) Could this storage of photons have preceded chemical storage of energy in living matter? And could this energy reserve explain some rather mysterious findings about the ability of some people to survive without ordinary metabolic energy feed (usually saints and this kind of people telling that light is enough for them to survive. Also animals are capable to these metabolic miracles [I17] : see the article "Researchers Seek to Demystify the Metabolic Magic of Sled Dogs" in Science. Of course, the storage of energy to that of dark matter or dark photons confined to the net defined by magnetic flux tubes could be the eventual manner to avoid energy waste and associated entropy growth inducing environmental problems. Hierarchy of Planck constants would allow the storage in arbitrary long length scales for given energy of photon so that even a community of organisms could have collective metabolic energy resources: maybe synergy has something to do with this.

The first article summarizing the Pollack-Zheng effect gives quantitative support for this picture. I have formatted the text as comments to the summary represented in the article of Mae-Wan Ho [D14].

3.2.1 Exclusion zones

The article summarizes the sequence of events initiated by the discovery of Gerald Pollack and his student Jian-ming Zheng [D17, D15]. As a matter fact, the fascinating findings described in detail by Gerald Pollack in his book were absolutely crucial for the recent TGD based view about quantum biology in which dark matter plays key role.

1. Pollack and his student discovered that suspensions of colloids and dissolved substances are excluded from a region extending some hundreds of micrometres from the surfaces of hydrophilic gels. An exclusion zone (EZ) of this magnitude conflicts the belief that interfacial water forming at liquid-solid, or liquid-air interfaces can be no more than a few layers of molecules thick. What's observed is a million layers or more! "Exclusion" means that the water suspension of micro-spheres moved away from the surface of gel with constant velocity and behaving like single structural unit.

   Comment: The sizes of cells vary up to hundreds of micrometers and cells are by definition structures which are isolated from the environment. Maybe EZs represent protocells or their predecessors. Pollack and coauthors have indeed proposed that their finding might relate to the origin of life [D15]. That the surface was that of gel might be important. In TGD based model of living matter gels have magnetic bodies and their presence might relate to the formation of the thick water layer in non-standard phase.

2. Similar exclusion zones were found next to any hydrophilic surface including surfaces coated with a monolayer of hydrophilic molecules, and around ion exchange resin beads. Electric charge appears to be important, as EZ failed to form around charge-exhausted resin beads. Although EZ can form in pure water, it is enhanced and stabilized by low concentrations of buffer (2 to 10 mM at pH 7).

   Comment: Hydrophily could correspond to the formation of magnetic flux tubes connecting the hydrophilic surface to water molecules as assumed in the model of protein folding and bio-catalysis [K2].

3. The EZ phase is very different from the bulk water. An unusually ordered crystalline phase where the molecules are less free to move is suggestive. The UV and visible absorption spectrum gave a single absorption peak at $\lambda \simeq 270$ nm in the UV region completely absent in the bulk phase. The infrared emission record showed that the EZ radiates very little compared with bulk water, as would be expected on account of the reduced mobility of water molecules. The magnetic resonance imaging mapping similarly gave a transverse relaxation time (T2) of 25.4 + 1 ms, which is shorter than the 27.1 + 0.4 ms recorded for the bulk water phase, again indicative of restricted motion.

   Comment: The reduced radiation might mean that part of photons are dark and bound inside magnetic flux tubes defining a structure responsible for the formation of gel like phases inside cell and perhaps also inside EZ. The interpretation as bio-photons is suggestive. This phase of water could be predecessor of the water in cell interior since in the crystalline phase long bio polymers like DNA and amino-acid sequences would be stable against hydration.

4. EZ had a different electrical potential from the bulk phase, by as much as 100 200 mV, depending on the hydrophilic surface. With a negatively charged surface such as polyacrylic acid or Nafion (widely used as a proton exchange membrane), the potential is negative compared with the bulk water away from the EZ. Simultaneously, the hydrogen ion (proton, H^+) concentration is high just outside the EZ, decreasing in a gradient away from it. This indicates that the formation of the EZ is accompanied by a separation of positive and negative electrical charges, which led to the build up of electrical potential between the EZ and the bulk water. In effect, the water has become an electrical battery, and can provide electricity through an external circuit.

   Comment: Cell membrane is also a battery and the potential is around 50-80 mV to be compared with 100 200 mV, and the size scale of cell varies from 5 micrometer to hundreds of micrometers so that EZs could be involved with the formation of cell and cell membranes. The kicking of electrons or protons to smaller space-time sheet could be the mechanism

inducing electric potential at a given space-time sheet. The formation of battery would mean that water could some day used to store very effectively the energy of solar radiation.

3.2.2 A connection with photosynthesis

Separating H^+ from e^- (electron) is the first step of photosynthesis in green plants which provides energy for most of the biosphere. In this case the energy comes from solar radiation. The separation of charges requires energy also in the case of EZ and the question is where this energy comes from in the case of EZ.

1. A clue came after having inadvertently left the experimental chamber with the EZ on the microscope overnight. Next morning, the EZ had shrunk considerably. But after turning on the microscope lamp, it began to immediately grow again, restoring itself within minutes to its former size. The energy for EZ formation comes from light, as in photosynthesis, but it can use the low energy part of the solar spectrum that photosynthesis cannot.

   Comment: Could one consider the possibility that photosynthesis involves unknown step and this step is just the kicking of electrons or protons to a smaller space-time sheet. This step would also induce the separation of charges and the generation of electric potential.

2. Although the entire spectrum of visible light appeared effective in making the EZ grow, the most effective part is in the infrared region, peaking at $\lambda \simeq 3100$ nm. A 10 minute exposure at that wavelength expanded the width of an EZ 3.7 times, and after an hour of exposure, the expansion was more than 6 times. After the light was turned off, the EZ remained constant for about 30 minutes before beginning to shrink, reaching halfway to its baseline level in about 15 minutes.

   Comment: $\lambda = 3100$ nm corresponds to.4 eV. The nominal value of the fundamental metabolic energy quantum is around $E_0 = .5$ eV and one has $E(k = 0, n = 3) = 0.4375$ eV for this value of E_0. Perhaps the photons indeed kick electrons or protons to a smaller space-time sheet.

   (a) In the case of protons the smaller space-time sheet would correspond to atomic space-time sheets characterized by $p \simeq 2^{137}$: the larger one would correspond to to $k = 141$.

   (b) For electrons the size of the smaller space-time sheet would be by a factor $m_p/m_e = 940/.5 = 1880 \simeq 2^{11}$ larger and would correspond to $k = 137 + 11 = 148$. This is one half of the thickness of the lipid layer of cell membrane. The larger space-time sheet would correspond to cell membrane thickness $L(151) = 10$ nm and perhaps the dark space-time sheet serving as a template for the formation of the cell membrane! If $E = .4$ eV corresponds to electron, then proton would correspond to $E(0, 3) = .44$ eV giving for the metabolic energy quantum the value $E_0(p) = 0.5029$ eV in the case of proton and $E_0(e) = 0.4616$ eV in the case of electron.

3. When the UV and visible range was tested, a peak in the degree of EZ expansion was detected at $\lambda = 270$ nm in the UV region, corresponding to the characteristic absorption peak of EZ that was identified before. However, as the optical power used in the UV and visible region was 600 times that in the IR, the most profound effect was identified in the IR region, particularly at 3 100 nm.

   Comment: $\lambda = 270$ nm corresponds to the energy 4.5926 eV. E=4 eV is the nearest metabolic energy quantum. This energy does not correspond directly to any metabolic energy quantum assignable to.4 eV or.43 eV. One must be however cautious with conclusions since the model is very rough.

4. The mechanism of EZ formation is still unknown. But the two wavelengths that expand the EZ most effectively may offer some hint. The UV wavelength 270 nm is close to the 250 nm ($\simeq 5$ eV) required to ionize water under standard state conditions and taking into account the hydration of the resulting ions. The 3 100 nm peak, on the other hand is close to the OH stretch of the ring hexamer identified as the most abundant species in infrared predissociation spectroscopy of large water clusters, and also in neon matrices by infrared spectroscopy. These

results suggest that photoexcitation of ring hexamers and photoionisation followed by ejection of protons play synergistic roles in the assembly of the EZ phase. Pollack and colleagues believe that the infrared radiation, though normally insufficient to break OH bonds, can nevertheless work via resonance induced dissociation of large hydrogen-bonded networks.

Comment: Ring hexamers bring in mind the crucial role of aromatic cycles in TGD inspired model of DNA as topological quantum computer which leads also to a model of ADP$\leftrightarrow$ ATP transition involving reconnection of magnetic flux tubes and having also information theoretic interpretation as a change of the topology of the braid structure defining topological quantum computer program [K14]. Magnetic flux tubes carrying dark electrons begin from these and can end up to other bio-molecules or water. Just a guess: could they end on ring hexamers?

3.2.3 Summary

The findings suggest additional details to the TGD based view about living matter.

1. The kicking of electrons or protons or both of them to a larger space-time sheet would be the first step in photosynthesis as I indeed suggested for years ago. The energy of 3100 nm photons indeed corresponds to that for the fundamental metabolic energy quantum. I have also proposed this process to be a fundamental step also in bio-catalysis: the temporary dropping of electron or proton of the catalyst molecule to a larger space-time sheet could provide the energy helping the reacting molecules to overcome the potential wall preventing the reaction from running. This metabolic coin could be returned to catalyst with high enough probability or the photons exchanged could be virtual.

   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.

2. The findings suggest also a mechanism for how solar radiation generates proto cells or their predecessors. The resulting phases of water have size extending to those for largest cells and the water could involve a gel like phase in which magnetic flux tubes containing dark matter could play a key role and eventually lead to quantum computer like behavior [K14]. The kicking of electrons (or protons) to smaller space-time sheet would induce ionization at given space-time sheet so that electric potential difference would result. The magnitude of the potential difference is of a correct order of magnitude. Cell membrane scale is present as a p-adic length scale for the space-time sheet of electrons before the kicking to the smaller space-time sheet and these space-time sheets could act as templates for the formation of cell membrane.

3. Interestingly, TGD based model of high T_c super conductivity predicts that both cell membrane length scale and size scale of cell are involved with the super-conductivity [K6]. Cell membrane acts as a Josephson junction in TGD based model of cell membrane, nerve pulse, and EEG.

3.3 A Model For Chiral Selection

Chiral selection of bio-molecules is one of the basic mysteries of biology and it is interesting to see whether the existing bits of data combined with vision about quantum TGD could help to build a coherent picture about the situation. Let us first try to identify the most important pieces of the puzzle.

1. Chiral selection requires parity breaking in the scale of biomolecules. Standard model predicts parity breaking interactions but the effects are extremely small above intermediate boson length scale which is by a factor 10^{-7} shorter than atomic length scale. The proposed

solution of the problem is that dark variants of intermediate gauge bosons are in question so that the Compton lengths of intermediate gauge bosons are scaled up by a factor $r = \hbar/\hbar_0$. Below the dark Compton length weak gauge bosons would be effectively massless and above it possess ordinary masses. Large parity breaking effects induced by dark intermediate gauge bosons would be possible.

2. For instance, for $r = 2^{44}$ for which EEG photons have energies just above thermal threshold at room temperature, the effective p-adic length scale would correspond to $L(k)$, $k = 89 + 44 = 133$ of about.2 Angstrom. This scale in turn would scale up to $L(133 + 44 = 177)$. Secondary p-adic length scale assignable to $k = 89$ which is important in zero energy ontology would correspond to $k = 2 \times 89 = 178$ which corresponds to about $L(178) \simeq 100$ μm, the length scale assignable to large cells and the thickness of water layers in the experiment of Pollack.

3. Parity breaking interaction is associated with spin and the interaction energy of form $ks \cdot E_Z$, where s is the spin of particle and E_Z is Z^0 electric field. Classical induced gauge fields are very strongly correlated in TGD since they are expressible in terms of four CP_2 coordinates and their gradients. Hence classical electromagnetic field E is in the generic case accompanied by classical Z^0 field $E_Z = aE$. This means that if there is classical electromagnetic field and charge density at the dark space-time sheet, large parity breaking effect is possible at the level of spin. The induced Z^0 electric field could force the spins to become parallel and in this manner induce also magnetization.

The crucial finding about which I learned three years ago is that L glutamate is more stable than R glutamate in water and that heavy water does not induce this effect [**?**]. This suggests a connection with Pollack-Zheng effect [D17]. Heavy water nuclei have vanishing spin whereas hydrogen nuclei have spin 1/2 so that H_2 in water molecules can be in spin singlet or triplet states (para and orto configurations). Could the nuclear spin of water molecules somehow induce parity breaking and the magnetic interaction distinguishing between these molecules?

1. Suppose that bio-molecules in question have magnetic moment and water carries magnetic field, most naturally at dark magnetic flux tubes. The parity breaking interaction energy $-p \cdot E$ with dark electric field remains invariant under reflection and rotation of π changing the orientation of the mirror image of the molecule with respect to electric field. The interaction energy with magnetic field however changes its sign since magnetic moment is not affected by the reflection but changes direction under rotation. The angular momentum of the molecule responsible for the magnetic moment can of course change sign but since the transformation involves acts on angular momenta only, it is not a symmetry of entire system. Indeed, if there is interaction between angular momentum degrees of freedom and geometric degrees of freedom the magnetic interaction energy for the mirror image is different. Suppose that the breaking of reflection symmetry induced by the chirality of the molecule induces internal electric field E_{int}. The parity breaking interaction energy $ks \cdot E_{int}$ would indeed break the symmetry in the transformation changing the directions of angular momenta and spins.

2. It deserves to be emphasize that the parity breaking of the molecule itself would induce the symmetry breaking if molecule possesses dark magnetic body. One can actually imagine a cascade of parity breakings proceeding from shorter to longer length scales in this manner.

3. The mechanism creating electric field could be the charging of water, perhaps by the Pollack-Zheng mechanism and having in TGD framework an interpretation as a basic mechanism storing the energy of sunlight to metabolic energy (kicking of electrons and/or protons to a smaller space-time sheet so that oppositely charge space-time sheets emerge as a consequence). A direct connection with metabolism would be admittedly a highly satisfactory feature of the mechanism.

4. Parity breaking energy $ks \cdot E$ for say dark protons assignable to hydrogen nuclei of bio-molecules in the internal electric field of the molecule or dark protons of water molecules in the electric field induced by Pollack-Zheng effect [D17] does not change sign under the reflection of the molecule so that spin polarization independent of chirality could result form both water molecules in crystal like phase and for bio-molecules possessing dark protons (and

dark hydrogen atoms). This could in turn serve as a seed for magnetization essential for the existence of dark magnetic flux tubes.

If water is replaced with heavy water there is no difference between L and R. What distinction H and D could explain this difference?

1. The basic difference between water and heavy water nuclei is that for water nucleus is just proton having spin 1/2 so that H_2 in water molecule can be in spin triplet and singlet states. Fractions of the two states are 3/4 and 1/4 in the absence of external magnetic field.

2. On the other hand, in atto-second time scale (corresponding length scale is 3 Angstroms) water is known to behave effectively as $H_{1.5}O$. A possible explanation is that 1/4: th of H nuclei/atoms are effectively dark having large Planck constant. The dark protons cannot correspond to H_2 in spin singlet state since the interaction energy $ks \cdot E$ would be small in this case. Dark spin triplet states of H_2 could however induce parity breaking in water and make crystal like water phase both electret and magnet. If the spin $s_z = 1$ with negative interaction energy with E becomes dark then 1/4 of hydrogen atoms would be dark and $H_{1.5}O$ formula would hold true. For D_2O this mechanism would not work.

3. The model for homeopathy led to the idea that dark nuclei consisting of scale up variants of nucleons possibly having size of order atomic length scale could be crucial for understanding living matter. The states of nucleons correspond naturally to those DNA, RNA, and aminocids and vertebrate genetic code emerges naturally with DNA code word replaced with 3 quark state with entanglement between the quarks representing the information. Could it be that dark protons of water combine to form dark nuclei providing a fundamental representation of the genetic code and could the spin of protons induce electro-weak chiral symmetry breaking. Also now this mechanism fails for D_2O.

3.4 Burning Water And Photosynthesis

For a physicist liberated from the blind belief in reductionism, biology transforms to a single gigantic anomaly about which recent day physics cannot say much. During years I have constructed several models for these anomalies helping to develop a more detailed view about how the new physics predicted by quantum TGD could allow to understand biology and consciousness.

The basic problem is of course the absence of systematic experimentation so that it is possible to imagine many new physics scenarios. For this reason the article series of Mae-Wan Ho [D14, D12, D10, D13] in ISIS was a very pleasant surprise, and already now has helped considerably in the attempts to develop the ideas further.

The first article "Water electric" [D14] told about the formation of exclusion zones around hydrophilic surfaces, typically gels in the experiments considered [D17]. The zones were in potential of about 100 meV with respect to surroundings (same order of magnitude as membrane potential) and had thickness ranging to hundreds of micrometers (the size of a large cell): the standard physics would suggests only few molecular layers instead of millions. Sunlight induced the effect. This finding allow to develop TGD based vision about how proto cells emerged and also the model for chiral selection in living matter by combining the finding with the anomalies of water about which I had learned earlier.

The article "Can water burn?" [D10] tells about the discovery of John Kanzius - a retired broadcast engineer and inventor. Kanzius found that water literally burns if subjected to a radio frequency radiation at frequency of 13.56 MHz [D1]. The mystery is of course how so low frequency can induce burning. The article "The body does burn water" [D13] notices that plant cells burn water routinely in photosynthesis and that also animal cells burn water but the purpose is now to generate hydrogen peroxide which kills bacteria (some readers might recall from childhood how hydrogen peroxide was used to sterilize wounds!). Hence the understanding of how water burns is very relevant for the understanding of photosynthesis and even workings of the immune system.

3.4.1 Living matter burns water routinely

Photosynthesis burns water by decomposing water to hydrogen and oxygen and liberating oxygen. Oxygen from CO_2 in atmosphere combines with the oxygen of H_2O to form O_2 molecules whereas

H from H_2O combines with carbon to form hydrocarbons serving as energy sources for animals which in turn produce CO_2. This process is fundamental for aerobic life. There is also a simpler variant of photosynthesis in which oxygen is not produced and applied by an-aerobic life forms. The article "Living with Oxygen" by Mae-Wan Ho gives a nice overall view about the role of oxygen [D11]. As a matter fact, also animals burn water but they do this to produce hydrogen peroxide H_2O_2 which kills very effectively bacteria.

Burning of water has been studied as a potential solution for how to utilize the solar energy to produce hydrogen serving as a natural fuel [D12]. The reaction $O_2 + H_2 \rightarrow 2H_2O$ occurs spontaneously and liberates energy of about 1.23 eV. The reverse process $2H_2 \rightarrow H_2O_2 + H_2$ in the presence of sunlight means burning of water, and could provide the manner to store solar energy. The basic reaction $2H_2O + 4h\nu \leftrightarrow H_2O_2 + H_2$ stores the energy of four photons. What really happens in this process is far from being completely understood. Quite generally, the mechanisms making possible extreme efficiency of bio-catalysis remain poorly understood. Here new physics might be involved. I have discussed models for photosynthesis and $ADP \leftrightarrow ATP$ process involved with the utilization of the biochemical energy already earlier [K21].

3.4.2 How water could burn in TGD Universe?

The new results could help to develop a more detailed model about what happens in photosynthesis. The simplest TGD inspired sketch for what might happen in the burning of water goes as follows.

1. Assume that 1/4 of water molecules are partially dark (in sense of nonstandard value of Planck constant) or at least at larger space-time sheets in atto-second scale [D9, D8, D16, D5]. This would explain the $H_{1.5}O$ formula explaining the results of neutron diffraction and electron scattering.

2. The question is what this exotic fraction of water precisely is. The models for water electret, exclusion zones and chiral selection lead to concrete ideas about this. Electrons assignable to the H atoms of (partially) dark H_2O reside at space-time sheet $k_e = 151$ (this p-adic length scale corresponds to 10 nm, the thickness of cell membrane). At least the hydrogen atom for this fraction of water molecules is exotic and findings from neutron and electron scattering suggest that both proton and electron are at non-standard space-time sheets but not necessarily at the same space-time sheet. The model for the burning requires that electron and proton are at different space-time sheets in the initial situation.

3. Suppose all four electrons are kicked to the space-time sheet of protons of the exotic hydrogen atoms labeled by k_p. This requires the energy $E_\gamma = (1 - 2^{-n})E_0(k_p)$ (the formula involves idealizations). At this space-time sheet protons and electrons are assumed to combine spontaneously to form two H_2 atoms. Oxygen atoms in turn are assumed to combine spontaneously to form O_2.

4. For $k_f = 148$ and $n = 3$ minimum energy needed would be $4E_\gamma = 4 \times .4 = 1.6$ eV. For $k_p = 149$ (thickness of lipid layer) and $n = 2$ one would have $4E_\gamma = 4 \times .3462 = 1.385$ eV whereas $H_2O_2 + H_2 \rightarrow 2H_2O$ liberates energy 1.23 eV. Therefore the model in which electrons are at cell membrane space-time sheet and protons at the space-time sheet assignable to single lipid layer of cell membrane suggests itself. This would also mean that the basic length scales of cell are already present in the structure of water. Notice that there is no need to assume that Planck constant differs from its standard value.

There is no need to add, that the model is an unashamed oversimplification of the reality. It might however catch the core mechanism of photosynthesis.

3.4.3 Burning of salt water induced by RF radiation

Engineer John Kanzius has made a strange discovery [D1]: salt water in the test tube radiated by radio waves at harmonics of a frequency f=13.56 MHz burns. Temperatures about 1500 K, which correspond to.15 eV energy have been reported. One can irradiate also hand but nothing happens. The original discovery of Kanzius was the finding that radio waves could be used to cure cancer by destroying the cancer cells. The proposal is that this effect might provide new energy source by

liberating chemical energy in an exceptionally effective manner. The power is about 200 W so that the power used could explain the effect if it is absorbed in resonance like manner by salt water.

Mae-Wan Ho's article "Can water Burn?" [D10] provides new information about burning salt water [D1], in particular reports that the experiments have been replicated. The water is irradiated using polarized radio frequency light at frequency 13.56 MHz. The energy of radio frequency quantum is $E_{rf} = .561 \times 10^{-7}$ eV and provides only a minor fraction $E_{rf}/E = .436 \times 10^{-7}$ of the needed energy which is $E = 1.23$ eV for single $2H_2O \to H_2O_2 + H_2$ event. The structure of water has been found to change, in particular something happens to O-H bonds. The Raman spectrum of the water has changed in the energy range $[0.37, 0.43]$ eV. Recall that the range of metabolic energy quanta $E(k,n) = (1 - 2^{-}n)E_0(k)$ varies for electron in the range $[.35, .46]$ eV in the model for the formation of exclusion zone induced by light. Therefore the photons assigned to changes in Raman spectrum might be associated with the transfer of electrons between space-time sheets.

The energies of photons involved are very small, multiples of 5.6×10^{-8} eV and their effect should be very small since it is difficult to imagine what resonant molecular transition could cause the effect. This leads to the question whether the radio wave beam could contain a considerable fraction of dark photons for which Planck constant is larger so that the energy of photons is much larger. The underlying mechanism would be phase transition of dark photons with large Planck constant to ordinary photons with shorter wavelength coupling resonantly to some molecular degrees of freedom and inducing the heating. Microwave oven of course comes in mind immediately.

As I made this proposal, I did not realize the connection with photosynthesis and actual burning of water. The recent experimental findings suggest that dark radio frequency photons transform to photons inducing splitting of water as in photosynthesis so that that one should have $r = \hbar/\hbar_0 = E_{rf}/4E$. One could say that large number of radio wave photons combine to form a single bundle of photons forming a structure analogous to what mathematician calls covering space. In the burning event the dark photon would transform to ordinary photon with the same energy. This process would thus transform low energy photons to high energy protons with the ratio $r = \hbar/\hbar_0$.

Therefore the mechanism for the burning of water in the experiment of Kanzius could be a simple modification of the mechanism behind burning of water in photosynthesis.

1. Some fraction of dark radio frequency photons are dark or are transformed to dark photons in water and have energies around the energy needed to kick electrons to smaller space-time sheets .4 eV. After this they are transformed to ordinary photons and induce the above process. Their in-elastic scattering from molecules (that is Raman scattering) explains the observation of Raman scattered photons. For a fixed value of $\hbar$ the process would occur in resonant manner since only few metabolic quanta are allowed.

2. How dark radio frequency photons could be present or could be produced in water? Cyclotron radiation assignable to say electrons in magnetic field comes in mind. If the cyclotron radiation is associated with electrons it requires a magnetic field of 4.8 Gauss the cyclotron frequency is 13.56 MHz. This is roughly ten times the nominal value $B_E = .5$ Gauss of the Earth's magnetic field and 24 times the value of dark magnetic field $B_d = .4B_E = .2$ Gauss needed to explain the effects of ELF em fields on vertebrate brain. Maybe dark matter at flux tubes of Earth's magnetic field with Planck constant equal to $\hbar/\hbar_0 = \frac{1}{4}\frac{E}{E_{rf}}$ transforms radio frequency photons to dark photons or induces resonantly the generation of cyclotron photons, which in turn leak out from magnetic flux tubes and form ordinary photons inducing the burning of water. $E_\gamma = .4$ eV would give $\hbar/\hbar_0 == 1.063 \times 2^{21}$ and $E_\gamma = .36$ eV would give $\hbar/\hbar_0 = .920 \times 2^{21}$.

3. Magnetic fields of magnitude.2 Gauss are in central role in TGD based model of living matter and there are excellent reasons to expect that this mechanism could be involved also with processes involved with living matter. There is indeed evidence for this. The experiments of Gariaev demonstrated that the irradiation of DNA with 2 eV laser photons (which correspond to one particular metabolic energy quantum) induced generation of radio wave photons having unexpected effects on living matter (enhanced metabolic activity) [I26], and that even a realization of genetic code in terms of the time variation of polarization direction could be involved. TGD based model [K5, K43] identifies radio-wave photons as dark photons with same energy as possessed by incoming visible photons so that a transformation of ordinary

photons to dark photons would have been in question. The model assumed hierarchy of values of magnetic fields in accordance with the idea about onion like structure of the magnetic body.

There are several questions to be answered.

1. Is there some trivial explanation for why salt must be present or is new physics involved also here. What comes in mind are Cooper pairs dark Na^+ ions (or their exotic counterparts which are bosons) carrying Josephson currents through the cell membrane in the model of the cell membrane as a Josephson junction which is almost vacuum extremal of Kähler action. In the experimental arrangement leading to the generation of exclusion zones the pH of water was important control factor, and it might be that the presence of salt has an analogous role to that of protons.

2. Does this effect occur also for solutions of other molecules and other solutes than water? This can be tested since the rotational spectra are readily calculable from data which can be found at net.

3. Are the radio wave photons dark or does water - which is very special kind of liquid - induce the transformation of ordinary radio wave photons to dark photons by fusing $r = \hbar/\hbar_0$ radio wave massless extremals (MEs) to single ME. Does this transformation occur for all frequencies? This kind of transformation might play a key role in transforming ordinary EEG photons to dark photons and partially explain the special role of water in living systems.

4. Why the radiation does not induce spontaneous combustion of living matter which contains salt. And why cancer cells seem to burn: is salt concentration higher inside them? As a matter fact, there are reports about [D3]. One might hope that there is a mechanism inhibiting this since otherwise military would be soon developing new horror weapons unless it is doing this already now. Is it that most of salt is ionized to Na^+ and Cl^- ions so that spontaneous combustion can be avoided? And how this relates to the sensation of spontaneous burning [D2] - a very painful sensation that some part of body is burning?

5. Is the energy heating solely due to rotational excitations? It might be that also a "dropping" of ions to larger space-time sheets is induced by the process and liberates zero point kinetic energy. The dropping of proton from k=137 (k=139) atomic space-time sheet liberates about.5 eV (0.125 eV). The measured temperature corresponds to the energy.15 eV. This dropping is an essential element in the ealier of remote metabolism and provides universal metabolic energy quanta. It is also involved with TGD based models of "free energy" phenomena. No perpetuum mobile is predicted since there must be a mechanism driving the dropped ions back to the original space-time sheets.

   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.

6. The electrolysis of water and also cavitation produces what is known as Brown's gas which should consist of water vapour and there might be a connection to the burning of salt water. The properties of Brown's gas [H2] however do not support this interpretation: for instance, Brown's gas has temperature of about 130 C but is able to melt metals so that some un-known mechanism liberating energy must be involved explaining also the claims about over-unity energy production in water splitting using electrolysis. TGD inspired model for Brown's gas [K22] suggests that activated water and Brown's gas correspond to same phase involving polymer sequences formed from exotic water molecules for which one hydrogen nucleus is dark and defining the analogs of basic biopolymers. The bond binding protons to a polymer like sequence would serve as the counterpart of covalent bond.

One also ends up with a more detailed TGD inspired view about basic mechanism of metabolism in living matter predicting a tight correlation between p-adic length scale hypothesis and hierarchy of Planck constants. The model differs in some aspects from the rough models considered hitherto assuming that metabolic energy is liberated as zero point kinetic energy when particle drops to a larger space-time sheet or as cyclotron energy when cyclotron quantum number decreases. Now a phase transition increasing the p-adic length scale of the space-time surface would liberate either kinetic energy of cyclotron energy. Quantum numbers would not change: rather, t the scale appearing as a parameter in the expression of kinetic or cyclotron energy would change adiabatically and in this manner guarantee coherence. Also a phase transition in which the changes of scale due to a reduction of Planck constant and increase of the p-adic length scale compensate each other liberate metabolic energy.

Recall that one of the empirical motivations for the hierarchy of Planck constants came from the observed quantum like effects of ELF em fields at EEG frequencies on vertebrate brain and also from the correlation of EEG with brain function and contents of consciousness difficult to understand since the energies of EEG photons are ridiculously small and should be masked by thermal noise.

3.4.4 Free radicals, expanding Earth, water memory, and Cambrian revolution

The title is intentionally chosen to involve notions which one would expect to have absolutely nothing in common. The purpose is to show that this expectation might be wrong. Consider first the free radical theory [I4]. The theory states that free radical produced in mitochondria are responsible for the ageing since they are highly reactive and cause damage for the DNA. One can however wonder what is the mechanism causing the generation of the free radicals.

A TGD based justification for the free radical theory came as unexpected application of the quantum model for how metabolic batteries are loaded in many-sheeted space-time. The kicking of electrons to smaller space-time sheet loads metabolic batteries in TGD Universe. The dropping of electrons back liberates metabolic energy. These processes occur all the time in ADP$\leftrightarrow$ATP "Karma's" cycle. The quantitative model for the burning of water producing hydrogen peroxide and hydrogen (this process could provide a mechanism of storing solar energy by a mechanism analogous to photosynthesis) as already discussed.

3.4.5 Burning water, photo synthesis, and water memory

The burning of water, photons synthesis and water memory are closely interrelated phenomena in TGD Universe. Recall first what was observed in the experiments carried out by the group led by Luc Montagnie.

1. What was done was filtration of human cells infected by bacteria in sterilization purpose to eliminate the infected cells. Human cells were added to the filtrate. Rather magically, the infection returned to the filtrate within few weeks. Something having size of order of nanoscale leaked through. It was also found that when the filtrate was diluted by water to produce an analog of homeopathic remedy, it produced at multiples of kHz if the dilution factor was in the range $10^{-7} - 10^{-12}$.

2. The second discovery was that if you have two bottles containing a solute of nanostructures such that for the first one dilution factor is small and for the second in the critical range so that it radiates at kHz frequencies. What was found that in the final situation neither radiates but only if the dilutions correspond to the same bacterial species! I proposed two interpretations. The first one was that the nanoscale systems in the highly diluted system are starving and gain metabolic energy by sending negative energy photons to the low dilution system and this makes them possible to replicate and achieve higher dilution after which the process stops.

3. One of the most fascinating possibilities suggested by the discovery is that the nanoscale structures identified as certain gene of the bacteria plus possibly something else (the magnetic body of gene in TGD context) might have been able to regenerate the bacteria themselves!

This would require a non-chemical representation of genetic code and its translation to DNA or RNA. For about year ago I indeed discovered a realization of genetic code in terms of dark nuclei with states of nucleons representing the code words [L1], [L1].

These findings allow a more detailed interpretation of the findings of the experiments of the group of Luc Montagnie.

1. The mysterious burning of water induced by radio waves in GHz range and interpreted in terms of a decomposition of water molecules to hydrogen peroxide and hydrogen: $2H_2 \rightarrow H_2O_2 + H_2$ is closely related to the splitting of water to hydrogen and oxygen occurs also in photosynthesis. The interpretation was that radio waves are resonantly transformed to dark photons with same frequency but with very large value of Planck constant and hence of energy followed by a transformation to ordinary IR photons with much higher frequency but same energy energy around.4 eV. The finding that Raman scattering (non-elastic scattering of photons on molecules) around this energy occurs in the burning water supports this view. The natural guess is that also in the recent case something similar occurs.

2. This kind of frequency scaling is one of the basic mechanisms of water memory as I learned for the first time from the lecture of Cyril Smith in CASYS conference many years ago. One of the basic findings was that there is an unknown mechanism transforming low frequencies to high ones and vice versa. The low frequencies are scaled up by a factor which has a preferred value $r \simeq 2 \times 10^{11}$ interpreted in TGD framework as the ratio of the dark matter Planck constant to the ordinary one. I christened this correlation as a scaling law of homeopathy.

3. It is interesting to apply the law to kHz frequency. In this case the law would give frequency $f = 2 \times 10^{14} >$ Hz. The corresponding energy is.826 eV, which is essentially twice the energy quantum associated with burning water and thus has interpretation as a p-adically scaled up frequency (by one octave). Interestingly, Mae-Wan Ho states in [D11] that *"to use water as electron-donor, and hence to produce oxygen, requires the creation of the chlorophyll-a in cyanobacteria and green plants that can be boosted to a higher electrochemical potential of 0.82 V"* . Hence.83 eV is very near to a metabolically interesting energy.

4. This finding supports the view that kHz radiation produced by nano-structures corresponds to dark phase conjugate photons with energy equal to a metabolic energy quantum. The interpretation would be that the unidentified nanoscale systems in the highly diluted system are starving and get metabolic energy by sending negative energy quanta in the hope that there are metabolic energy reservoirs around able to absorb them. If bio-photons are Bose Einstein condensates of dark cyclotron photons at the flux tubes of magnetic body acting like population reversed lasers, they could serve as metabolic energy reservoir as suggested in on basis of the discovery described by Mae-Wan Ho in [D14].

5. A continual fight for metabolic resources is raging everywhere in Nature, presumably also at the monocellular level. It would not be surprising if harmful bacteria would try to steal the metabolic energy of other organisms stored (say) as bio-photons by sending phase conjugate light to the bio-photon resources of multicellular organisms. Nor it would be surprising if living organisms would have developed manners to prevent this. The fine tuning of the metabolic frequencies so that only the members of the same species can share the energy could guarantee this. Also password like protocols might have developed and either or both of them might be involved.

   In the two-bottle experiments the nanoscale systems in the highly diluted system would gain metabolic energy by sending negative energy photons received by the low dilution system. The gain of metabolic energy would make possible for the nanosystems to replicate and achieve higher dilution after which the process would stop as was indeed observed. That this took place only for the bacteria of same species supports the interpretation that frequency tuning or password mechanism was involved. This metabolic mechanism (quantum credit card as I have called it) could be a completely general mechanism energy sharing mechanism for cells of the same multicellular organism and perhaps even same species in TGD Universe.

4 DNA Waves And Water

The article "DNA waves and water" by L. Montagnier, J. Aissa, E. Del Giudice, C. Lavallee, A. Tedeschi, and G. Vitiello [I33] has created quite a furor even before its publication. The article was preceded by article [I32], whose results led to my own proposal about the existence of new kind of representation of DNA in water [L2] and the recent article indeed suggests the existence of a new kind nano-scale representation of DNA besides electromagnetic representation of the code, which was also suggested for years ago by the group of Peter Gariaev [I24] and also in TGD framework [K18]. New Scientist reacted by an article "Scorn over claim of teleported DNA" [I5], whose title is completely misleading (nothing new in popular science journalism dominated by sensationalism): authors make no claim about quantum teleportation.

Already "DNA waves and water" is enough to induce a deep growl from the throat of a hard-nosed skeptic, and the words "homeopathy" and "water memory" are the signals, which transform even civilized skeptic to a raging blood hound. Water memory at gene level is indeed what the article is about. What makes the situation so problematic is that Montagnier is HIV Nobelist so that it is not so easy to dismiss the work as has been done routinely for all work related to water memory since the days of Benveniste and before.

The story began when Benveniste found evidence for water memory [I20, I21]. Water solution of biomolecules was diluted so that there was no trace about the molecules. What Benveniste and collaborators claimed was that the treated water is however somehow able to represent the biologically relevant properties of molecules so that its action on some biomolecules can be the same as that of the original molecules. This could obviously explain the claimed effects of homeopathy.

Benveniste got a label of fraudster in a scientific investigation led by the magician James Randi (true, this is what the standards of skeptic science sadly often are!). The work of Benveniste has been however continued behind the scenes and it has been for a long time to possible to reproduce the effects of biologically active molecules by using only the low frequency electromagnetic spectrum of these molecules which suggest that biological signalling relies on low frequency em radiation [I21]. Skeptics have simply dismissed all this research.

That genes have electromagnetic representation have been also claimed by Peter Gariaev and his collaborators for long time ago in terms of the notion of wave DNA [I24] (references contain also other articles of Gariaev and collaborators). I have proposed TGD inspired models for wave DNA related effects [K43, K1]. The latter article has been written in collaboration with Peter Gariaev. Also bio-photons [I35] and the effects of ELF em fields on vertebrate brain [J10] relate very closely to the story in TGD framework. Quite generally, the findings provide additional key data allowing to develop the vision about the central role of electromagnetism related macroscopic effects in living matter.

Also Huping Hu and Maoxin Wu [J15] have reported highly brain effects involving water and electromagnetic fields. Applying magnetic pulses to the brain when an anesthetic was placed in between caused the subject person to feel the effect of anesthetic. Also drinking water exposed to magnetic pulses, laser light or microwave radiation when an anesthetic was placed in between caused brain effects. The proposed interpretation was in terms of quantum entanglement. The explanation based on the mimicry of the anesthetic molecules by water does not exclude the presence of quantum entanglement.

In the following I will develop a more detailed model for the findings reported in [I32] using the new findings of Montagnier's team [I33]. The findings provide information allowing to develop much more detailed view about water memory and representations of genetic code in terms of water and related ideas about the role of dark matter (understood as a hierarchy of phases with large value of Planck constant) in biology.

4.1 The Basic Findings Of Montagnier's Group

The claim of Montagnier's team is that the radiation generated by DNA affects water in such a manner that it behaves as if it contained the actual DNA. A brief summary of experiment of Montagnier and collaborators is in order.

1. Two test tubes containing 100 bases long DNA fragments were studied. Both tubes were subjected to 7 Hz electromagnetic radiation. Earth's magnetic field was eliminated to prevent

its possible interference (the cyclotron frequencies of Earth's magnetic field are in EEG range and one of the family secrets of biology and neuroscience since seventies is that cyclotron frequencies in magnetic fields have biological effects on vertebrate brain). The frequencies around 7 Hz correspond to cyclotron frequencies of some biologically important ions in the endogenous magnetic field of.2 Tesla explaining the findings. This field is 2/5 of the nominal value of the Earth's magnetic field.

2. What makes the situation so irritating for skeptics who have been laughing for decades for homeopathy and water memory is that the repeated dilution process used for the homeopathic remedies was applied to DNA in the recent case. The dilution containing no detectable amounts DNA (dilution factor was 10^{-12}) was placed in second test tube whereas the first test tube contained 100 bases long DNA in the original concentration.

3. After 16 to 18 hours both tubes were subjected to polymerase chain reaction (PCR), which builds DNA from its basic building bricks using DNA polymerase enzyme. What is so irritating that DNA was generated also in the test tube containing the highly diluted water. Water seems to be able to cheat the polymerase by mimicking the presence of the actual DNA serving in the usual situation as a template for building copies of DNA. One could also speak about the analog quantum teleportation.

In TGD inspired quantum biology the representations of genes in terms of temporal patterns of em radiation are in central role. TGD leads to a concrete model for water memory in terms of the magnetic body of biomolecule whose cyclotron frequency pattern codes for the biological effects of the molecule. Water memory means that water can build magnetic bodies mimicking those of biomolecules or perhaps steal them in the process of dilution which involves the shaking of the solution.

TGD suggest also another representation of the genetic code in terms of dark nucleons [L1], [L1], which could be highly relevant for the realization of water memory in terms of a dark portion of water for which there exist empirical evidence [K13]. This dark portion would also explain the numerous anomalies of water. It became as a total surprise that the states of dark nucleons correspond in natural manner to DNA, RNA, tRNA, and amino-acids. DNA would define only one particular representation of the genetic code, which in the primary form would be realized at elementary particle level and that there could exists many representations of DNA. Also the model for DNA as topological quantum computer [K14] proposes a non-standard representation of the code.

The existence of a multitude of representations of the code would not be too surprising when one realizes that the information processing performed by computers involves endless variety of different representations of various codes. The problem is about attitudes: the dogma that biology is nothing but chemistry is what is being challenged and we love dogmas because they liberate us from the burden of using our own brains.

4.2 Questions

Montagnier's work gives support for water memory in terms of representations of some molecules in terms of water molecules or some nano-structures present in water treated in the same manner as the homeopathic remedies are made. What is really amazing is that the representations seem also to realize genetic code. The experimental arrangement stimulates several questions which I try to answer in the framework of TGD inspired model of biology.

1. The presence of 7 Hz magnetically induced oscillation seems to be necessary for the presence of the effect. What is the role of this radiation whose frequency is not far from the lowest Schumann resonance frequency with nominal value of 7.83 Hz. Recall that this frequency is in the lowest approximation determined by the radius of Earth of alone. The wave length of 7 Hz photons is slightly larger than the circumference of Earth. Could it be that a temporal pattern associated with a single period of 7 Hz oscillation could code for DNA codons. The energies involved are of course ridiculously small as compared to the thermal energy at room temperature and quantal effects are excluded in standard quantum theory.

2. How water could represent some biologically relevant aspects of molecules? For what kind of molecules this representation does exist? What are the roles of mechanical agitation and dilution in the generation of water memory? Does the 7 Hz frequency near the lowest Schumann resonance frequency relate to this somehow?

3. How water and electromagnetic radiation could represent genetic code?

4.3 TGD Inspired Answers To The Questions

In the following TGD inspired answers to the questions posed in the introduction are discussed. The answers are of course very tentative and involve a lot of speculative new and non-tested physics predicted by TGD.

4.3.1 Some key ideas of TGD inspired quantum biology

TGD helps to imagine possible answers to these questions. The identification of dark matter as a hierarchy of phases with large Planck constant [K15, K13] and the notion of magnetic body [L2] - both deriving naturally from basic quantum TGD- are the key notions.

1. The basic vision is that magnetic body communicates with biological body and controls it by using a generalized variant of EEG consisting of fractal hierarchy of dark photons corresponding to a hierarchy of values of Planck constant [K12] with large Planck constant implying that even ELF photons can have thermal energies above thermal energy. This is the essential element in the model for the effects of ELF frequencies on vertebrate brain. The transformation of dark photon to a bunch of ELF photons or single high energy photon would be basic mechanisms transforming dark photons to ordinary ones. Biophotons would be dark photons transformed to single dark photon. EEG would represent outcome consisting of a bunch of ELF photons.

2. TGD suggests that dark DNA, RNA, ... and even dark amino-acids could have a key role in biological evolution providing kind of virtual world realization of biomolecules. This would make possible a controlled evolution analogous to the research and development carried out in industry. This is in conflict with the vision of standard biology according to which the planning of travel phone would be a process in which one throws some random collection of electronic components to a hat and looks whether a travel phone emerges from the hat after sufficiently long waiting period.

   Biological R&D would require that transcription and translation process have dark counterparts. Also the transcription of dark DNA to ordinary DNA and vice versa and even more general processes should be possible. If the water containing ordinary DNA contains its dark variant able by its darkness to leak through the filters used in the experimental situation studied by Montagnier and collaborators, the dark DNA could be able to cheat the polymerase protein so that it interprets dark DNA as a genuine DNA template and starts to generate ordinary DNA. If the magnetic flux tubes coding for DNA are all that is relevant for this, this mechanism would not depend whether the ends of flux tubes contain real or dark DNA.

3. The dark magnetic flux tubes connecting bio-molecules make it possible for them to recognize and find each other in the dense soup of biomolecules. The reduction of Planck constant for the flux tube brings the bio-molecules near to each other so that catalytic reaction becomes possible. The reconnection process for flux tubes is also in an essential role and involved with ADP-ATP process and would provide elegant realization of codes.

4. In this framework evolutionary leaps can be seen as a quantum leap in which a new level of dark matter hierarchy with Planck constant larger than those of already existing levels emerges. Another basic implication is the existence of coherent gene expressions in various length scales leading to the notion of hypergenome and collective gene expression.

4.3.2 Representations for the genetic code in TGD

TGD suggest several non-standard representations of the genetic code.

1. Temporal patterns of electromagnetic radiation with some carrier frequency is one possibility. Gariaev's work suggests that temporal patterns of polarization directions of radiation could code for DNA sequences with each nucleotide corresponding to a definite change of polarization direction [K43]. This would mean a hierarchy of realizations of the code corresponding to different frequency scales with period of radiation defining the duration of the code word.

2. The TGD inspired model for DNA as topological quantum computer [K14] suggests a realization of codons in terms of u, and d quarks and their antiquarks at the ends of magnetic flux tubes connecting DNA nucleotides to lipids of nuclear or cellular membranes. TGD indeed predicts the possibility of several fractally scaled up copies of hadron physics with different mass scales and also dark variants of ordinary hadron physics with the Compton lengths of quarks scaled up while keeping mass scales the same. Entire fractal hierarchy of representations corresponding to carrier frequencies of dark photons could be realized.

3. One of the most amazing predictions of TGD comes from the model of dark nucleons [L1], [L1]. The states of dark nucleons are in 1-1 correspondence with DNA, RNA, tRNA, and amino-acids and vertebrate genetic code is realized naturally as dark nuclear strings analogous to ordinary nuclei which are also nuclear strings in TGD based model of nuclei. The representation could be based on triplets of magnetic flux tubes with quarks at ends correlating with the genetic code words defined by the states of dark nuclei just like the representation of DNA in DNA as TQC model. A natural guess would be that the size scale of dark nucleon is same as the size scale of single DNA triplet.

Montagnier's and Gariaev's findings suggest that genetic code is also represented in terms of frequencies. How this could be achieved? The TGD based model of music harmony [L14] [K36] (see `http://tinyurl.com/zg3aaj7`) relies on the idea that 12-note scale is representable as a closed non-self-intersecting curve (Hamilton's cycle) at icosahedron having 12 vertices. The harmony assignable to a given Hamilton's cycle is characterized in terms of 3-chords assignable to the 20 faces (triangles) of the icosahedron once the 12-note scale is represented as a particular Hamilton's cycle.

Remarkably, the number of amino-acids is also 20! One indeed ends up with a model in which 20+20+20=60 DNA codons are represented by 3-chords for a triplet of harmonies defined by Hamilton's cycles predicting correctly the numbers of DNAs coding for a given amino-acid for vertebrate code. One must however assume that also tetrahedral harmony is present to get 64 DNA codons rather than only 60. TActually two variants of the code are predicted and altogether one obtains the standard 20 amino-acids plus two additional ones identified as Pyl and Sec known to be realized in living matter.

In music realization DNA codons can be represented as 3 dark photons or phonons with appropriate frequency ratios. This representation could explain the findings of Montagnier and Gariaev. There is also a connection with TGD inspired theory of consciousness. Music both expresses and induces emotions. The proposal is that the representation of DNA codons in terms of triplets of sounds or dark photons defines molecular level representation of emotions. There is large number of different harmonies and they could represent different moods.

4.3.3 What is the role of 7 Hz radiation?

7 Hz is near the frequency of the lowest Schumann resonance representing collective oscillation of the Earth's magnetic field and one can wonder about its role in the experiment of Montagnier and collaborators.

1. 7 Hz need not provide a representation for genetic code although it could do so. A possible role is as the provider of bio-rhythm and as a possible source of energy in the case that dark photons with energy above thermal energy are in question. TGD inspired theory of consciousness predicts what I call self hierarchy and one can speak about gene expression at the level of organism and even population. Schumann resonance would naturally couple

with living matter and couple the magnetic bodies of living systems to the magnetic body of Earth- magnetic Mother Gaia one might say. Flux tubes within flux tubes would be simplest representation for the coupling making possible frequency modulation and also amplitude modulation. Frequency modulation is especially interesting and the song of whales provides a possible concrete example of underlying frequency modulation. The model for hologram generating properties of DNA suggests that the dark photons assignable to 7 Hz radiation pump energy to build up hologrammic representations of DNA.

2. Cyclotron resonances for ions in the Earth's magnetic field are in 1-100 Hz range and it has been known from seventies that electromagnetic fields in this frequency range have effects of vertebrate brain. These effects look very quantal and correspond to cyclotron frequencies which is.2 Gauss- 2/5 of the nominal value of the Earth's magnetic field. Also the authors of the article suggest that cyclotron resonances of ions are involved and in TGD inspired model for living body in terms of magnetic bodies cyclotron resonances are in a key role. Cyclotron frequencies could provide a coupling of biologically important ions to Schumann resonance if the flux tubes involved can vary their thickness so that the strength of magnetic field varies by flux conservation.

3. VLF frequencies above kHz seem to take this role in water memory. The wave lengths and corresponding layers of magnetic bodies are still enormous as compared to that of DNA.

4.3.4 How water could represent molecules?

The TGD inspired model for how how water could represent at least some aspects of at least some molecules is based on earlier ideas plus some ideas inspired by the findings of Montagnier's group and by the role of ordered water and hydrogen bonds in the self-organization of biomolecules.

1. The basic idea is that the magnetic body of the molecules represents biologically relevant aspects of molecule in the sense that the cyclotron radiations generated by the magnetic body is responsible for biological control and also receives signals from part of organism in some length and time scales. The mechanical agitation of water involves in the process generating water memories implies that the magnetic bodies of some molecules just drop to water. This is enough for the mimicry of the biomolecules by water.

2. Water interacts strongly with polar (hydrophilic) molecules so that the polarity of the molecules in question is expected to be very relevant for the process. Polar molecules are covered by a hydrogen bonded layer of ordered water molecules analogs to ice covering. This molecular ice freezes various biomolecules to standard configuration and the feed of energy freezes the ice cover so that processes like protein folding and formation of their aggregates which is central element in the reaction of living matter to external perturbations becomes possible. The natural idea is that the polar molecules having hydrogen bonds with water layer dictate to high degree the structure of the magnetic body.

3. The mechanical agitation of water could feed the energy needed to induce the splitting of the hydrogen bonds of a polar molecule so that the ice coating to which the magnetic body of the molecule would drop out. The process would be similar to the reaction of biomolecule to external influence. This magnetic body would represent the molecule in terms of cyclotron frequencies and behave as a real molecule as far as the effects caused by cyclotron frequencies are considered. Basically a symbolic representation of the biomolecule would be in question.

This mechanism is obviously very general and the prediction is that water remembers the presence of molecules with polar regions and do not distinguish between molecules with different non-polar regions. These non-polar regions are hydrophobic and tend to be shielded from water. Protein folding is one example of this shielding.

4.3.5 How the magnetic bodies could represent genetic code?

The intriguing finding that about 1/4 of hydrogen atoms of water behave effectively like dark matter in atto-second time scale was one of the first findings motivating the development of ideas

about dark matter as large $\hbar$ phases and is also of crucial importance for the model of water memory. The TGD based explanation is that dark hydrogen atoms correspond to dark protons with Compton size of order atom size at least. The varying fraction of this phase would explain the large number of anomalies related to the thermodynamics of water.

The proposal is that the splitting of hydrogen bond transforms the hydrogen or at least the proton of hydrogen to a dark nucleon. The states of dark nucleons would correspond to multiplets assignable to DNA, RNA, tRNA code words, and aminocids. If the state of dark nucleon corresponds to quarks assignable to the ends of the three magnetic flux tubes, one has a representation of the genetic code in terms of dark nuclear string consisting of protons glued to form dark nuclear string (TGD indeed leads to a model of nuclei as nucleon sequencies connected by color magnetic bonds [K8]).

4.3.6 How transcription and translation type processes could be realized for dark DNA and how dark DNA and DNA could transform to each other?

Reconnection of magnetic flux tubes allows to imagine a very simple model for how DNA is coded to dark DNA and vice versa. As a matter fact, the process applies to very general class of processes defining a pairing of biomolecules. All that is needed is that the quark pair at the ends of the flux tube to some degree dictates which molecules can form. One can actually imagine a generalization of the genetic code applying to much more general molecules than molecules involved with the genetic code if this mechanism involves dark nucleons at the ends of the magnetic flux tubes involves.

1. Assume that the nucleotides of dark DNA and conjugate molecules are connected by flux tubes having quark and antiquark at their ends that u, d and their antiquarks correspond in one-one manner to DNA nucleotides so that coding results. Suppose that similar coding takes place for dark DNA in the sense that dark DNA code work is connected by three flux tubes to its conjugate for corresponding dark amino-acid. Assume that both dark and ordinary DNA nucleotides can be be connected to their conjugates by relatively long flux tubes (large $\hbar$) and that they can be also accompanied by short-circuited flux loops. Assume again that genetic code mapping codons to quarks is realized. Similar short circuited closed flux loops could be possible for amino-acids and RNA.

2. Assume that a reconnection for long flux tube connecting nucleotides and their conjugates and for nucleotide flux loop is possible if corresponding quarks are same so that the assignment realizes genetic code. For instance, a reconnection in the middle of flux tubes connecting dark DNA and its conjugate would generate an ordinary DNA sequence. If this sequence binds to DNA strand and if the reverse of the reconnection process occurs after that, dark DNA sequence becomes coded ordinary DNA sequence. Obviously much more general processes of this kind are possible and are relatively independent of what is at the ends of the flux tubes so that genetic coded would permeate whole biology and determined selection rules of reaction involving all kinds of polar molecules.

4.3.7 What is the role of dilution and agitation?

I have already discussed these questions. The following discussion involves new ideas inspired by the findings of Montagnier's group.

The role of dilutions in the generation of water memories looks like a mystery and provides strongest weapon for a simple-minded skeptic and one can make only guesses in this respect. The situation does not distinguish between DNA and other molecules which water is able to represent. All these molecules could correspond to dark molecules resulting when the hydrogen bonds connecting polar molecule to its water coating split if above ideas are on a right track. Consider now the questions.

1. Is the dilution necessary in order that the magnetic flux tubes of the molecular magnetic expected to have size of order 100 nm in the solution do not overlap? This would mean that the density of dark DNA in the experiments of Montagnier would be rather low in the experimental situation, maybe something like 1 DNA sequence per volume of cell nucleus.

Can so low density explain the effects of polymerase in the experiment of Montagnier's team? Could the critical dilution be the dilution above which the 7 Hz radiation is able to serve as a metabolic resource?

2. Could it be that the density of dark molecules is actually much higher than the dilution would suggest? This would require replication of dark molecules, which is indeed quite conceivable if dark molecules define a life form preceding ordinary DNA. The mechanical agitation could provide the metabolic energy for the dark molecules. Dark molecules could also be part of time in lethargic state and wake up only when energy is fed and replicate just as biomolecules are ice-covered and wake up only when external perturbation feeds energy and induces self-organization. But why would be critical dilution required? Why the density of ordinary molecules must be so small? This is difficult to understand.

3. Is it the number of dilutions and agitations which matters rather than the density of the ordinary molecules in the final situation? Could the sequence of dilutions induce an evolutionary process analogous to a sequence of environmental catastrophes posing evolutionary pressures (population density for dark molecules is reduced by a factor of ten) and leading to rapid evolution of dark DNA variant able to replicate and survive? Could each mechanical agitation induce quantum phase transitions increasing the value of Planck constant for the flux tubes inducing evolutionary leaps and increasing the size scale of the corresponding magnetic body? Could the associated feed of metabolic energy also induce a replication of the dark molecules so that one would have a population with a density much higher than that of the ordinary molecules in the final situation? Whether the number of agitation-dilution processes matters instead of final density of molecules could be tested by using different initial values for the density.

4. Cyclotron radiation of dark photons from the magnetic body of dark DNA transforming to ordinary VLF photons serves as a signature for its presence. In the abstract of [I31] Montagnier group reports following.

   > Electromagnetic signals of low frequency have been shown to be durably produced in aqueous dilutions of the Human Immunodeficiency Virus DNA. In vivo, HIV DNA signals are detected only in patients previously treated by antiretroviral therapy and having no detectable viral RNA copies in their blood. We suggest that the treatment of AIDS patients pushes the virus towards a new mode of replication implying only DNA, thus forming a reservoir insensitive to retroviral inhibitors. Implications for new approaches aimed at eradicating HIV infection are discussed.

   "New mode of replication" would correspond in TGD framework to replication of magnetic bodies of RNA or DNA representing genes as dark nucleon sequences and would allow HIV RNA or RNA to survive despite the treatment.

The idea about rapid micro-evolution taking place in human time scale for the magnetic bodies is as radical as it is fascinating but is in principle testable. I have considered alternative explanations but they are not so simple as this one. I do not of course believe that attitudes in biological sciences would be mature for testing this kind of ideas. Big changes in the world view are painful and take place slowly and existing theoretical hegemony is the worst obstacle in the progress.

5 About Physical Representations of Genetic Code in Terms of Dark Nuclear Strings

The view about evolution as a random process suggests that genetic code is pure accident. My own view is that something so fundamental as life cannot be based on pure randomness. TGD has led to several proposals for genetic code, its emergence, and various realizations based on purely mathematical considerations or inspired by physical ideas. One can argue that genetic code is realized in several manners just like bits can be represented in very many manners. Two especially interesting proposals have emerged. The first one is based on geometric model of music harmony

involving icosahedral and tetrahedral geometries. Second model has two variants based on dark nuclear strings: the original version maps codons do dark nucleons, the more recent version maps codons to dark 3-nucleon states. Both models predict correctly the numbers of DNA codons coding for a given amino-acid but the model based on dark 3-nucleon triplets is favoured by some recent findings suggesting a pairing between DNA nucleotides and dark nucleons. Also the counterparts of RNA,tRNA, and amino-acids are predicted. In the sequel the updated nuclear string variant is summarized and also its connection with the model of harmony is discussed.

5.1 Background

The view about evolution as a random process suggests that genetic code is pure accident. My own view is that something so fundamental as life cannot be based on pure randomness. TGD has led to several proposals for genetic code, its emergence, and various realizations based on purely mathematical considerations or inspired by physical ideas (see chapters of [K19] and [L1, K20]). One can argue that genetic code is realized in several manners just like bits can be represented in very many manners.

Two especially interesting proposals have emerged. The first one is based on geometric model of music harmony [L14] involving icosahedral and tetrahedral geometries. Second one having two variants is based on dark nuclear strings. Both models predict correctly the numbers of DNA codons coding for a given amino-acid. In the sequel the nuclear string variant and also its connection with the model of harmony is discussed in detail.

It is good to start with an overall view about physical realization of genetic code that I have discussed during last twenty years.

5.1.1 Genetic code and Combinatorial Hierarchy

The first proposal [K18] was purely mathematics inspired and in terms of so called Combinatorial Hierarchy consisting of certain Mersenne primes $M_k = 2^k - 1$ via the formula $M(n+1) = M_{M(n)}$ having interpretation in terms of abstraction. The list beginning from $M(1) = 2$ is $2, M_2 = 3, M_3 = 7, M_7 = 127, M_{127} = 2^{127} - 1$: it is not known whether subsequent integers are Mersenne primes. The idea is that the $2^k - 1$ points define almost full Boolean algebra spanned by k bits- one visualization is as a polygon. The algebra defined $k - 1$ bits is maximal full Boolean sub-algebra having interpretation as maximal number of mutually independent statements, which can hold true simultaneously. For M_7 ($k = 3$) one would have 2 bits and 4 codons. For M_7 one would have $k = 7$ and 6 bits and genetic code. For M_{127} one would have 126 bits and one would have "memetic" code realizable in terms of sequences of 21 DNA codons.

5.1.2 Geometric theory of harmony and genetic code

The idea that the 12-note scale could allow mapping to a closed path going through all vertices of icosahedron having 12 vertices and not intersecting itself is attractive. Also the idea that the triangles defining the faces of the icosahedron could have interpretation as 3-chords defining the notion of harmony for a given chord deserves study. The paths in question are known as Hamiltonian cycles and there are 1024 of them [A1]. There paths can be classified topologically by the numbers of triangles containing 0, 1, or 2 edges belonging to the cycle representing the scale. Each topology corresponds to particular notion of harmony and there are several topological equivalence classes.

In the article [L18] I introduced the notion of Hamiltonian cycle as a mathematical model for musical harmony and also proposed a connection with biology: motivations came from two observations. The number of icosahedral vertices is 12 and corresponds to the number of notes in 12-note system and the number of triangular faces of icosahedron is 20, the number of amino-acids. This led to a group theoretical model of genetic code and replacement of icosahedron with tetra-icosahedron to explain also the 21st and 22nd amino-acid and solve the problem of simplest model due to the fact that the required Hamilton's cycle does not exist. The outcome was the notion of bioharmony.

All icosahedral Hamilton cycles with symmetries(Z_6,Z_4, Z_2^{rot} and $Z_2 refl$ turned out to define harmonies consistent with the genetic code. In particular, it turned out that the symmetries of

the Hamiltonian cycles allow to to predict the basic numbers of the genetic code and its extension to include also 21st and 22nd amino-acids Pyl and Sec: there are actually two alternative codes - maybe DNA and its conjugate are talking different dialects! One also ends up with a proposal for what harmony is leading to non-trivial predictions both at DNA and amino-acid level.

The conjecture is that DNA codons correspond to 3-chords perhaps realized in terms of dark photons or even ordinary sound. There are 256 different bio-harmonies and these harmonies would give additional degrees of freedom not reducing to biochemistry. Music expresses and creates emotions and a natural conjecture is that these bio-harmonies are correlates of emotions/moods at bio-molecular level serving as building bricks of more complex moods. Representations of codons as chords with frequencies realized as those of dark photons and also sound is what suggests itself naturally. This together with adelic physics involving hierarchy of algebraic extensions of rationals would explain the mysterious lookin connection between rational numbers defined by ratios of frequencies with emotions.

5.1.3 Letter-wise representations of genetic code in terms of single particle states

The model for DNA-cell membrane system as topological quantum computer with lipids and DNA nucleotide or codons connected by flux tubes led to a proposal for the correspondence of letters of genetic code with particle states.

1. The original proposal was that the 4 letters A,T,C,G correspond to dark u and d quark and their antiparticles $\overline{u}$ and $\overline{d}$. Quarks and their antiparticles would reside at the ends of the flux tube. Spin would not matter in this model. The obvious criticism is that introducing dark antiquarks is too far fetched.

2. One can also consider a variant for which one has u and d quarks and spin matters.

3. TGD based model of bio-superconductivity assumes that flux tubes appear as pairs with members of Cooper pair at parallell flux tubes [K34, K35]. This suggests that electron pairs at in spin 1 and spin 0 states could realize the code. The spin of the electrons would matter and one would obtain 4 states - two qubits in correspondence with A,T,C,G.

Also the model of dark nuclear strings allows to imagine letter-wise representations of the genetic code. The model for cold fusion based on the findings of Prof. Holmlid and his group [C1, L28] leads to the idea that Pollack's EZs [L16] are accompanied by dark nuclear strings consisting of dark protons connected by color flux tubes analogous to mesons [L23, L28]. Color bonds would have quark and antiquark at their ends [L1]. This leads to non-trivial predictions and nuclear anomalies giving support for the notion of nuclear string have emerged, the latest anomaly is so called X boson with mass of 17 MeV [L29, C2] having identification as p-adically scaled analog of pion.

Dark protons could also decay to neutrons by dark weak decays rapidly since dark weak bosons are effectively massless below dark Compton length. Furthermore, proton plus negatively charged color bond could behave like neutron as far as chemistry is considered. The X boson anomaly of nuclear physics [L29] suggests that the flux tubes in the ground state correspond to pion-like states which can be colored: this could bind the nucleons to form a nucleus. The evidence for the occurence of cold fusion in living matter gives support for the role of dark nuclear strings [K51] [L28].nOne can consider several representations of the genetic code in this framework.

Consider first models for which letters are represented separately.

1. Dark protons and neutrons have 4 spin states and could correspond to letter A,T,C,G. In this case dark color bonds would not matter. A rather convincing proposal for a pathway leading to a selection purines as DNA nucleotides has been proposed [I23]. TGD based model [L26] suggests that acidic solutions contain dark protons and purine results when the precursor amine combines with dark proton such that the proton remains dark. Could DNA nucleotide pair with dark protons and neutrons (resulting in dark beta decay from dark proton strings yielded by Pollack's mechanism)?

2. Also the 4 states of dark color bonds between dark nucleons (3 pion-like states and one eta meson like state: spin 1 bonds would be analogous to ρ and ω mesons and have higher mass)

correspond to letters A,T,C,G. Now the dark protons and neutrons would not matter. This option would require that the character of the nucleotide correlates with the color flux tube attached to the dark proton. They would have at their ends charge conjugate color bonds. The states would be of form $u\overline{u}, d\overline{d}, u\overline{d}, d\overline{u}$ with the ordering of q and $\overline{q}$ correlating with the direction in which transcription and replication take place being thus same or opposite). For conjugate strand the direction of strand would be opposite in the sense that one would have $\overline{u}u, \overline{d}u, \overline{du}, \overline{u}u$.

For this option one could consider the strands of dark DNA double strand being connected by flux tube pairs resulting when U-shaped color flux tube have reconnected. If color flux tubes are colored, color confinement could bind the dark protons to dark nucleus. Similar mechanism could be at work for the ordinary nuclei.

The basic problem of all the proposals based on letter-wise correspondence is that they do not even try to explain the numbers of DNA codons coding for a given amino-acid and are also silent about tRNA.

5.1.4 Codon-wise representations of genetic code realized in terms of dark nuclear strings

For this option entire codons rather than letters would be represented. The difference between two representations is analogous to that between spoken and written languages. In spoken languages words are not analyzed further to letters. These models are able to predict also the numbers of codons coding for a given amino-acid successfully.

1. The geometric theory of harmony represents codons as 3-chords without assigning fixed notes to A,T,C,G and explains also DNA-amino-acid correspondence.

2. The map of codons to the dark nucleon states of dark nucleon consisting of dark u and d type quarks does the same and also predicts the degeneracies successfully.

3. This model can be modified by replacing u and d by dark nucleon states p and n without any change in predictions related to genetic code. The evidence that DNA codons indeed couple to dark nucleon states [L26] supports this option.

In the sequel I consider the models mapping DNA codons to dark nucleons and then generalize the model so that it applies to triplets of dark nucleons.

5.2 Models of genetic code based on dark nuclear strings

Water memory is one of the ugly words in the vocabulary of the main stream scientist. The work of pioneers is however now carrying fruit. The group led by Jean-Luc Montagnier, who received Nobel prize for discovering HIV virus, has found strong evidence for water memory and detailed information about the mechanism involved [K20, K43], [I32]. The work leading to the discovery was motivated by the following mysterious finding. When the water solution containing human cells infected by bacteria was filtered in purpose of sterilizing it, it indeed satisfied the criteria for the absence of infected cells immediately after the procedure. When one however adds human cells to the filtrate, infected cells appear within few weeks. If this is really the case and if the filter does what it is believed to do, this raises the question whether there might be a representation of genetic code based on nano-structures able to leak through the filter with pores size below 200 nm.

The question is whether dark nuclear strings might provide a representation of the genetic code. In fact, I posed this question year before the results of the experiment came with motivation coming from the attempts to understand water memory. The outcome was a totally unexpected finding: the states of dark nucleons formed from three quarks can be grouped to multiplets in one-one correspondence with 64 DNAs, 64 RNAS, and 20 amino-acids and there is natural mapping of DNA and RNA type states to amino-acid type states such that the numbers of DNAs/RNAs mapped to given amino-acid are same as for the vertebrate genetic code.

5.2.1 Mapping DNA and amino-acids to dark nucleon states

The dark model emerged from the attempts to understand water memory [K20]. The outcome was a totally unexpected finding [L1, K20]: the states of dark nucleons formed from three quarks connected by color bonds can be naturally grouped to multiplets in one-one correspondence with 64 DNAs, 64 RNAS, 20 amino-acids, and tRNA and there is natural mapping of DNA and RNA type states to amino-acid type states such that the numbers of DNAs/RNAs mapped to given amino-acid are same as for the vertebrate genetic code.

The basic idea is simple. The basic difference from the model of free nucleon is that the nucleons in question - maybe also nuclear nucleons - consist of 3 linearly ordered quarks - just as DNA codons consist of three nucleotides. One might therefore ask whether codons could correspond to dark nucleons obtained as open strings with 3 quarks connected by two color flux tubes or as closed triangles connected by 3 color flux tubes. Only the first option works without additional assumptions. The codons in turn would be connected by color flux tubes having quantum numbers of pion or η.

This representation of the genetic would be based on entanglement rather than letter sequences. Could dark nucleons constructed as string of 3 quarks using color flux tubes realize 64 DNA codons? Could 20 amino-acids be identified as equivalence classes of some equivalence relation between 64 fundamental codons in a natural manner? The codons would be not be anymore separable to letters but entangled states of 3 quarks.

If this picture is correct, genetic code would be realized already at the level of dark nuclear physics and maybe even in ordinary nuclear physics if the nucleons of ordinary nuclear physics are linear nucleons. Chemical realization of genetic code would be induced from the fundamental realization in terms of dark nucleon sequences and vertebrate code would be the most perfect one. Chemistry would be kind of shadow of the dynamics of positively charged dark nucleon strings accompanying the DNA strands and this could explain the stability of DNA strand having 2 units of negative charge per nucleotide. Biochemistry might be controlled by the dark matter at flux tubes.

The ability of the model to explain genetic code in terms of spin pairing is an impressive achievement, which I still find difficult to take seriously.

1. The original model mapping codons to dark nucleon states assumed the overall charge neutrality of the dark proton strings: the idea was that the charges of color bonds cancel the total charge of dark nucleon so that all states uuu, uud, udd, ddd can be considered. The charge itself would not affect the representation of codons. Neutrality assumption is however not necessary. The interpretation as dark nucleus resulting from dark proton string could quite well lead to the formation the analog of ordinary nucleus via dark beta decays [L28] so that the dark nucleus could have charge. Isospin symmetry breaking is assumed so that neither quarks nor flux tubes are assigned to representations of strong $SU(2)$.

   There is a possible objection. For ordinary baryon the mass of Δ is much larger than that of proton. The mass splitting could be however much smaller for linear baryons if the mass scale of excitations scales as $1/h_{eff}$ as indeed assumed in the model of dark nuclear strings [L23, L28].

2. The model assumes that the states of DNA can be described as tensor products of the four 3-quark states with spin content $2 \otimes 2 \otimes 2 = 4 \oplus 2_1 \oplus 2_2$ with the states formed with the 3 spin triplet states $3 \otimes 3 = 5 \oplus 3 \oplus 1$ with *singlet state dropped*. The means that flux tubes are spin 1 objects and only spin 2 and spin 1 objects are accepted in the tensor product. One could consider interpretation in terms of ρ meson type bonding or gluon type bonding. With these assumptions the tensor product $(2 \otimes 2 \otimes 2) \otimes (5 \oplus 3)$ contains $8 \times 8 = 64$ states identified as analags of DNA codons.

   The rejection of spin 0 pionic bonds looks strange. These would however occur as bonds connecting dark codons and could correspond to different p-adic length scale as suggested by the successful model of X boson [L29].

   One can also ask why not identify dark nucleon as as closed triangle so that there would be 3 color bonds. In this case $3 \otimes 3 \otimes 3$ would give 27 states instead of 8 ($\oplus 1$). This option does not look promising.

3. The model assumes that amino-acids correspond to the states 4×5 with $4 \in \{4 \oplus 2 \oplus 2\}$ and $5 \in \{5 \oplus 3\}$. One could tensor product of spin 3/2 quark states and spin 2 flux tube states giving 20 states, the number of amino-acids!

4. Genetic code would be defined by projecting DNA codons with the same total quark and color bond spin projections to the amino-acid with the same (or opposite) spin projections. The attractive force between parallel vortices rotating in opposite directions serves as a metaphor for the idea. This hypothesis allow immediately the calculation of the degeneracies of various spin states. The code projects the states in $(4 \oplus 2 \oplus 2) \otimes (5 \oplus 3)$ to the states of 4×5 with same or opposite spin projection. This would give the degeneracies $D(k)$ as products of numbers $D_B \in \{1, 2, 3, 2\}$ and $D_b \in \{1, 2, 2, 2, 1\}$: $D = D_B \times D_b$. Only the observed degeneracies $D = 1, 2, 3, 4, 6$ are predicted. The numbers $N(k)$ of amino-acids coded by D codons would be

$$[N(1), N(2), N(3), N(4), N(6)] = [2, 7, 2, 6, 3] \ .$$

   The correct numbers for vertebrate nuclear code are $(N(1), N(2), N(3), N(4), N(6)) = (2, 9, 1, 5, 3)$. Some kind of symmetry breaking must take place and should relate to the emergence of stopping codons. If one codon in second 3-plet becomes stopping codon, the 3-plet becomes doublet. If 2 codons in 4-plet become stopping codons it also becomes doublet and one obtains the correct result $(2, 9, 1, 5, 3)$!

   It is difficult to exaggerate the importance of this simple observation suggesting that genetic code is realized already at the level of dark or even ordinary nuclear physics and bio-chemistry is only a kind of shadow of dark matter physics.

5.2.2 Objections based on group theory and statistics

The model and its generalization replacing u, d with nucleon states p, n works amazingly nicely but is better to try to invent objections against the proposal and try to find inconsistencies. Fermi and Bose statisticsare the most obvious providers of killer arguments.

1. The basic objection is that if the quarks are organized in linear structures, one cannot talk about representation of 3-D rotation group since symmetry breaking to SO(2) acting along common axis which could be either the local axis along dark DNA helix of the axis of the entire helix. The linear ordering of the quarks is not consistent with the full harmonics. Rather, harmonics restricted to half space $0 \leq \theta \leq \pi/2$ ($\pi \geq \theta \geq \pi/2$) should characterize the "upper" ("lower") flux tube direction at the position of quark in the middle.

   If reflection along quantization axis and SO(2) generate the symmetries one still has labelling of the states by angular momentum projection and states form doublets $(m, -m)$. The representations of SO(3) split into these representation and the numbers of states with given spin projection remain the same. Therefore the predictions for the numbers of DNA codons coding given aminoacid are not changed. It is quite possible that braid statistics made possible by 1-dimensionality is needed to realize the idea about ordering and this would allow to have full DNA multiplets.

2. In quark model one forms tensor product of tensor products of 3 quark spin states and 3 quark isospin states and by color singletness requires that the state is completely antisymmetric in quark degrees of freedom. The state is completely symmetric in the non-colored degrees of freedom. One obtains only two representations $\Delta \leftrightarrow (3/2, 3/2)$ and $N = (1/2, 1/2)$ with positive parity. In quark model context the presence of other tensor products in $(4 \oplus 2_1 \oplus 2_2)_S \otimes (4 \oplus 2_1 \oplus 2_2)_I$ is forbidden. One reason is that spatial wave function is assumed to be symmetric in ground state. This forbids 2_2 in spin degrees of freedom. Symmetrization leaves only the Δ and N (Note that the total number of these state is 20!). Now strong isospin is broken and it is natural to not include it to the tensor product.

3. The presence of 2_2 would be forbidden in quark model since it would require antisymmetric spatial wave function to compensate for the antisymmetry of 2_2. In the recent case the

situation is 1-dimensional and the ordering along nuclear string forces localization of quarks and one cannot have identical wave functions for quarks.

1-D situation also suggests strongly braid statistics. Perhaps the situation could be understood in terms of fermionic oscillator operators along nuclear string having anti-commutation relations corresponding to non-trivial braid statistics - maybe making the statistics commutative. This could naturally allow anti-symmetrization along nuclear string for 2_2 states.

4. If one assumes ordinary statistics, one could one take care of the statistics of the 16 states in $2_2 \otimes (5 \oplus 3)$ by assuming that for 2_2 the color state is symmetric and thus 10-D representation of $SU(3)$. The state associated with color flux tubes cannot compensate this color (triality is 1) since it must correspond to triality zero representation. If the colors of DNA strand and conjugate correspond to 10 and $\overline{10}$ and color entanglement cold guarantee color singletness for the codon pairs. This would however require anti-quarks for the conjugate strand.

   3 10:s associated with 3 codons contains in their tensor product a singlet (see `http://tinyurl.com/zjxxqhj`). Minimal color singlet dark DNA sequence would requite 3 color codons. One can of course wonder whether the presence of 3 decouplet codons - 2 at the beginning and 2 at end and one in the middle could define genes as basic units.

5. The statistics problem is encountered also for the flux tubes. 5 (and 1) as symmetric representation is allowed by statistics but triplet is antisymmetric and thus not allowed. Again braid statistics might help. If one assumes that the flux tubes are colored - say color octets - and color wave function for flux tube pairs is antisymmetric, one can achieve Bose statistics for 3. Flux tube pair would correspond to $8 \in \{8 \times 8\}$ and minimum of two flux codons would be needed for color singletness in flux tube degrees of freedom.

6. For the counterparts of amino-acids one has only $4 \otimes 5$ allowed also by statistics considerations assuming color singlets. Could distinction between DNA/RNA and amino-acids related to statistics, perhaps braid statistics. The suggested role of braid strands possibly connecting DNA double strands and DNA double strands and lipid layers of cell membrane encourages the question whether the DNA strand and its conjugate entangle via via the reconnection of the color flux tubes defining U-shaped "tentacles" to a flux tube pair connecting the strands. For amino-acids they would not be needed. Same could happen in the transcription process of DNA to mRNA and in the translation process for mRNA tentacles and those associated with tRNA.

5.2.3 It is also possible to map DNA and amino-acids to dark 3-nucleon states

The assumption that entire codon rather than letter corresponds to a state of dark proton does not conform with the model for the origin of purines as DNA nucleotides [L26] assuming that purines and in fact all nucleotides are combined with dark proton unless one assumes that 3 nucleotides combine with the same dark proton. This looks somewhat artificial but cannot be excluded.

Amazingly, the arguments of the model involve only the representations of rotation group and since p and n have same spin as u and d, the arguments generalize to 3- nucleon states (ppp, ppn, pnn, nnn) connected by two color bounds and organized to linear structures. Concerning genetic code, exactly the same predictions follow in the recent formulation of the model. In this case quark color is not present. One could however use the 1-dimensionality and the ordering of dark nucleons as already described.

This variant has several nice features. The model is consistent with the model for dark nucleon strings consisting of nucleons and color bonds between them. There is no need to introduce Δ type nucleon states and colored states are not needed in fermionic sector. Color bonds must be colored if one wants ordinary bosonic statistics for flux tubes but here braid statistics might help. Colored bonds could of course have some important function.

5.2.4 Ordinary or braid statistics?

There are four options to consider: ordinary/braid statistics (1/2) and dark nucleon/dark nucleon triplet as representation of DNA codon (a/b). One has options 1a,1b,2a,2b.

1. Option 1a. For the ordinary statistics amino-acid like dark nucleons are color singlets. Part of DNA codons represented as dark nucleons and would be colored and 10-D representation of SU(3). Dark amino-acids need not have color bonds with dark parts of other colored biomolecules like DNA,RNA, with exception possible formed by dark tRNA. DNA double strand could realize color confinement via the reconnection of color flux tubes.

2. Option 1b. Option 1b requires in ordinary statitics for antisymmetric doublet an antisymmetric wave function for the 3 nucleons not allowing constant valued wave function also disfavored by the linear ordering. This condition might have the same implications as braid statistics.

3. Options 1a and 1b. DNA is the only molecule that appears as double strands. A possible explanation is that codons and anticodons are paired by U-shaped flux tubes associated with the color bonds of dark DNA to form color singlets. Nucleonic colors would sum up to zero along the strand.

4. Option 2a. For braid statistics it could be possible to avoid colored states of nucleon and flux tubes altogether.

5. Option 2b. The codons would have no color and amino-acids could obey braid statistics reducing to ordinary statistics. This would not be the case for DNA/RNA.

5.2.5 Objections Against the Identification of Codons as Dark Nucleon States

Consider next some particle physicist's objections against the option mapping codons to dark nucleon states.

1. The realization of the model requires the dark scaled variants of spin 3/2 baryons known as Δ resonance and the analogs (and only the analogs) of spin 1 mesons known as ρ mesons. The lifetime of these states is very short in ordinary hadron physics. Now one has a scaled up variant of hadron physics: possibly in both dark and p-adic senses with latter allowing arbitrarily small overall mass scales. Hence the lifetimes of states could be scaled up.

2. Both the absolute and relative mass differences between Δ and N *resp.* ρ and π are large in ordinary hadron physics and this makes the decays of Δ and ρ possible kinematically. This is due to color magnetic spin-spin splitting proportional to the color coupling strength $\alpha_s \sim .1$, which is large. In the recent case α_s could be considerably smaller - say of the same order of magnitude as fine structure constant 1/137 - so that the mass splittings could be so small as to make decays impossible.

   The color magnetic spin interaction energy give rise to hyperfine splitting of quark in perturbative QCD is of form $E_c \propto \hbar g B/m$, where m is mass parameter which is of the order of baryon mass. Magnetic flux scales as $\hbar$ by flux quantization and if flux tube thickness scales as $\hbar^2$, one has $B \propto 1/\hbar$. Mass splittings would not depend on $\hbar$, which does not make sense. Mass splitting becomes small for large $\hbar$ if the area of flux quantum scales as $\hbar^{2+n}$, $n > 0$ so that color magnetic hyper-fine splitting scales as $1/\hbar^n$ from flux conservation. The magnetic energy for a flux tube of length L scaling as $\hbar$ and thickness $S \propto \hbar^{2+n}$ has order of magnitude $g^2 B^2 LS$ and does not depend on $\hbar$ for $n = 1$. Maybe this could provide first principle explanation for the desired scaling.

   The size scale of DNA would suggest that single DNA triplet corresponds to 3 Angstrom length scale. Suppose this corresponds to the size of dark nucleon. If this size scales as $\sqrt{\hbar}$ as p-adic mass calculations suggest, one obtains a rough estimate $\hbar/hbar_0 = 2^{38}$. The proton-Δ mass difference due to hyper-fine splitting would be scaled down to about $2^{-38} \times 300$ MeV $\sim 10^{-9}$ eV, which is completely negligible in the metabolic energy scale .5 eV. If the size of dark nucleon scales as $\hbar$ the mass difference is about 12 eV which corresponds to the energy scale for the ionization energy of hydrogen. Even this might be acceptable.

For these reasons the option mapping codons to dark nucleon triplets is clearly favored and will be discussed in the following.

5.3 The model mapping codons to dark 3-nucleon states

The model based on dark 3-nucleon states is discussed seems more realistic and will be discussed in more detail in the sequel.

5.3.1 Could dark DNA, RNA, tRNA and amino-acids correspond to different charge states of codons?

If dark codons correspond to dark nucleon triplets as assumed in the following considerations there are 4 basic types of dark nucleon triplets: ppp, ppn, pnn, nnn. Also dark nucleons could represent codons as uuu, uud, udd, ddd: the following discussion generalizes as such also to this case. If strong isospin/em charge decouples from spin the spin content is same independently of the nucleon content. One can consider the possibility of charge neuralization by the charges assignable to color flux tubes but this is not necessarily. In any case, one would have 4 types of nucleon triplets depending on the values of total charges.

Could different dark nucleon total charges correspond to DNA,RNA, tRNA and amino-acids? Already the group representation content - perhaps correlating with quark charges - could allow to distinguish between DNA, RNA, tRNA, and amino-acids. For amino-acids one would have only 4×5 and ordinary statistics and color singlets. For DNA and RNA one would have full multiplet also color non-singlets and for tRNA one could consider $(4 \oplus 2_1 \oplus 2_2) \times 5$ containing 40 states. 31 is the minimum number of tRNAs for the realization of the genetic code. The number of tRNA molecules is known to be between 30-40 in bacterial cells. The number is larger in animal cells but this could be due to different chemical representations of dark tRNA codons.

If the net charge of dark codon distinguishes between DNA,RNA, tRNA, and amino-acid sequences, the natural hypothesis to be tested is that dark ppp, ppn, pnn, and nnn sequences are accompanied by DNA,RNA, tRNA, and amino-acid sequences. The dark beta decays of dark protons proposed to play essential role in the model of cold fusion [**?**]ould transform dark protons to dark neurons. Peptide backbones are neutral so that dark nnn sequence could be also absent but the dark nnn option is more natural if the general vision is accepted. There is also the chemically equivalent possibility that only dark protons are involved: dark proton + neutral color bond would represent proton and dark proton + negatively charged color bond would represent neutron. At this moment it is not possible to distinguish between these two options.

Is this picture consistent with what is known about charges of amino-acids DNA,RNA, tRNA, and amino-acids? Consider first the charges of these molecules.

1. DNA strand has one negative charge per nucleotide. Also RNA molecule has high negative charge. This conforms with the idea that dark nucleons accompany both DNA and RNA. DNA codons could be accompanied by dark ppp implying charge neutralization in some scale and RNA codons by dark ppn. The density of negative charge for RNA would be 2/3 for that for DNA.

2. Arg, His, and Lys have positively charged side chains and Asp,Glu negative side chains (see `https://en.wikipedia.org/wiki/Amino_acid`). The charge state of amino-acid is sensitive to the pH value of solution and its conformation is sensitive to the counter ions present. Total charge for amino-acid in peptide however vanishes unless it is associated with the side chain: as in the case of DNA and RNA it is the backbone whose charge is expected to matter.

3. Amino-acid has central C atom to which side chain, NH_2, H and COOH are attached. For free amino-acids in solution water solution $NH_2 \rightarrow NH_3^+$ tends to occur pH=2.2 by receiving possibly dark proton whereas COOH tends to become negatively charged above pH= 9.4 by donating proton, which could become dark. In peptide OH attach to C and one H attached to N are replaced with peptide bond. In the pH range 2.2-9.4 amino-acid is zwitterion for which both COOH is negatively charged and NH_2 is replaced with NH_3^+ so that the net charge vanishes. The simplest interpretation is that the ordinary proton from negatively ionized COOH attaches to NH_2 - maybe via intermediate dark proton state.

4. The backbones of peptide chains are neutral. This conforms with the idea that dark amino-acid sequence consists of dark neutron triplets. Also free amino-acids would be accompanied

by dark neutron triplets. If the statistics is ordinary only 4 dark nnn states are possible as also 5 dark color flux tube states.

5. tRNA could involve dark pnn triplet associated with the codon. An attractive idea is secondary genetic code assigning RNA codons to tRNA-amino-acid complex and projecting $8 \otimes (5 \oplus 3)$ containing 64 dark RNA spin states to $8 \otimes 5$ containing 40 dark tRNA spin states with same total nucleon and flux tube spins. Dark tRNA codons would in turn be attached to dark amino-acids by a tertiary genetic code projecting spin states $8 \otimes 5$ to $4 \otimes 5$ by spin projection. In the transcription dark tRNA would attach to dark mRNA inducing attachment of dark amino-acid to the growing amino-acid sequence and tRNA having only dark tRNA codon would be left. The free amino-acids in the water solution would be mostly charged zwitterions in the pH range 2.2-9.4 and the negative charge of COO^- would be help in the attachement of the free amino-acid to the dark proton of tRNA codon. Therefore also the chemistry of free amino-acids would be important.

   An interesting question is why pnn triplets for tRNA would only 5 in flux tube degrees of freedom entire 8 in nucleon degrees of freedom. For RNA consisting of ppn triplets also 3 would be possible. What distinguishes between ppn and pnn?

The model should explain the widely different properties of DNA,RNA , tRNA, and amino-acids. There are two options.

1. DNA/RNA/amino-acid codons could correspond to ppp/ppn/nnn and tRNA would correspond to pnn (order is not necessarily this). Different charge or dark codons explain why DNA (RNA) has H (OH) in $2'$ position. The repulsive Coulomb energy between dark codons would be stronger for DNA and the compensation of this forces by the magnetic tension associated with the flux tube pair connecting codon and anticodon this might have something to do with the stability of DNA double strand.

   (a) The instability of RNA as compared to DNA would result from the instability of the ribose in RNA (deoxiribose in DNA) as indeed believed. The absence of RNA double strands could be due to the instability of the flux tube pair assignable to n-n. This trivially implies absence of replication and transcription if it is based on same mechanism as in the case of DNA.

   (b) pnn structure could explain why tRNA does not form sequences and allow to understand wobble pairing, which states that the third mRNA codon does not correspond to unique tRNA anticodon but one has C,A,U $\rightarrow$ I and U$\rightarrow$ I. Due to the symmetries of the third letter of the codon, this is consistent with the genetic code. The physical explanation for wobble base pairing could relate to pnn structure of tRNA. If the charge ordering is random one would have nnp,npn,pnn and C,A,U $\rightarrow$ I could correspond to these 3 situations whereas for U$\rightarrow$ I the correspondence would not depend on the ordering. Also for RNA one would have ppn,pnp, npp degeneracy but in this case one would have charge independence.

   A possible charge pairing between RNA and tRNA would be p$\leftrightarrow$n. The charge pairing between DNA and RNA could be p $\rightarrow$ n for the third least significant letter of DNA. This would minimize the coding errors possibly induced this pairing.

   (c) One can criticize the charge assignment ppn (possibly allowing permutations) for RNA codons. Could dark weak beta decays give rise to 1-D lattice like structure? Could the repetitive structure be due to energy minimization.

2. Could the correspondence be letterwise? For DNA A,T,C,G would correspond to p, and for RNA A,C,G to p and U to n. Codons not containing U wold be ppp type codons and one can wonder why the oxiribose for them is not replaced with de-oxiribose. The possible presence of n in dark codons could explain why RNA sequences are highly unstable and why they do not replicate and transcribe.

5.3.2 Replication, transcription, translation

The formation of flux tube pairs between molecules would be central in replication and transcription and in all bio-catalysis. Dark DNA would replicate first to dark DNA or mRNA. This requires that the building bricks of dark DNA and mRNA emerge from environment perhaps by mechanism involving reconnection for the magnetic tentacles and reduction of h_{eff} bringing the molecules near each other. Flux tube pairs between dark DNA codonsandtheir conjugates (individual dark RNA codons) would be formed during replication (transcription). The formation of flux tube pair between mRNA and dark tRNA part of tRNA would bring tRNA to mRNA, where amino-acid would associate with the growing amino-acid sequence.

For options 1a and 1b based on ordinary statistics color singletness condition could play an important role in the replication and transcription.

1. If the value of h_{eff} before reconnection and contraction of flux tube dictating the scale of color confinement is large enough, colored dark nucleons could float as free - possibly colored states - in the environment for option 1a). For option 1b dark nucleons could be present in environment - this could relate directly to the ionization in electrolyte. For options 1a and 1b dark codons representing dark tRNA molecules would accompany them.

2. For options 1a) and 1b) color confinement in flux tube degrees of freedom by forming dark color flux tube pairs between dark DNA and its conjugate in codon-wise manner could give rise to DNA double strands as chemical shadows of dark double strands. The coupling between codon and anticodon would be defined by the condition that the total color bond spins of paired codons are opposite. Quark color could be compensated for option 1a along DNA strand: 3 10:s give singlet. One can of course ask whether dark DNA RNA sequences exist rather than being built during replication and transcription.

5.3.3 Are sound-like bubbles whizzing around in DNA essential to life?

I got a link to a very interesting article [I27] about sound waves in DNA (see `http://tinyurl.com/z7hod9b`). The article tells about THz de-localized modes claimed to propagate forth and back along DNA double strand somewhat like bullets. These modes involve collective motion of many atoms. These modes are interpreted as a change in the stiffness of the DNA double strand leading to the splitting of hydrogen bonds in turn leading to a splitting into single strands. The resulting gap is known as transcriptional bubble propagating along double strand is the outcome. I do not how sound the interpretation as sound wave is.

It has been proposed that sound waves along DNA give rise to the bubble. The local physical properties of DNA double strand such as helical structure and elasticity affect the propagation of the waves. Specific local sequences are proposed to favor a resonance with low frequency vibrational modes, promoting the temperary splitting of the DNA double strand. Inside the bubble the bases are exposed to the surrounding solvent, which has two effects.

Bubbles expose the nucleic acid to reactions of the bases with mutagens in the environment whereas so called molecular intercalators may insert themselves between the strands of DNA. On the other hand, bubbles allow proteins known as helicases to attach to DNA to stabilize the bubble, followed by the splitting the strands to start the transcription and replication process. The splitting would occur at certain portions of DNA double strand. For this reason, it is believed that DNA directs its own transcription.

The problem is that the strong interactions with the surrounding water are expected to damp the sound wave very rapidly. Authors study experimentally the situation and report that propagating bubbles indeed exist for frequencies in few THz region. Therefore the damping deo not seem to be effective. How this is possible? As an innocent layman I also wonder how this kind of mechanism can be selective: it would seem that the bullet like sound wave initiates transcription at many positions along DNA. The transcription should be localized to a region assignable to single gene. What could guarantee this?

Can TGD say anything interesting about the mechanism behind transcription and replication?

1. In TGD magnetic body controls and coordinates the dynamics. The strongest hypothesis is that basic biochemical process are induced by those for dark variants of basic bio-molecules

(dark variants of DNA, enzymes,...). The belief that DNA directs its own transcription translates to the statement that the dark DNA consisting most plausibly from sequences of dark proton triplets ppp at dark magnetic flux tubes controls the transcription: the transcription/replication at the level of dark DNA induces that at the level of ordinary DNA.

2. If the dark DNA codons represented as dark proton triplets (*ppp*) are connected by 3 flux tube pairs, the reverse of the reconnection should occur and transform flux tube pairs to two U-shaped flux tubes assignable to the two dark DNA strands. Dark proton sequences have positive charge +3e per dark codon giving rise to a repulsive Coulomb force between them. There would be also an attractive force due to magnetic tension of the flux tubes. These two forces would compensate each other in equilibrium (there also the classical forces due to the negatively charged phosphates associated with nucleotides but these would not be so important).

   If the flux tube pairs are split, the stabilizing magnetic force however vanishes and the dark flux tubes repel each other and force the negatively charged DNA strands to follow so that also ordinary DNA strand splits and bubble is formed. The primary wave could therefore be the splitting of the flux tube pairs: whether one can call it as a sound wave is not clear to me. Perhaps the induced propagating splitting of ordinary DNA double strand could be regarded as an analog of sound wave.

   The splitting of flux tube pairs for a segment of DNA would induces a further splitting of flux tubes since repulsive Coulomb force tends to drive the flux tubes further away. The process could be restricted to DNA if the "upper" end of the split DNA region has some dark DNA codons which are not connected by flux tubes pairs. This model reason why for dark proton sequences.

3. This model does not yet explain how the propagating splitting wave is initiated. Could a quantum phase transition increasing the value of h_{eff} associated with the flux tube pairs occur for some minimal portion of dark DNA "below" the region associated with gene and lead to the propagating wave induced by the above classical mechanism? That the wave propagates in one direction only could be due to chirality of DNA double helix.

An interesting question is how the RNA world vision (see `https://en.wikipedia.org/wiki/RNA_world`) relates to this general picture.

1. There are strong conditions on the predecessor of DNA and RNA satisfies many of them: reverse transcription to DNA making possible transition to DNA dominated era is possible. Double stranded RNA exists `https://en.wikipedia.org/wiki/RNA#Double-stranded_RNA` in cells and makes possible RNA genome: this would however suggest that cell membrane came first. RNA is a catalyst. RNA has ability to conjugate an amino-acid to the $3'$ end of RNA and RNA catalyzes peptide bond formation essential for translation. RNA can self-replicate but only relatively short sequences are produced.

2. TGD picture allows to understand why only short sequences of RNA are obtained in replication. If the replication occurs at the level of dark ppn sequences as it would occur for DNA in TGD framework, long RNA sequences might be difficult to produce because of the stopping of the propagation of the primary wave splitting the flux tube pairs. This could be due to the neuron pairs to which there is associated no Coulomb repulsion essential for splitting.

3. In TGD framework RNA need not be the predecessor of DNA since the evolution would occur at the level of dark nucleon strings and DNA as the dark proton string is the simpest dark nucleon string and might have emerged first. Dark nuclear strings would have served as templates and biomolecules would have emerged naturally via the transcription of their dark counterparts to corresponding bio-polymers.

5.3.4 Is bio-catalysis a shadow of dark bio-catalysis based on generalization of genetic code?

Protein catalysis and reaction pathways look extremely complex (see `http://tinyurl.com/kp3sdlm`) as compared to replication, transcription, translation, and DNA repair. Could simplicity emerge

if biomolecules are identified as chemical shadows of objects formed from dark nuclear strings consisting of dark nucleon triplets and their dynamics is shadow of dark stringy dynamics very much analogous to text processing?

What if bio-catalysis is induced by dark catalysis based on reconnection as recognition mechanism? What if contractions and expansions of U-shaped flux tubes by h_{eff} increasing phase transitions take that reactants find each other and change conformations as in the case of opening of DNA double strand? What if codes allowing only the dark nucleons with same dark nuclear spin and flux tubes spin to be connected by a pair of flux tubes?

This speculation might make sense! The recognition of reactants is one part of catalytic action. It has been found in vitro RNA selection experiments that RNA sequences are produced having high frequency for the codons which code for the amino-acid that these RNA molecules recognize (`http://tinyurl.com/kp3sdlm`. This is just what the proposal predicts!

Genetic codes DNA to RNA as $64 \to 64$ map, RNA to tRNA as $64 \to 40$, tRNA to amino-acids with $40 \to 20$ map are certainly not enough. One can however consider also additional codes allowed by projections of $(4 \oplus 2_1 \oplus 2_2) \otimes (5 \oplus 3(\oplus 1))$ to lower-dimensional sub-spaces defined by projections preserving spins. One could also visualize bio-molecules as collections of pieces of text attaching to each other along conjugate texts. The properties of catalysts and reactants would also depend by what texts are "visible" to the catalysts. Could the most important biomolecules participating biochemical reactions (proteins, nucleic acids, carbohydrates, lipids, primary and secondary metabolites, and natural products, see `https://en.wikipedia.org/wiki/Biomolecule`) have dark counterparts in these sub-spaces.

The selection of bio-active molecules is one of the big mysteries of biology. The model for the chemical pathway leading to the selection of purines as nucleotides [L26] assumes that the predecessor of purine molecule can bind to dark proton without transforming it to ordinary proton. A possible explanation is that the binding energy of the resulting bound state is higher for dark proton than the ordinary one. Minimization of the bound state energy could be a completely general criterion dictating which bio-active molecules can pair with dark protons. The selection of bio-active molecules would not be random after all although it looks so. The proposal for DNA-nuclear/cell membrane as topological quantum computer with quantum computations coded by the braiding of magnetic flux tubes connecting nucleotides to the lipids wlead to the idea that flux tubes being at O=-bonds [K14].

5.3.5 Comparing TGD view about quantum biology with McFadden's views

McFadden [I40] has very original view about quantum biology: I have written about his work for the first time for years ago, much before the emergence of ZEO, of the recent view about self as generalized Zeno effect, and of the understanding the role of magnetic body containing dark matter [K16]. The pleasant surprise was that I now understand McFadden's views much better from TGD viewpoint.

1. McFadden sees decoherence as crucial in biological evolution: here TGD view is diametric opposite although decoherence is a basic phenomenon also in TGD.

2. McFadden assumes quantum superpositions of different DNAs. To me this looks an unrealistic assumption in the framework of PEO. In ZEO it is quite possible option.

3. McFadden emphasizes the importance of Zeno effect (in PEO). In TGD the ZEO variant of Zeno effect is central for TGD inspired theory of consciousness and quantum biology. Mc Fadden suggests that quantum effects and Zeno effect are central in bio-catalysis: the repeated measurement keeping reactants in the same position can lead to an increase of reaction rate by factors of order billion. McFadden describe enzymes as quantum mousetraps catching the reactants and forcing them to stay in same position. The above description for how catalysis catches the reactants using U-shaped flux tube conforms with mousetrap picture.

   McFadden discusses the action of enzymes in a nice manner and his view conforms with TGD view. In ZEO the system formed by catalyst plus reactants could be described as a negentropically entangled sub-self, and self indeed corresponds to a generalized Zeno effect. The reactions can proceed in shorter scales although the situation is fixed in longer scales

(hierarchy of CDs): this would increase the length of the period of time during which reactions can proceed and lead to catalytic effect. Zeno effect in ZEO plus hierarchies of selves and CDs would be essentially for the local aspects of enzyme action.

4. Protons associated with hydrogen bonds and electronic Cooper pairs play a universal role in McFadden's view and the localization of proton in quantum measurement of its position to hydrogen bond is the key step of enzyme catalysis. Also TGD dark protons at magnetic flux tubes giving rise to dark nuclear strings play a key role. For instance, McFadden models enzyme catalysis as injection of proton to a very special hydrogen bond of substrate. In TGD one has dark protons at magnetic flux tubes and their injection to a properly chosen hydrogen bond and transformation to ordinary proton is crucial for the catalysis. Typical places for reactions to occur are C=O type bonds, where the transition to C-OH can occur and would involve transformation of dark proton to ordinary proton. The transformation of dark proton to ordinary one or vice versa in hydrogen bonds would serve as a biological quantum switch allowing magnetic body to control biochemistry very effectively.

   What about electronic Cooper pairs assumed also by McFadden. They would flow along the flux tube pairs. Can Cooper pairs of electrons and dark protons reside at same flux tubes? In principle this is possible although I have considered the possibility that particles with different masses (cyclotron frequencies) reside at different flux tubes.

McFadden [I40] has proposed quantum superposition for ordinary codons: This does not seem to make sense in PEO since the chemistries of codons are different) but could make sense in ZEO. In TGD one could indeed imagine quantum entanglement (necessary negentropic in p-adic degrees of freedom) between dark codons. This NE could be either between additional degrees of freedom or between spin degrees of freedom determining the dark codons. In the latter case complete correlation between dark and ordinary DNA codons would imply also the superposition of their tensor products with ordinary codons.

The NE between dark codons could also have a useful function: it could determine physically gene as a union of disjoint mutually entangled portions of DNA. Genes are known to be highly dynamical units, and after pre-transcription splicing selects the portions of the transcript translated to protein. The codons in the complement of the real transcript are called introns and are spliced out from mRNA after the pre-transcription (see `https://en.wikipedia.org/wiki/RNA_splicing`).

What could be the physical criterion telling whether a given codon belongs to exonic or intronic portion of DNA? A possible criterion distinguish between exons and introns is that exons have NE between themselves and introns have no entanglement with exons (also exons could have NE between themselves). Introns would not be useless trash since the division into exonic and exonic region would be dynamical. The interpretation in terms of TGD inspired theory of consciousness is that exons correspond to single self.

5.3.6 Is there a connection between geometric model of harmony and nuclear string model of genetic code?

There should exists a connection between the geometric model of harmony and genetic code and the model of genetic code discussed.

1. Dark DNA strands could be connected by color flux tubes to form a double strand by reconnections of U-shaped color flux tubes. What would induce a codon-wise or letter-wise pairing of DNA codons and their conjugates represented as dark quark triplets to form double DNA strand? Cyclotron resonance could accompany reconnection (magnetic field strength would be identical and reconnection could occur).

2. One has the correspondence codon $\leftrightarrow$ state of dark nucleon or codon $\leftrightarrow$ state of dark nucleon triplet. The geometric model of harmony and genetic code [L14] represents the codons as 3-chords. The 3-chord would be represented in terms of cyclotron frequencies of dark photons assignable to the 3 dark quarks (nucleons) in the state. Each quark-color bond pair (including the pion-like bond) could be in 12 states with corresponding cyclotron frequency mappable to the basic octave. The cyclotron frequency triplets would be same for codons and conjugates.

The only manner to understand the scale is in terms of spectrum of magnetic field strengths for U-shaped flux tube pairs.

This would require 3 pairs of flux tubes between the dark codons of DNA strands. If the quarks inside linear dark proton are connected by color flux tubes (like protons in the model of dark nucleus). Reconnection for U-shaped flux tube connecting quarks would give rise to the double strand formed by dark proton strings. The magnetic field strength of the 3-flux tubes would be determined by the state of dark proton and would be same for DNA and RNA codons and also for RNA codons and corresponding tRNA-amino-acid complexes. The cyclotron frequencies would define a scaled up variant of Pythagorean scale projected to the basic octave [L14]. This option does not favor the idea about separater 4-letter code.

3. The geometric model for harmony is formulated in terms of orbits of the subgroups of the isometry groups of tetrahedral and icosahedral geometries. The DNAs coding particular amino-acid correspond correspond to the orbit of the triangle of icosahedron corresponding to the amino-acid. The decomposition $60 \to 20+20+20$ suggests strongly decomposition of I to 20 Z_3 cosets containing 3 elements each other and in correspondences with the triangular faces of icosahedron.

4. The model of the genetic code just discussed relies on the model of dark nucleon based on group theory. The symmetric groups of Platonic solids are in turn associated with inclusion of hyper-finite factors and appear in Mc Kay correspondence, whose proof involves decompositions of SU(2) representations to the representations of the discrete subgroups of Platonic solids. A further observation is that the numbers of elements for isometries of icosahedron and tetrahedron are 60 and 4 respectively: the sum is 64. Could the action of Z_3 leaving face invariant could be posed as an additional condition on amino-acids and reduce the amino-acid representation to $4 \otimes 5$.

5. In the geometric model of harmony genetic icosahedral 20+20+20 part of the code involves a combination of three different Hamilton's cycles mapping 60 DNAs to 20 amino-acids: in terms of icosahedral group I and its coset space I/Z_3 these maps correspond to coset projections. Could the decomposition $(4 \oplus 2_1 \oplus 2_2) \otimes (5 \otimes 3)$ be understood in terms of a reduction to icosahedral and tetrahedral subgroups of rotation group or of their spin coverings.

   In this process finite-dimensional representation of $SO(3)$ decomposes to a direct sum of representations of the discrete subgroup if its dimension is larger than any of the dimensions of representations of the finite sub-group (for basic facts about these see `http://tinyurl.com/ho4onbs`). One might hope that the decomposition of the representations of SO(3) appearing in the above formula under icosahedral group and or tetrahedral group could allow to understand the emergence of DNA, RNA, tRNA, and amino-acids as kind of symmetry breaking.

6. In the geometric model of harmony 64-codon code [L14] is obtained as a fusion 60-codon code assignable to icosahedron + 4 codon code assignable to tetrahedron. There are actually two codes corresponding to tetrahedron and icosahedron as disjoint entities and tetrahedron glued to icosahedron along one face. The model explains the two additional amino-acids Pyl and Sec coded for a variant of the genetic code.

How could these two successful models relate to each other? In p-adic physics of cognition Platonic solids and polygons can be seen as discrete approximation for sphere [L27] and biomolecules could be understood as cognitive representation in the intersection of real and p-adic space-time surface consisting of algebraic points. Could one assign icosahedron and tetrahedron to a codon in some concrete manner? Could the attachment of tetrahedron to icosahedron along one face have concrete meaning? The answer seems to be negative.

1. One can about the interpretation of the 12 vertices of the icosahedron - how number 12 could be assigned with the genetic code? The vertices correspond to notes perhaps represented as magnetic field strength at the flux tubes assignable to color bonds. This field strength should be determined by the spin state of dark 3-nucleon. No concrete nuclear string counterpart seems to exist for the closed Hamiltonian cycle consisting of 12 notes and in case of tetrahedral

extension of 13 notes. 12 vertices of icosahedron correspond to 12 notes and 20 faces to 3-chords so that there is not need for more concrete correspondence.

2. The attachment of tetrahedron to icosahedron would bring in further note very near to one of the notes of Pythagorean scale and corresponding 3-chords. This has concrete interpretation and there is no need to make this more concrete at the level of geometry of DNA. If icosahedron and tetrahedron are disjoint one obtains four additional codons. It seems that all these 4 3-chords be assigned with the 3 color bonds, one note for each of them. What distinguishes at the level of dark nucleon string the situations in which tetrahedron is attached and non-attached to the color bond? In presence of attachment there would be 1 shared 3-chord corresponding to stop codon assignable with the shared face. The 13:th note appearing in 4 3-chords differs very little from one of the notes of the icosahedral scale: this corresponds to the fact that 12 perfect quints do not quite give 7 octaves as already Pythagoras realized. Crazy question: Could this small difference relate to the small relative mass difference $(m_p - m_n)/m_p \simeq .0014$ making itself possible visible in cyclotron frequency scale? The idea does not seem plausible: $[(3/2)^{12} - 2^7]/2^7 \simeq .014$ is 10 times larger than $(m_p - m_n)/m_p \simeq .0014$.

The conclusion is that genetic code can be understand as a map of stringy nucleon states induced by the projection of all states with same spin projections to a representative state with the same spin projections (total quark spin and total flux tube spin). Genetic code would be realized at the level of dark nuclear physics and biochemical representation would be only one particular higher level representation of the code. A hierarchy of dark baryon realizations corresponding to p-adic and dark matter hierarchies can be considered. Translation and transcription machinery would be realized by flux tubes connecting only states with same quark spin and flux tube spin.

6 Field Codes Associated With Homeopathy And A Model For The Magnetic Body

Homeopathy involves also more complex aspects than mere entrainment and imprinting. Benveniste represents evidence for codes based on the modulations of the carrier frequency [I20, I21] . This kind of code brings in mind the magnetic pulse patterns inducing altered states of consciousness [J18]. Cyril Smith claims that the imprinted frequency can be an arithmetic function (sum or product) of the imprinting pair of frequencies [J5].

These claims of course look highly implausible in the reductionistic framework. The presence of magnetic bodies acting as intelligent intentional agents changes the situation in TGD Universe. Dark plasma oscillations patterns induced by state function reduction of charge entanglement by W MEs define an ideal representation for the code words inducing motor actions, and one ends up to a more detailed vision about how magnetic body receives and experiences sensory input from the biological body and controls it using codes with code words expressed as plasma oscillation patterns transformed to ionic waves. The model for Priore's machine [I41, I46] allows to test these ideas.

6.1 Plasmoids As Primitive Life Forms Associated With Magnetic Bodies

In TGD framework plasmoids can be regarded as primitive life forms associated with rotating magnetic flux quanta, and it has been demonstrated that plasmoids seem to possess the basic characteristics of a living system [I43]. The plasma in question is dark plasma. BE condensates of ions defining dark plasmas represent more advanced life forms of this kind. Dark plasma oscillations define ideal representations for field patterns inducing ionic (say Ca^{++}) waves (by many-sheeted Faraday's law) in turn inducing generalized motor activities.

The possibility of charged entanglement induced by W MEs and generating Bose-Einstein condensates of exotic ions brings in a genuinely new element to the model of plasmoids discussed earlier as predecessors of biological life [K16]. The notion has been already applied in the model of nerve pulse [K37]. One can speak about non-Abelian holograms at the level of dark matter with

W bosons taking key role in the realization of motor actions and neutral bosons playing similar role in the realization or sensory and memory representations.

6.1.1 Plasmoids as rotating magnetic systems

If plasmoids rotate they generate em charge by the effect effect known already by Faraday but not explained satisfactorily by Maxwell's electrodynamics. In TGD framework vacuum charge density induces radial electric field inducing radial Ohmic current which is not divergenceless and hence charges the rotating magnet. Cell, DNA, and other sub-systems in living matter are usually negatively charged and the underlying reason could be the presence of rotating plasmoids around which biochemical life forms have evolved.

Also Searl device [H5], [H1] discussed in [K42] is a rotating magnetic system. In this case the charging of the system implies an effective loss of weight in Earth's electric field. Searl device is known to develop cylindrical magnetic walls [**?**]. According to TGD based model of Searl device [K42], the rotating magnetic walls represent a simple example of a magnetic body containing dark matter. The energy and angular momentum transfer from the magnetic flux walls generated by the rotation to the rotating system is assumed to explain the accelerated rotation of the system.

6.1.2 Dark plasma waves

Dark plasma waves have synchronously oscillating spatial patterns. Charge densities correspond to the order parameters of BE condensates of bosonic ions so that the introduction of the ion densities is not an idealization as in the non-quantum situation.

The dispersion relation of dark plasma oscillations in the lowest order approximation reads as

$$f_p = \sqrt{e^2 n/m} \ ,$$

where n and m are the number density and mass of plasma waves. In the case of dark plasma waves n corresponds to the density defined by the order parameter of the Bose-Einstein condensate of ordinary or exotic ions. The dispersion relation does not depend on wave vector at all so that the plasma wave recurs to the same pattern again and again and therefore provide ideal representations of mental images.

Since the notion of ionic density is not an idealization in case of dark plasma waves, it seems sensible to assign energy quantum to the dark plasma waves. Since plasma frequency is purely classical quantity the plasma energy $E_p = \hbar(k) f_p$ would scale as $\hbar(k)$ and an increasing hierarchy of plasma wave energies is predicted. These energies could define the metabolic energy quanta in the case of plasmoid life forms. These quanta can decay to $k_d = 0$ low energy quanta as they are used.

Plasma wave patterns could provide a realization for the control commands inducing motor activities and the energy of the plasma wave could be sucked from metabolic energy sources by time mirror mechanism (see **Fig.** `http://tgdtheory.fi/appfigures/timemirror.jpg` or **Fig. ??** in the appendix of this book) and dissipated in the realization of motor action as the plasma wave decomposes into r plasma waves at the lowest level of the hierarchy.

Quite large energies are involved at higher levels of dark matter hierarchy and the question arises whether there exist suitable sources of metabolic energy. The dropping of electrons from $k = 137$ atomic space-time sheets could provide metabolic energy quantum $E(137) \simeq 1$ keV. The dropping of electron from $k = 131$ space-time sheet would liberate energy $E(131) \simeq 64$ keV. The requirement that plasma wave energies correspond to zero point kinetic energies forces quantization of the densities of ions for Bose-Einstein condensates. Also the cyclotron transition energies of electrons or their Cooper pairs can provide the metabolic energy quanta. Note that metabolic efficiency requires quantization of the densities of Bose-Einstein condensates.

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.

A further source of metabolic energy could be dark microwave photons generated by quartz crystals in the rock. Callahan has found that rocks consisting mainly of quartz SiO_2 serve as a source of bio-photons and that paramagnetic soil implying strong Schumann resonance amplitudes is favorable for the well-being of plants [I7]. Bio-photons could be produced as de-coherence products of dark microwave photons. Interestingly, SiO_2^{--} ion has cyclotron frequency 10 Hz for the nominal value $B_E = .5$ Gauss of the Earth's magnetic field equal to the fundamental bio-rhythm and the p-adic frequency $f(2, 127)$ associated with the memetic code.

It is possible to assign definite time scales to various plasma densities in magnetosphere possibly relevant to consciousness and this in principle makes it possible to build a more detailed view about quantal magnetosphere.

6.1.3 Dark plasma wave patterns as a tool of bio-control

Dark plasma wave patterns correspond to small deviations of charge densities from the non-equilibrium charge density by exotic ionization. Charge entanglement by W MEs with the magnetic body is an ideal mechanism for the generation of these deviations.

W ME generates oscillatory entanglement with coefficients which depend on space-time coordinates. In the state function reduction one of the outcomes is a state in which Bose-Einstein condensates in both systems carry exotic nuclear em and weak charges.

The reduction occurs for entire Bose-Einstein condensates of bosonic ions at biological body. The stronger the W field, the higher the probability that exotically charged BE condensate results. Ionic BE condensates define the pixels of the motor map as well as sensory map and the size of coherence region determines the pixel size. Similar mechanism works at the level of sensory input to the magnetic body.

Dark plasma waves induce ordinary ionic waves such as Ca^{++} waves as asymptotic self-organization patterns which would naturally correspond to generalized motor actions. Plasma wave patterns generate also cyclotron radiation the interaction of which with Josephson junctions induce a sensory representation for these patterns so that the control loop closes. Digital spatial and temporal modulation of the plasma wave patterns makes possible field codes for motor activities induces by ionic waves. Obviously the coding of plasma wave patterns to motor actions would be very robust.

6.2 Field Representations Of Information Using Codes

As already mentioned, the work of Benveniste [I20, I21], Gariaev [I26], and Persinger [J18] provides evidence for the existence of field codes and for the view that water can learn associations [I6]. The basic distinction as compared to the genetic code is that field codes could be context dependent conventions somewhat like natural languages since magnetic body brings in conscious intelligence and flexibility. Therefore the earlier vision about memetic code [K18] assuming strict duration of the memetic codons could be un-necessarily restrictive.

6.2.1 Information theoretic aspects

Code words are names for biological functions which can be very complex.

1. Associative learning of the code

Flexibility is the basic property of the field codes. The codes can be therefore context dependent and characterize individual organism rather than being biological invariants. Personal code might well be necessary in order to guarantee that biological body cannot be "possessed" by outsiders. The higher the level of dark matter hierarchy, the higher this flexibility is expected to be (natural language in contrast to primitive signals which are rather universal). The work of [I20] [I20, I21] and the report of Smith about context specified 7-bit code for frequency importing [J5] provide support for the associative learning in water.

Flexibility implies that an associative learning of the code is required. There are two diametrically opposite manners to understand what the establishment of the code could mean.

1. The definitely higher IQ and quantum flexibility of the magnetic body suggests that magnetic body learns by searching the patterns inducing the desired responses of the biological body.

2. Magnetic body could also teach, or rather modify, the biological body to respond in a desired manner to plasma wave patterns. This mode of learning requires plasticity and might be important at the level of brain: associative regions of the cortex of higher primates are indeed known to be highly plastic so that changes of connectivity could make possible this kind of learning. The learning requires feedback circuit. An input signal representing the motor action is dark plasma wave pattern. There is also a motor input modifying the response function of the biological body using already learned code. The feedback is essentially the output allowing to decide about next motor input modifying the response function. Automatic associative learning results if the control loop is made automatic. A fascinating possibility is that this kind of modification could occur at the level of genes as a kind of genetic self engineering.

Quite generally, spin glass degeneracy and classical non-determinism are prerequisites for learning at various levels of dark matter hierarchy. In neuroscience rewards and punishments represented by neurotransmitters and various information molecules are believed to drive the learning.

2. The information content of code is maximized

Negentropy Maximization Principle [K26] is expected to pose constraints on the possible codes but it is difficult to imagine deduction of these constraints directly from NMP. The number theoretic model reproducing the genetic code as well as its variants [K9] suggests much more direct direct approach.

Number theoretical variants of Shannon entropy allow interpretation as positive information measures. The information content of the code should be maximized by assigning to it somehow a statistical ensemble or a set of statistical ensembles. In the model of genetic code the 64 codons labelled by integers in the range 0, ..., 63 and the corresponding amino-acids are labelled by the 18 primes $p < 64$ and integers 0, 1 which correspond to DNAs labelled by 0, 1. Hence the task reduces to finding an assignment $n \to p(n)$. The prime associated with a given integer from the maximization of negentropy for the entire code. Dynamics is thermodynamics for the partitions of n to a sum of r integers, $r = 1, ..., n$. Quantum criticality suggests that the Hamiltonian $H(r)$ (or rather, Boltzmann weights) can be engineered freely. The negentropy $N(n)$ is maximum over p-adic negentropies $N_p(n)$ (formally Shannon entropies) fixing the prime $p(n)$.

This principle generalizes to an arbitrary code provided one can label the codewords using integers n and their images by primes $p(n)$. In the model of the genetic code n codons code for 0, 1 and primes $p < n$, whose number $N(n)$ behaves for large values of n like $N(n) \simeq n/log(n)$. This is obviously a highly non-trivial prediction about the code. The model as such does not tell anything about how the plasma oscillation patterns are labelled by integers.

The patterns to which codons are mapped should be effectively digital just as in the case of a computer graphics. Dark matter Bose-Einstein condensates react as single particles and serve as natural digits and the number of codons is finite. BE condensate patterns induce patterns of ionic waves (such as Ca++ waves), and if it is only the asymptotic self-organization pattern which matters, the degeneracy of the code follows naturally.

3. How the meaning emerges?

Information without meaning is not information. The model based on magnetic body and biological body allows to understand how the meaning of the symbolic signals used in the communications emerges. The biological self-organization process induced by the signal acting as a control signal give rise to a mental image at the level of biological body (symbolic mental image at the level of brain and sensory mental images at the level of sensory organs) shared by the magnetic body via entanglement. This mental image would give the meaning for the signal.

6.2.2 How magnetic body perceives?

In order to speak about perception as something more than a completely automatic process, it is necessary to assume that the perceiver is an intentional agent receiving sensory input and able to perform motor actions. Magnetic bodies at higher levels of dark matter hierarchy would be a natural identification for the recognizer.

1. The general model for motor action and sensory communications

The general model for motor actions and communications of sensory input to the magnetic body relies crucially on magnetic flux quanta connecting system to its magnetic body and Josephson junctions serving the role of sensory receptors. This model was first developed for cell with cell/nuclear membrane serving as Josephson junction and DNA double strand as a basic instrument of motor action allowing to realize motor commands via gene expression. An essential assumption is the presence of quantum critical high T_c super-conductivity, or actually two kinds of super-conductivities possible in some finite temperature range for which a good guess is 36-37 °C [K12]. The model assigns to the cell membrane and its scaled up variants a hierarchy of Josephson junctions and generalized EEGs. $k_d = 47$ corresponds to the 5 Hz frequency of EEG.

This model allows to develop a model of sensory perception using the patterns of Josephson radiation. The model of Comorosan effect [**?**] suggests that even molecules could be carriers of supra currents and that the structures formed by enzymes and substrate molecules contain Josephson junctions. Hence the model might apply even when the perceiving system is the magnetic body of bio-molecule, say that of a molecular motor. In the case of DNA double strand the identification of the candidates for Josephson junctions is obvious.

Josephson junction codes information about all kinds of radiation to the pattern of Josephson radiation. In particular, the dark cyclotron radiation generated by the cyclotron transitions of the cyclotron BE condensates at the magnetic bodies creates a voltage perturbation and thus affects Josephson current in the Josephson junctions assignable with the recognizing system and the resulting Josephson radiation received by the magnetic body contains information about the cyclotron radiation emitted by the target.

2. How magnetic body perceives the sensory input from the biological body?

An important question is how the magnetic body generates the cyclotron radiation to which the biologically important molecules respond. In the vicinity of Earth (say below ionosphere) this radiation could be generated by the ions themselves but at high enough heights it is basically protons and electrons which are present in significant amounts.

An elegant resolution of the problem would be provided by the model of frequency imprinting and entrainment. Exotically ionized super-nuclei formed by protonic strings dropped to magnetic flux sheets are able to mimic ordinary ions. These super-nuclei could also act as receiving antennas and can serve as kind of amplifiers in the recognizing system. Time mirror mechanism would also allow to amplify phase conjugate signal using population reversed cyclotron laser.

3. Sensory input from biological body as a somatosensory map at magnetic body

The basic recognition process is related to the recognition of the patterns of Josephson radiation consisting of frequencies $f_{n,\pm} = nf_c \pm f_J$. Somehow these patterns must define what might be called somatosensory maps at the level of magnetic body.

The previous work with frequency coding of positions of objects of perceptive field using varying cyclotron frequencies [K39] suggests that the magnetic field at the magnetic flux quanta is slowly varying so that the input at frequency $f_{n,\pm} = nf_c \pm f_J$ generates resonant cyclotron transitions at a position of the magnetic flux quantum determined by the condition $\hat{f}_c = f_{n,\pm}$.

This would map the sensory input to a geometric pattern along magnetic body defined by the varying intensity of induced cyclotron transitions and magnetic body would experience the input from the biological as a kind of bodily sensation. It is quite possible that same sensory input is mapped to several positions at the magnetic body.

The harmonics of "alpha" band would correspond to $\hat{f}_c = nf_c$ and would correspond to motor areas of the magnetic body disjoint from sensory areas. "beta" and "theta" bands would correspond to $nf_c + f_J$ and $nf_c - f_J$ and receive sensory input. This allows two options.

1. The magnetic flux could vary in discrete manner so that $\hat{f}_c = nf_c$ would corresponds to magnetic flux $n\hbar(k)$: in this case the harmonics of alpha band would correspond to disjoint flux quanta within which magnetic field varies in a relatively narrow range. In this case EEG bands would have precise geometric correlates.

2. If the magnetic flux has minimal value of $\hbar(k)$, the area of the magnetic flux quantum would vary as $S(n) \propto 1/\sqrt{n}$ by flux quantization. There would be a cutoff in n since the field strength cannot be too high.

If the magnetic field strength decreases as a function of distance from Earth as one might expect, beta and gamma bands would be nearer to the biological body than theta and delta bands for both options. This conforms with the fact that the EEG activity above alpha band is typically associated with rapid reactions and the time delay due to the sensory communications should be minimal. The magnetic body can extend below the Earth's surface where the field strength increases.

The role of brain would be to construct symbolic representations by abstracting only the essential features of the sensory input so that also pattern completion would become possible. Magnetic body itself would accept the sensory input from brain and body as such.

6.2.3 Dark plasma wave patterns as motor commands

Since dark plasma waves recur again and again to the same pattern they are ideal for the field representation of codewords representing biological activities. Dark plasma oscillations can induce various ionic waves such as Ca^{++} and Mg^{++} waves since plasma wave modifies the scalar potential at dark space-time sheets and thus also at ordinary space-time sheets by Faraday law in many-sheeted space-time. Plasma wave pattern generates also a pattern of cyclotron radiation in the magnetic field and its presence is detected at the magnetic body via sensory system so that a motor-sensory feedback loop results.

Dark plasma wave patterns would define self-organizing "motor mental images" assignable to the biological body and perhaps also with motor areas of magnetic bodies since the motor control of magnetic bodies from higher levels is also expected to be present. These self-organization patterns would represent control commands realized in terms of frequencies and spatial field patterns assignable to W MEs. Digitalization would be implied by the size of the coherent region of the BE condensate making collective quantum phase transition to a state involving plasma oscillation with a probability proportional the intensity of W field inside coherence region.

The realization of motor action involves W MEs. Exotic W bosons behave as massless particles below the weak length scale but above this scale they possess a mass obtained by p-adically scaling down the mass ~ 80 GeV of the ordinary $k = 89$ W boson. This suggests that a large metabolic energy of order W boson mass is needed to generate W ME and that this energy transformed to the energy of plasma oscillation as charge entanglement is reduced and produces exotic ionization. This metabolic energy could be provided by the dropping of an electron from atomic or sub-atomic space-time sheet to a larger space-time sheet.

6.3 Priore's Machine As A Test Bench For The Model

Theoretician encounters often inventions which work but seem to defy all attempts to understand them. Even more, it seems a complete mystery how the inventor has ended up with his device, unless one accepts the idea that the inventor was working under the guidance of some higher level conscious entities. Priore's machine demonstrated to heal cancer certainly belongs to this category. Although the biological effects of the Priore's device are described in high detail, the construction of the machine, which is very complicated, is described in a very sketchy manner [I46]. This makes it difficult to see what is essential and what is not. In the following the model for bio-control is taken as a guideline in attempts to understand why Priore's machine works.

6.3.1 Three approaches to the cure of cancer

One can approach the cure of cancer from at least three different directions.

1. Cure the cancer cells

The general vision about biological evolution as emergence of higher levels of dark matter hierarchy suggests that some higher levels in the hierarchy of magnetic bodies are lacking in the case of cancer cell population so that cells become lonely individuals having replication as the sole purpose of life. Dysfunction at the level of super-genes looks a plausible reason for the asocial behavior. Magnetic flux sheets corresponding to some super genes could be lacking so that "social" control from some magnetic bodies in the hierarchy would fail. A possible cure of cancer would be healing of the cancer cells by super-gene therapy: something probably not possible for a long time even if the concept made sense.

The basic problem could be the absence of a magnetic body responsible for the quantum bio-control at some levels of the p-adic and dark matter hierarchies. The cure would be the restoration of this magnetic body by using external magnetic fields. The control of this magnetic body by higher level magnetic bodies should be mimicked by inducing periodic modulations of the magnetic field strength with frequencies which correspond to important bio-rhythms. The functioning of Priore's machine supports this interpretation.

2. Help immune system in its task

The presence of cancer cells is not a fatal problem if immune system is intact. The simplest reason for the failure of the immune system to eliminate cancer cells would be that it does not possess metabolic resources or that it lacks "soldiers" doing the dirty jobs, or messengers mediating commands to the battle field. Perhaps the restricted metabolic energy resources do not allow to generate plasmoids realizing the control commands from higher levels of the immune system as plasma wave patterns. In this case a possible cure would be the introduction of metabolic energy from outside and generation of additional plasmoids. Priore's machine seems to stimulate the immune system somehow and there is no detectable direct effect on the replication of the cancer cells. Thus this strategy could be realized by Priore's machine to some extent.

3. Could cancer be cured by editing the geometric past?

The earlier attempt to understand the functioning of Priore's machine was based on the idea that cancer cells realize some biological program ("replicate", more or less) plus the hypothesis that control commands correspond to holograms and the reversals of these commands to phase conjugates of the holograms. This allows to imagine the possibility of curing cancer by using the phase conjugate of the command "replicate".

This does not however work. The simple reason is that the general model for the realization of intentions implies that *all* motor actions are realized in terms of phase conjugate MEs, in particular negative energy W MEs inducing charge entanglement. The phase conjugate of the motor command would thus represent communication of sensory information rather than negation of the motor command. This duality between passive and active aspects of consciousness seems rather deep and has remained without sufficient attention hitherto.

One can however consider the possibility of sending the motor command "do not replicate" to a sufficiently distant geometric past or a command for an immune system to eliminate the replicators more effectively than it does in the recent geometric past. This would be essentially editing of geometric past affecting also the geometric now and could induce rather dramatic quantum jumps in which the state of patent would suddenly change. Highest levels of dark matter hierarchy consistent with the duration of the human life cycle should be involved which suggests that this kind of healing is based on spiritual practices indeed claimed to induce miraculous healings. Indeed, in the case of Priore's machine the time scales involved are so fast that there is no reason to believe that it could send motor commands to the immune system of the distant geometric past.

6.3.2 Description of the device

Consider first the main points related to the structure and function of the device.

1. Plasma is present

Priore's machine is a tube containing rotating plasma. Ions of Ne and Argon gas are used. No information about how complete the ionization is given although the field used is enough to ionize $n = 3$ electrons in the case of Argon. The estimate for the pressure is given but temperature is not reported so that it is not possible to make reliable estimates about the density of the plasma.

The voltage $V = .43$ kV voltage generates the plasma in the tube. Argon and Neon are reported to be used as plasma gases. For Argon ionization energy is $E_1 \sim 18^2 \times 13.6$ eV$= 4.405$ keV. The ionization of $n = 3$ electrons with energy $E_3 = E_1/9$ is possible by the electrons accelerated in the voltage and gaining thus maximal energy of .49 keV if dissipative effects can be neglected. 8-fold ionization is possible for Ar since the energies of $n = 3$ electrons are nearly degenerate. For Ne the potential ionizing electrons at $n = 2$ shell would differ by a factor $(3 \times 10/2 \times 18)^2 = 25/36 \simeq .7$ from that for Ar. Also Hg plasma is mentioned [I41]: the tube is reported to be 2 mmHg vacuum: my interpretation is that it contains 2 millimoles of Hg that is 1.2×10^{21} Hg atoms per tube volume.

For Hg the ionization energy of $n = 6$ electrons would be about 5 times higher than for Ar so that 5 times higher voltage would be needed.

2. Cyclotron frequencies of Ar and Ne ions are equal to the cyclotron frequency of Ca ion

The observation which puts bells ringing is that Ar^{++} and Ne^{+} have same cyclotron frequency as Ne^{+} as Ca^{++}. The radiation at the cyclotron frequency of Ca^{++} is known to have effects on living matter [J19], and TGD based model for these effects led to the model for the hierarchy of generalized EEGs associated with the dark matter hierarchy [K12].

3. Plasma is rotating

A rotating deflector to which ions arrive induces a rotation of the plasma in the direction of the axis of the cylindrical cavity. Rotation frequency f is reported to be below 100 rpm ($f \leq 1.7$ Hz). Rotation makes the plasmoids charged by an effect known already by Faraday. Also Searl device is a rotating magnetic system and its charge explains the reported effective loss of weight as being due to the interaction with the Earth's radial electric field. Searl device is also known to develop cylindrical magnetic walls [H5, H1]. According to the TGD based model of the Searl device the rotating magnetic walls represent a simple example of a magnetic body containing dark matter. In this case the dropping of electrons from atomic space-time sheet to a larger space-time sheet provides the energy for the accelerated rotation and for the formation of magnetic walls. Also transfer of angular momentum to magnetic walls is in principle possible.

The rotation of the plasma with the magnetic flux lines frozen to the plasma could create a similar situation, and the rotating magnetic walls could receive metabolic energy from the dropping of electrons and provide it for the immune system whose stimulation seems to be involved with the healing. Also the magnetic field in the region of target would rotate so that plasmoids containing biologically important dark ions could be generated also here.

4. Magnetic field of order kGauss is present

Magnetic field of order kGauss is present also in the target. 620 Gauss and 1240 Gauss are the typical field values used. It would be nice to understand why the strength of the magnetic field used is what it is. The ratio of the magnetic field $B_1 = 612$ Gauss to the dark magnetic field $B_d = .2$ Gauss playing key role in the TGD based model of living matter is $B_1/B_d = 2^{11+1/2}$ with 5 per cent accuracy, which suggests that p-adically scaled up version of this magnetic field corresponding to the p-adic length scale $k = 169 - 23 = 146 = 2 \times 73$ could be in question.

The external magnetic field is modulated between some limits with the period of heart beat in the optimal situation. Hence the values of magnetic fields at which biological effects occur could differ from the nominal values. For $B_{end} = .2$ Gauss the cyclotron energies of all biologically important ions are above thermal threshold if the magnetic flux quanta correspond to $k_d \geq 43$ levels of dark matter hierarchy. For 62 Gauss magnetic field this holds true for $k_d \geq 33$ and for 1240 Gauss for $k_d \geq 32$. Note that one has $h_{eff} = nh$, where n is product of distinct Fermat primes and power 2^{k_d}. For kHz frequency the lower bound is $k_d \geq 22$.

5. Modulated microwave radiation is present

Microwave radiation with frequency $f_1 = 9.4$ GHz modulated by a frequency $f_2 = 17$ MHz in a typical experiment is also present. The wavelengths used are in range 3 cm–80 cm corresponding to the range 10 GHz–.38 GHz. The optimal microwave frequency depends on the organ irradiated. Microwave radiation is crucially important and there are reasons to believe that its frequency can vary only in a narrow range. The intensity of the microwave radiation correlates strongly with healing effects. The presence of the modulation is necessary to achieve the healing effect. Several modulation patterns are used which suggests that control commands based on field code are involved.

6. Also highly energetic charged particles are involved

The system involves very high voltages generating highly energetic electrons and ions [I46]. These voltages are much higher than the ionization voltage for Ne and Ar or even Hg. Hence the highly energetic electrons and X rays could be essential also for the primary function of the Priore's machine. Highly energetic electrons and ions could give their energy for dark microwave photons. High energy X rays with energies $E \simeq 300$ keV would transform to dark microwave photons which

in turn would be transformed to plasma oscillations. The patent of Priore mentions that a typical voltage $V = 300$ kV is present in the device [I46] so that electrons accelerated in this voltage could indeed provide the X rays transforming to dark microwave photons to dark plasma oscillations.

6.3.3 A proposal for the mechanism of healing

The model for the hierarchy of EEGs discussed in [K12] is a good starting point in the attempts to understand that role of the modulated microwave photons and external magnetic field. In this model Josephson radiation has energies in visible and UV range for the typical values of the resting potential. Frequency modulation of Josephson radiation is used to code information and frequency modulated Josephson radiation is also responsible for both the representation of sensory data at the magnetic body and motor control by magnetic body. Since the amplitude modulated microwave radiation is responsible for the healing effects the natural proposal is that it is transformed to dark photons with frequencies in the same range as Josephson radiation associated with the cell membrane.

1. Microwave photons have frequency $f = 9.4$ GHz. The corresponding photon energy is below the thermal threshold. The condition that the energy of the dark photons with this energy is the energy E_J of Josephson photon reads as

$$\frac{E_J}{eV} = .41 \times \frac{f}{10^{14}\ Hz} \times r \ . \tag{6.1}$$

   For $r = 2^{16}$ one obtains $E = 2.66$ eV.

2. For electron the cyclotron frequency for $B_{end} = .2$ Gauss is $c_c(e) = 6 \times 10^5$ Hz. For $B = 620$ Gauss $= 3100 B_{end}$ and for $r = 2^{16}$ the energy of cyclotron energy quantum is

$$\frac{E_c}{eV} = r \times \frac{B}{B_{end}} \times .41 \times \frac{f_c(e)}{10^{14}\ Hz} = .49\ \ eV \ . \tag{6.2}$$

   This is the energy of metabolic energy quantum.

This observations would suggest that the mechanism involves both control signal and transfer of metabolic energy.

1. The amplitude modulated microwave photons transform to Josephson radiation coupling to some biologically important ion at cell membrane and transmit information in accordance with the finding that the modulation pattern is important.

2. The cyclotron photons associated with electrons at the magnetic flux tubes of the external magnetic field generate cyclotron radiation serving as a source of metabolic energy.

For the mechanism to work it is essential to have a desired value of Planck constant once the value of the magnetic field is fixed. This fixes the ration of the microwave photon energy and electron's cyclotron energy so that one has $f/B = constant$. $k_d = 16$ is the value in the case considered. The proposal is consistent with Mersenne hypothesis: the value of k_d corresponds to the pair $k = 151$ and $k = 167$ of Mersenne primes assignable corresponding to the size scale of 10 nm (cell membrane) adn 250 nm (size of cell nucleus). It is important to notice that these scales correspond to electron Compton scales $L_e(k) = \sqrt{5}L(k)$ rather than p-adic length scales $L(k)$.

6.4 Fields And Genes

Fields and genes could relate in several manners. Field patterns could code for genes in the sense that W MEs would induce the Mg^{++} waves activating genes. Coding of genes by plasma wave patterns would be a higher level code in which genes take the role of amino-acids and plasma wave patterns that of genes. Genes could be also expressed as field patterns: introns are good candidates in this respect. There are claims that field patterns can induce genetic modifications: perhaps there are genes coding for genetic self engineering operations.

6.4.1 Coding of genes by plasma wave patterns

According to the dark matter inspired vision, magnetic bodies act as intentional agents inducing processes like DNA transcription and translation. The model for the findings of Gariaev [I26] led to the proposal that the radio wave spectrum emitted by DNA subject to irradiation by laser light could be a superposition of copies of EEG like spectra corresponding to various p-adic length scales. The spectrum suggests that cyclotron frequencies of Mg^{++} ions are present (25 Hz for ordinary EEG). Mg^{++} ions are indeed known to be important for the functioning of DNA. Therefore magnetic bodies could excite Mg^{++} waves use dark plasma oscillations induced by W MEs as control commands to excite Mg^{++} waves leading to the activation of various processes like translation and transcription. Perhaps even topological quantum computation like processes could occur [K44]. Each gene could be sensitive to a particular subset of Mg^{++} wave patterns and thus to a particular subset kind of W field patterns. The frequency assignable to W ME in turn correlating directly with its distance from magnetic body could be automatically select the correct group of genes.

In principle the coding of genes by plasma oscillation patterns could be context sensitive and perhaps the genome contains a subset of genes which are purely personal so that foreign magnetic bodies cannot activate them. Also the portions of hyper genes in given organism could be activated by plasma oscillation patterns characteristic for this organism. Language could correspond directly to this kind of oscillation patterns perhaps activating intronic portions of the genome to express itself in some un-orthodox manner, say processes involving RNA, field patterns, or topological quantum computation [K44].

At lower levels field codes are expected to be rather hard-wired just like computer languages or primitive languages consisting of signals. The codons of the memetic code could be realized as sequences of 21 DNA triplets at the intron level [K18] and corresponding plasma oscillation patterns might correspond directly to linguistic expressions.

If field codes are learned, the question arises whether also genetic code is learned in the same manner. Variations of the genetic code and the slight context dependency of some variants of the genetic code [K9] support the view that genetic code is probably also learned at very early stages of biological evolution. The deviations from universality would suggest that the maximization of the total information of the code occurs only locally in the space of all codes.

6.4.2 Is electromagnetic information represented using genetic code?

The TGD based model of the genetic code as a single code in a hierarchy of codes results from a model for abstraction process as a repeated formation of Boolean statements about Boolean statements [K18]. This process starts from two statements (0 and 1) and gives at the first step $2^2-1=3$ statements if one statement (represented set-theoretically by empty set) is thrown away. At the next steps one obtains by a similar procedure $2^3-1=7$, $2^7-1=127$, $2^{127}-1$, etc. statements: the numbers of statements are obviously given by Mersenne numbers. The number of the mutually consistent statements is $1, 2, 4, 64, ...$ at various levels of the hierarchy and the interpretation of DNA and its conjugate as representations and their negations suggests itself as being associated with the level $M_7 = 127$. There are good reasons to assume that these codes are realized in many manners in living matter and can represent all kinds of information.

Smith gives in his article support for the existence of seven bit electric code emerging already at the level of frequency imprints in water making possible arithmetic operations for the external frequencies imprinted to water [J5]. The seven bit character of the code brings in mind the hierarchy of genetic codes predicted by TGD [K18] and encourages the conjecture that the sequences of 7 vacuum current pulses with single pulse representing either zero or one should provide an electromagnetic realization of the genetic code and its conjugate each consisting of 64 different pulse sequences and that a sequence and its Boolean conjugate represent command and its time reversal.

In his talk about water memory effects related to homeopathy Cyril Smith reported in CASYS2001 [J5] evidence for a context dependent 7-bit coding of binary arithmetic operations (addition, subtraction, multiplication and division) of two source frequencies, call them f_1 and f_2, giving as a result the imprinted frequency $f(f_1, f_2)$. The experimental arrangement involves two frequency sources (f_1 and f_2) contained by beakers, a pulse generator and the "receiver". The arithmetic

operation determining the frequency imprinted into water as a function $f(f_1, f_2)$ of f_1 and f_2 is coded by a pair of pulse sequences consisting of 7 pulses with 1 and 0 represented by the polarity of the electrical pulse.

1. For instance, when the beakers and receiver are (in this order) along East-West axis (Earth's magnetic field is important!) and connected serially to the pulse generator, the pulse sequence 1001001 1111111 codes for addition. When the receiver is replaced between the beakers connected to the pulse generator in a parallel manner, multiplication results.

2. When the beakers are in East-West direction and coupled serially to the pulse generator, 1000001 1111111 codes for subtraction. When the beakers are along North-South axis, the same sequence codes for division. f_1/f_2 or f_2/f_1 results depending on the order of the frequency sources connected in a serial manner to the pulse generator.

3. When the latter sequence 1111111 is replaced by 0000000, the imprint is in the "opposite phase" (biologically depressive instead of being stimulatory). Thus the latter sequence might tell whether genetic code or its conjugate is used and thus whether the imprinted frequency represents command or its time reversal realized as a reference wave giving rise to a hologram.

What one can conclude about the general structure of the code on basis of these experimental evidence?

1. The result of the arithmetic operation is context dependent and thus not coded completely by the binary sequence. As a consequence, single bit can code for the binary operation in question and 3+3 bits can be used to code for additional operations acting on each of the two arguments.

2. The structure of the code word should reflect the structure of the binary arithmetic operation, which is quite generally of form $(f_1, f_2) \to Xf_1OYf_2$, where O denotes $+, -, \times$ or $/$ and X and Y are operations acting on the arguments f_1 and f_2.

   (a) The requirement that the time reversal of the bit sequence also codes for a binary operation fixes the general structure of the codeword to be XOY where X and Y have same length and O is thus in the middle of the codeword.

   (b) The context dependence of the operation implies that O can be represented by a single bit. $O = o_1$ in the middle of the codeword is indeed invariant under the time reversal. $O = 1$ signifies addition or multiplication whereas $O = 0$ signifies subtraction or division.

   (c) The 3-bit sequences $X = x_1x_2x_3$ and $Y = y_1y_2y_3$ should code for the possible operations performed for the arguments. Note that the number of bits is same as that for the codewords at the level $M_3 = 7$ below $M_7 = 127$. For commutative operations like $+$ and $\times$ the time reversal of the codeword obtained by changing the order of the bits in the command should yield the same end result. This is the case if the time reversal $Y = X_T$ of X obtained by reversing the order of bits in X has the same effect on f_2 as X has on f_1. $X = 100$ and $Y = 001$ appearing in the operations are indeed mirror images and have interpretation as identity operations. Besides identity operation 7 additional operations for the arguments are predicted to be possible (this brings in mind octonion units). Clearly, the pairs (X, Y) of operations correspond to 64 DNA code words and the arithmetical operation itself corresponds to the 7: th bit in the middle of the codeword.

   (d) The proposed structure of the codeword is consistent with the data reported in [J5]. In particular, the symmetry of the sequence 1000001 coding for a division with respect to the reversal of the bits is compensated by the asymmetry induced by the exchange of the beakers. In the case of subtraction the change of the order of beakers should change the sign of the imprinted frequency: does this mean that the effect of resulting frequency is changed to its time reversal?

Of course, one can pose several critical questions relating to the experimental arrangement. Has it been tested how the situation changes when the direction of the linear arrangement is not East-West or North-East? Does the outcome of the operation change continuously in this kind of operation? In how wide a range of frequencies the coding of the arithmetic operations has been verified? However, the mere demonstration that

1. the structure of the pulse sequences consisting of a pair of 7 pulses determines the imprinted frequency as function $f(f_1, f_2)$ of the source frequencies f_1 and f_2 and that

2. the effect of this frequency is changed from stimulatory to depressive by the binary conjugation of the binary sequence is consistent with the view that a realization of the genetic code by electromagnetic pulse sequences is in question and that reference wave and its phase conjugate induce opposite biological effects.

6.4.3 Is it possible to transfer genetic information using field patterns?

The work of Yu. Chen Kangeng gives evidence that the transfer of the genetic information by electromagnetic means is possible [J2]. According to [I25], where the method is summarized, the successful transfer of the genetic information from a donor bio-system to an acceptor system was achieved via high-frequency electromagnetic fields feed repeatedly through the optically-active donor bio-system and then delivered over a long period of time to the receiving bio-system in its early developmental stages. The hybrids created through the irradiation of eggs and seeds with such "genetically loaded" fields are claimed to show very specific mixed characteristics that were transferred to the next generation without need for further irradiation.

It would seem that the donor genome or parts of it are imprinted to the electromagnetic field pattern in the process and that this field pattern is able to modify the target genome.

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 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.

The mechanism could explain the findings of Sheldrake about learning at the level of species. The observed rather recent emergence of 223 new genes into human genome [I16, I38] could be understood as a genetic self engineering rather than genetic engineering by more advanced civilizations as suggested in [K10] (note however that the higher levels of dark matter hierarchy can be also regarded as "more advanced civilizations"). A further quite recent mystery discussed in [K18] is that corals seem to possess genes responsible for higher level psychological functions in mammals [I29]: it is very difficult to understand this as an outcome of selective pressures combined with random mutations. The proposed mechanism might explain these genes as a result of genetic engineering.

The basic ingredient of the coral backbone is calcium carbonate $CaCO_3$. Salt is in question so that also Ca^{++} and CO_3^{--} ions are present. Ca^{++} could obviously give rise to Calcium waves. CO_3^{--} has atomic weight $A = 60$ with cyclotron frequency 10 Hz for the nominal value of the Earth's magnetic field. This frequency defines the fundamental biological rhythm and characterizes also memetic code. It characterizes also effectively 2-dimensional waves closed inside the ionospheric cavity: for l^{th} harmonic the frequency is $f = \sqrt{l(l+1)}/2\pi R_E$, R_E Earth's radius, and $l = 1$ gives 10 Hz frequency. Could the transfer of the genetic information in the Earth's length scale with 126-bit memetic codons be realized as ripples 10 Hz waves make possible genetic self engineering of coral genome?

During the early developmental stages the genome might be plastic enough to allow genetic self

engineering. The genetic modification during this period also the most rational option since this gives the best guarantee that the modifications are transferred to the offspring.

6.4.4 Could genes be expressed in terms of field patterns?

The previous considerations assume that genes are activated using field patterns. It is also possible to consider the possibility that genes are expressed in terms of field patterns. Introns which are chemically silent are excellent candidates in this respect and the notion of memetic code relies to the idea that intronic portions of genome consist of sequences of 21 DNA triplets defining memetic codons expressed electromagnetically. This would also fit nicely with the hypothesis that introns correspond to hyper genes. Note however that introns could also express themselves by activating processes involving nuclear RNA, in particular genetic self engineering. Even process like topological quantum computation can be assigned to introns.

6.5 Magnetic Mirrors, Remote Viewing And Remote Healing

Magnetic mirrors formed by the magnetic flux tube-ME pairs occur in many different contexts in TGD inspired theory of consciousness. Magnetic mirrors of length of order light life appear in the model of long term memory (when I, that is my magnetic body, looks at sufficiently distant mirror I see the me of the geometric past). Magnetic mirrors are crucial for the model of the sensory canvas and there seems to be no sharp difference between different types of memory which suggests that there is an entire hierarchy of memories in various p-adic time scales.

Dark matter hierarchy provides a classification for the memories in terms of the level of the dark matter hierarchy [K12], and it is possible to identify the time scale of sensory experience as a very short term memory with time of.1 seconds (in accordance with the findings of Libet), minute scale short term memory, a memory with a time scale of days, and what is usually regarded as long term memory in terms of the levels of the dark matter hierarchy.

Magnetic mirrors play a key role in the model of frequency imprinting and provide a general molecular recognition mechanism as well as model for how sensory percepts are communicated to the magnetic body and how magnetic body performs motor actions. Magnetic mirrors allow also a generalization of many-sheeted DNA so that magnetic mirrors represent genetic information in electromagnetic form.

The wide applicability of the magnetic mirror notion suggests in accordance with the fractality of consciousness that various functions associated with the magnetic mirrors are aspects of the same basic phenomenon. Magnetic mirrors would thus provide sensory canvases, long term memory mirrors and recognition mechanism at all length scales. Even many-sheeted DNA would possess sensory canvas and long term memories, perhaps an entire hierarchy of them. One can even consider the possibility that our long term memories are average over those associated with genes associated with various neurons!

Nothing in principle precludes the possibility that magnetic mirrors can also serve as bridges between different organisms: even the notion of organism must be generalized if the idea of multi-brained magnetic selves is taken seriously. The notions of super– and hyper genes give a concrete content for this generalization [K25, K12]. This could make possible effects similar to observed at DNA level (such as self assembly and translation of RNA to proteins). Why this kind of telepathic bridges are rarely realized in the post-modern society can be understood as a result price to be paid for the gradual individualization taken place during evolution from bacteria to bicamerality to modern consciousness: in the era of market economy it would not be wise to allow a direct access to your personal consciousness from outside.

6.5.1 A general model for remote viewing and healing

The last observation suggest also a general model for the phenomena like remote viewing and healing defying standard science explanations (see the article of Lian Sidorov [J17]). One healing method goes under name Qigong (see the article [J6]). Qigong is a general term for a large variety of traditional Chinese energy exercises and therapies. Qigong is generally considered as a self-training method or process through Qi (vital energy) and Yi (consciousness or intention) cultivation to achieve the optimal state of both body and mind. The traditional Chinese medicine

postulates the existence of Qi, which could be regarded as a kind of subtle energy circulating around the physical body.

In TGD framework the energy associated with MEs and supra-curents flowing along magnetic circuitry would be a natural counterpart of Qi. Yi would in turn would translate to p-adic cognitive representations representing also intentions, perhaps p-adic variants of MEs. Internal Qigong refers to self healing whereas external Qigong means directing Qi energy or intention to help others by opening Qi blockages or inducing the sick Qi to get out of body, or helping to achieve Qi balance. The physiological, chemical and electromagnetic effects of both internal and external Qigong have been studied ([J17] contains large number of related references). Also the effects of Qigong healing on cancer has been studied [J6].

Skeptics tend to eliminate these effects from their consciousness simply by denying their reality or claiming that only placebo effects are in question. The deep irony is that placebo effect represents a basic example of this kind of effect. The basic psychological reason for this reactive attitude is very simple: only the understood phenomenon is an existing phenomenon. In TGD framework these phenomena can be indeed understood using a model generalizing the vision about endogenous bio-control so that the sender and receiver of the control signal can be different organisms. Thus independently whether the claimed effects are replicable not, this kind of effects are more or less predicted by TGD framework.

The general model for remote viewing and healing is roughly following.

1. Magnetic mirrors connecting the sender and receiver make possible a universal mechanism for the transfer of intent (Yi) and action (Qi). p-Adic MEs represent the transfer of a mere intent and real MEs represent a transfer of action. p-Adic ME can be transformed to real ME either by receiver or some higher level magnetic self.

2. The transfer of intent gives rise to a healing mechanism which can act both endo- and exogenously. ME-magnetic flux tube pairs characterized by their fundamental frequencies make possible bridges between healer and healee and allow a resonant interaction in which healer can initiate various control commands or 4-dimensional templates represented as holograms. Also smaller MEs can be send along these MEs serving as bridges (this is like throwing balls with light velocity!).

3. The ME-magnetic flux tube pair connecting healer and healee acts as a reference wave which can initiate an arbitrarily complex hologram representing biological program. Healer has the ability to generate and amplify the frequencies which induce holograms representing the control commands. In particular, healer can initiate complex biological programs without knowing anything about their functioning.

4. It is quite possible that also multi-brained and -bodied higher level magnetic selves actively participate in the process.

6.5.2 Dark matter hierarchy and remote mental interactions

The ideas inspired by dark matter hierarchy allow a concretization of these ideas.

1. Charge entanglement as basic mechanism of remote mental interactions

The sharing of mental images could quite universally involve charge entanglement by W MEs so that remote mental interactions, the basic mechanism of intentional action, and exotic weak interactions would be very closely related.

Negative W MEs become also a basic tool of intentional interaction and the active party could in principle use the body of the subject person to realize his intentions. Hypnosis could rely on this mechanism. This could occur also in the case of healing, and the generalized motor commands would include gene expression. The body of the healee would provide the metabolic energy in this case.

There is a mental disorder in which patient mimics with an amazing authenticity the gestures of persons which she does not know beforehand. The neuro-scientific explanation would probably relay on exceptionally active/abundant mirror neurons. One can imagine two alternative quantum explanations: either the motor areas of the patient quantum entangle with those of the object

of mimicry or the magnetic body of the object entangles with the motor areas of patient, whose magneto-immune system fails for some reason.

If the code defined by the proposed map of plasma oscillation patterns mediated by W MEs to generalized motor actions (induced by ionic waves) is not universal, the healer must use only the universal part of the code, be able to learn the personal code of the healee, or act with the mediation of collective levels of self hierarchy able to utilize "multi-person" codes. The universality might fail only at the higher levels of dark matter hierarchy where organisms become individuals.

2. Time mirror mechanism as energy source

The healee can suck metabolic energy from the healer by time mirror mechanism, that is by sending neutral negative energy MEs received by the healer or possible third party.

Remote mental interactions affecting non-biological targets would rely on same mechanisms, in particular charge entanglement by W MEs. For instance, capacitors with voltage near to a dielectric breakdown might be sensitive targets of remote mental interactions. The model of Priore's machine suggests that remote mental interactions could affect and even generate plasmoids in rotating plasma.

3. Hierarchy of time scales associate with remote mental interactions

It is possible to assign to the remote mental interactions a hierarchy of time and length scales and in time scales shorter than human life cycle there are seven levels involved. This brings in mind chakra hierarchy. Since magnetic bodies at levels $k_{em} \geq 4$ have astrophysical size scale, the distance between the biological bodies of the healer and healee does not matter at these levels. The time scale remote viewing process would correspond to the time scale of entanglement identifiable as the time scale of the generalized EEG involved.

6.5.3 Comparison with data

The model of remote healing and vision proposed above seems to conform with the findings described in [J17] (the URL references of this article provide a comprehensive source of background data).

1. Coordinate healing and healing using adjunct

The basic observation [J8, J17] is that there are two classes of transfer of intent (including remote healing and vision as special cases).

1. The target is found by the remote healer or viewer being given a name, location, birthdate, etc. What is strange is that this information need not have any conscious meaning for healer. This can be understood if multi-brained magnetic selves are involved with the process so that it is enough that the information has meaning for some brain involved. The well-documented effects of prayer groups (see [J8] which gives various aspects of spiritual healing) could be understood if the higher level selves receiving information from all prayers are actively engaged in the process. Also a coherent amplification of the effect (the so called Maharishi effect in transcendental meditation proportional to the square of the number of participants) would be involved.

2. An adjunct (an object previously treated by the healer, such as water, cloth, a crystal, etc) is used by the healee with or without the healers's knowledge. Adjunct could act as a relay station being connected to the healer and healee by MEs containing same frequencies. Besides serving as relay station, the adjunct can also act as an antenna amplifying the healing frequencies. This would explain why water (LC water blobs), linear structures like lock of hair of healee containing DNA, and crystals are effective adjuncts. This also explains why remote viewer can have vision about the viewed by touching some object belonging to the viewed.

2. The role of imagery

The role of imagery is known to be important. The abilities of the sender to transmit the intent seem to be better the more vivid is his/her ability to imagine the intent. This conforms with the

hypothesis that the transfer of intent involves at basic level the generation of a p-adic space-time sheet transformed to real form at some stage and that the transformation to a real action occurs in the easiest manner if the p-adic pseudo constants involved are genuine constants as for real solutions of the field equations.

2. Two kinds of healing mechanisms seem to be involved

TGD view conforms with the fact that two kinds of healing mechanisms seem to be involved. Healer either uses his own energy to influence the healee or uses "universal energy". In the first case healer herself would transform the p-adic intent into a real action. In the second case this transformation is carried out by the healee or some third agent, possibly higher level self.

3. Distance does not seem to matter

The model explains also how healing effects can be achieved over distances of thousands of miles. The basic characteristic of MEs is that they allow a directed propagation of classical energy without attenuation (Maxwell's equations do not allow this kind of solutions). Thus, if magnetic mirrors serve as bridges between the sender and receiver of intent, the high precision communication of intent does not look mysterious.

Lian Sidorov [J17] mentions the experiment performed by M. Sue Benford et al. (unpublished), where exposing half of a hair sample to a non-ionizing radiation produced radiographic film exposure underneath the other half of the sample, located many miles away. The explanation of this effect must be based on macroscopic entanglement. The basic idea is that the effect is analogous to spin measurement in Einstein-Rosen-Podolski experiment: that is, the measurement of the spin of an electron fixes the spin of the electron entangled with it. The simplest explanation that come in mind are following.

1. The exposure to the non-ionizing radiation reduced charge entanglement by dark W MEs between the two halves of the the sample and that the resulting exotically ionized state produced the radiation leading to the exposure of the film.

2. In another experiment of Sue Benford [I45] (to be discussed in the next section) the intentional action of the experimenter is reported to induce dots and tracks in the photographic emulsion. It is is not possible to exclude the possibility that the subconscious intentional action of the experimenter might have produced the exposure also in this experiment.

Variants of this experiment could provide a justification for the notion of macroscopic quantum entanglement. In particular, charge entanglement by W MEs could in principle be demonstrated by proving so simultaneous generation of opposite charges by state function reduction that it cannot be explained in terms of em currents flowing with sub-luminal velocity.

4. Supra currents in astrophysical length scales as an alternative for charge entanglement

A competing explanation for genuinely non-local generation of charge is charge transfer by supra currents along magnetic flux quanta. One could test also the hypothesis of super-conductivity in macroscopic length scale by using variant of this kind of experiment. For instance, a variant of this test is based in the addition isotopes of selected ions to other half of the sample and finding whether the fraction of ion isotopes increases in the second half of the sample located, say, at the second side of the globe. That supra-currents could flow in these length scales is in consistency with the magnetic sensory canvas model.

The model for auroras as an astrophysical quantum phenomenon discussed in [K6, K7] relies on the assumption that the magnetic flux tubes of both earth's and solar magnetic fields are superconductors (solar wind would thus flow as supra currents). A topological model for the crucial reconnection phenomenon of the magnetic field lines of earth's and solar magnetic fields results. Recombination is accompanied by the leakage of the supra currents to nonconducting space-time sheets through flux tubes: this mechanism is a good candidate for a universal mechanism leading to breakdown of super-conductivity and is presumably involved with a wide class of atmospheric phenomena like lightnings, ball lightnings, tornadoes, etc.. The model allows to identify the mechanism generating the electric fields responsible for the acceleration of ions eventually giving rise to auroras via collisions with the ions of the ionosphere.

What is fascinating that the sounds claimed to be heard during auroras but not measured by micro-phones might represent genuine extrasensory percepts resulting from the perturbations of

the magnetic auditory canvas caused by the auroras. The breakdown of the super conductivity might even correlate with the loss of consciousness reported to sometimes occur during perceiving auroras. This picture encourages to think that weather phenomena, in particular thunder storms, relate to our consciousness also in extrasensory manner.

5. The effects of healers to the em frequency spectrum of water

There is evidence that healers can affect the em frequency spectrum of water. In [J17] examples of these effects are listed: the Raman spectra of water can be influenced from a distance up to 1900 km; the polarization angle of He-Ne laser can be affected by so called waiqi method; the IR spectrum (hydrogen bonds) of sterile water changes in the proximity of therapeutic touch practitioners. Experiments do not support the hypothesis that the time of exposure correlates with the intensity of the effect. On the other hand, the treatment time of adjuncts is known to be an important factor in the distant healing. Also the UV spectrum of the water treated by healers differs from that for control samples.

It is not difficult to understand these effects in terms of W entanglement inducing an exotic ionization of dark Bose-Einstein condensates in turn inducing electric fields at the level of ordinary matter (recall the many-sheeted version of Faraday's law). Atoms with exotically ionized nuclei behave effectively like isotopes and have thus slightly different energy levels than their ordinary counterparts. This could serve as a test for the presence of exotic ions. Same applies to exotically ionized molecules.

The effects at UV frequencies could involve MEs with lengths shorter than 10^{-7} meters are involved and produced in de-coherence of dark photons to ordinary photons. Micro-tubules in UV length scale range are natural candidates for being accompanied by $k_d = 0$ UV MEs (for instance, the receptors in retina contain micro–tubuli in UV wave length range). The cell membrane could contain an array of MEs of length $L_e(151) = 10$ nm parallel to lipids whereas genes should involve also MEs with lengths corresponding to the wave lengths of visible light [I24].

Especially interesting wave lengths for bio-photons in IR-UV range are the electrnic Compton scales $L_e(151) = 10$ nm, $L_e(157) = 80$ nm, $L_e(163) = 640$ nm, and $L_e(167) = 2.52$ μm which all correspond to Gaussian Mersenne primes (Mersenne primes are in a preferred role in elementary particle physics: all charged leptons, nuclei, hadrons and intermediate gauge bosons correspond to ordinary or Gaussian Mersennes). That these primes span all p-adic length scales between cell membrane thickness and cell length scale could be the number theoretic correlate for the miracle of life. Needless to emphasize, the finding that these frequencies are biologically special frequencies would give an enormous boost for TGD approach.

According to the original model the transfer of intent could involve sending of MEs with short lengths, say in UV or IR range: this would be like throwing a ball to a tunnel. The model based on de-coherence of dark MEs does not seem to require this. Be as it may, these MEs would move inside larger MEs forming the bridge between sender and receiver. $L_e(163) = .640$ μm, which is in the lower end of the visible portion of photon spectrum ($.4 - .7$ μm) and thus corresponds to red light, equals with.6 per cent precision with the wave length $\lambda = 644$ μm associated with photosynthesis by chlorophyll b) and with 6 per cent precision to the wave length $\lambda = 680$ μm associated with the photosynthesis by chlorophyll a). Could it be that magnetic mirrors with these wave lengths amplify photosynthesis by first amplifying the incoming visible light in a resonant manner?

6. Exotic weak force and biology

The basic prediction of TGD is entire hierarchy of exotic electro-weak and color physics corresponding to preferred p-adic length scales. These p-adic physics in turn involve dark hierarchy. It is clear that dark variants of exotic weak bosons would play key role in living matter. There is evidence that exotic weak interactions is involved with remote mental interactions. According to [J12], even radioactive decay rate of Am241 has been influenced by intent. There is evidence also for weak interactions in astrophysical length scales. The lifelong work of Russian scientist Shnoll demonstrates the fluctuations for the rates of various chemical and radioactive processes vary with periods related to astrophysical phenomena (see [E1], [E1] and [K4]. Exotic weak forces would also explain also the mysterious chiral selection occurring in living matter. These observations together with other applications of exotic weak forces encourage to think that weak MEs could have an important biological role.

Ordinary neutrinos seem to correspond to $k = 13^2 = 169$ space-time sheet. The quantum model of hearing revised so that it is consistent with the vision about dark matter [K36] forces to assume the existence of exotic neutrinos with $k = 127$ space-time sheet (electron length scale) coupling to $k = 113$ weak bosons. This encourages a generalization: perhaps leptons and quarks can reside in many length scales: for instance, at the space-time sheets $k = 151, 157, 163, 167$ corresponding to the biological Gaussian Mersennes. This assumption does not imply any conflict with what is known about weak and color interactions, in particular asymptotic freedom, since the bosons of different physics would couple directly only to the particles of their own physics.

There are several reasons to suspect that above atomic length scales several p-adic length scales can define copies of electro-weak and color physics and their dark variants. This is actually not new finding. The masses of low lying hadrons can be understood if the p-adic prime $p \simeq 2^k$, k integer, characterizing quark can depend on hadron [K30]. The poorly understood aspects related to the determination of top quark mass suggest that the p-adic length scale assignable to quarks can vary in a wide range [K27]. Also the mass scale of neutrinos seems to depend on environment [K29, K27]. In condensed matter physics the huge variations of electrons effective mass might be partly due the variation of the p-adic length scale assignable to electron.

7. The role of the magnetic fields

The treatment of water by magnetic fields is known to stimulate plant growth and to affect IR absorption spectra, surface tension and crystallization patterns. The effects resemble those achieved by the treatment of healer. The emission of bio-photons in IR and UV range have been frequently measured in the proximity of healers. This is easy to understand if MEs and magnetic fields form magnetic mirrors so that presence of either makes the presence of another probable. For instance, magnetic fields could stimulate the formation of plasmoids.

8. The transfer of intent has EEG correlates.

In one class of experiments described in [J17] the sender and receiver are located separately in sensory shielded rooms and extrasensory transfer of information is attempted while both sender and receiver are connected to electroencephalographs. The sender transmits his intent during randomly selected intervals and receiver attempts to guess the moments of transmission. Experiments demonstrate no conscious ability to guess the moment of transmission. However, a statistically significant correlation between the actual sending time and the alpha wave amplitude was found in the receiver.

alpha wave synchronization was detected between pairs of qigong masters and their receivers even when they were separated by a distance of 4 km. A possible interpretation is that the low frequency part of EEG, in particular alpha band (perhaps Schumann frequency) are used by the higher level multi-brained magnetic selves which act as relay stations receiving the intent of the sender and communicating it to the receiver. That alpha band is involved fits nicely with the fact that the cyclotron frequencies of most biologically important bosonic ions are in alpha band. Note that the energies of dark EEG quanta are above thermal threshold for $k_d \geq 40$.

This hypothesis is also natural since Schumann frequencies are associated with the oscillations of the magnetic flux quanta also representing sensory canvases and magnetic components of our selves (the quantum energies assignable to Schumann frequencies f_S would come as $E_S(k) = \hbar(k) f_S$). Note however that for the complex structures formed by the magnetic flux tubes of Earth's magnetic field also other resonance frequencies than Schumann frequencies are expected. The time lapse between the sending and onset of the unconscious physiological response in the receiver was found in these experiments to vary in the range 10–17 seconds: this would suggest that $k_d = 54$ level of the dark matter hierarchy is involved.

7 The Role Of Dark Micro Waves In Living Matter

It has already earlier become clear that microwaves play a fundamental role in living matter and I have performed a considerable amount of work in attempts to integrate various ideas to a coherent overall view. The ideas about dark matter hierarchy provide new insights to the problem although much remains to be understood.

7.1 Dark Microwaves And Metabolism

Already the model for plasmoids leads to the idea that microwave photons could serve as "food" of plasmoids. The basic objection that microwave photons have sub-thermal energies can be circumvented when microwave photons are dark.

7.1.1 Are dark microwaves produced in protein dynamics?

Micro-waves are produced by the protein conformational dynamics and the rotational transitions of water molecules and their clusters might mimic and amplify the rotational spectra of molecules. This could provide a first principle explanation for why one encounters microwaves in so many strange phenomena related to living matter.

In the most conservative approach, the internal degrees of freedom for atoms and molecules cannot be dark so that the conformational dynamics of proteins could not produce dark photons. It is however good to avoid too strong prejudices at this stage, and one can indeed imagine the existence of the dark counterparts of atoms and molecules having the same energy spectrum as ordinary atoms. One can also imagine what might be called N-atoms and N-molecules for which the spectrum of transition energies would be scaled up by a factor $N \leq r$, $r = 2^{k_d}$ and the emitted photons would have r-fold MEs as space-time correlates and could decay to bunches of N^k ordinary photons. Note that one has $h_{eff} = nh$, where n is product of distinct Fermat primes and power 2^{k_d}.

If this picture makes sense, the conformational and rotational dynamics of DNA and proteins could produce dark microwave photons at arbitrarily level of dark matter hierarchy. One can argue that the idea about N molecules literally on top of each other from the point of view of M^4 factor of imbedding space looks rather strange. On the other hand, nothing strange is involved if one looks the situation at space-time level. Here only the experiment can decide and the claims of Randell [D4] [D4] might be seen as an experimental support for the notion of N-atom in the case of hydrogen.

7.1.2 Dark microwaves as metabolic currency

If the intensity of the magnetic field is of about.2 Tesla, which by the quantization of magnetic flux corresponds to the p-adic length scale $L(157)$, (80 nanometers), electronic cyclotron transitions generate micro-waves and the system can thus generate its "food" itself. Also dark microwave photons can result in this manner.

Also the liberation of zero point kinetic energy in the dropping of protons and ions from $k = 151$ to larger space-time sheets generates micro-wave radiation and could be an essential part of the self-organization. In this case however the microwave photons would be ordinary photons and have sub-thermal energy. 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.

The conformational and rotational dynamics of proteins provides a further mechanism producing microwaves and if the notions of inherently dark atom and molecule make sense this dynamics could produce metabolic energy utilizable by plasmoids.

7.1.3 Micro-wave MEs as bridges between space-time sheets

The earlier model for various phenomena discussed in this chapter emphasized the breaking of super-conductivity induced by a transfer of particles between super-conducting and non-super-conducting space-time sheets. In the recent framework the breaking of dark super-conductivity could occur by a phase transition to the ordinary phase. If the atoms and molecules are dark only in the sense they are ordinary particles topologically condensed on dark space-time sheets, their identity is not affected by the process. The mysterious appearance of atoms to places where

they should exist is a signature of the phase transition. Sue Benford has documented this kind of phenomenon to be discussed later.

The transfer of charged particles between space-time sheets is possible provided flux tubes connecting the boundary of a smaller space-time sheet to the boundary of a larger space-time sheet are generated [K6, K7]. Particles simply flow along this bond connecting the space-time sheet to the larger space-time sheet, say magnetic flux tube, and also vice versa.

One can imagine various kinds of flux tubes and also MEs could act as bridges allowing particles to flow between different space-time sheets. In this case the acceleration of the charged particle in the electric field of ME gives it energy so that the mechanism could act also as a metabolic mechanism. In particular, MEs could drive protons from large space-time sheets to $k = 137$ space-time sheets by providing them with the energy of about.5 eV of metabolic energy quantum. Same applies to electrons.

The transfer could occur in several steps.

1. Quantum-classical correspondence suggests that it should be possible to understand how absorption of photons corresponds to the process in which the "bridges" are generated by MEs. MEs carry transversal electric field and magnetic fields. There is infinity variety of various kinds of MEs but for the simplest MEs electric and magnetic fields have constant linear direction orthogonal to each. Electric field defines a potential difference which is constant in length scales much shorter than the wave length of ME.

2. By generalizing the quantization of the magnetic flux to that for electric flux one obtains that the potential difference satisfies $eV = n\omega = nf \times 2\pi$. This means that an ion having a charge e accelerating in the radial field gets energy $E = n\omega$. Thus absorption of photon with energy $n\omega$ corresponds classically to acceleration in the electric field of ME and getting same energy. For ion having opposite charge acceleration would be replaced by deceleration and one must speak of emission of photon with energy $E = n\omega$. The model for how ADP-ATP process is indeed based on the assumption that metabolic energy generates an electric potential in which protons are accelerated to get energy of .5 eV.

3. The proposed classical picture implies that ordinary micro-wave MEs can induce the transfer of ions to $k = 149$ and $k = 151$ space-time sheets and the transfer of electrons to $k = 157$ space-time sheets. The bridge generated by ME is expected to have a width given by atomic length scale. A good guess is that the thickness of MEs is given by the exotic weak length scale involved with the level of dark matter hierarchy in question.

7.2 Poorly Understood Effects Related To Micro-Waves

Micro-waves span the wave length range 1 mm–30 cm corresponding to the frequency range 300–1 GHz. There is support for the importance of micro-waves for living systems coming from various anomalous phenomena involving micro-waves. The connection with homeopathy has been already discussed and this discussion will not be repeated.

7.2.1 Microwave hearing

Micro-wave hearing [I30] is a phenomenon in which micro-waves in the frequency range.2-3 GHz (wave length range 150-10 cm) induce hearing sensation.

The basic features of the microwave hearing are following.

1. There is evidence that ears are not involved with the micro-wave hearing [I14]. The average pressure of the radar wave at the threshold of hearing is roughly three orders of magnitude less than the average pressure of a sine wave in air at the threshold of hearing air waves.

2. The location of the most sensitive area for hearing radar is remote from the ears, on top of the head.

3. The subjective frequency spectrum seems to include higher frequencies for radar hearing than for normal hearing of air waves.

4. The direction from which sound is experienced to arrive does not change as the head is turned around in the radar field.

For dark microwave photons the energies of photons would higher by a factor $r = 2^{k_d}$ and much above the thermal threshold which could explain the strong physiological effect.

Brain space-time sheet has correct size scale to serve as a receiving (dark) micro-wave antenna: it could also act as active radar generating (dark) microwave photons. That the most sensitive region is at the top of head, would conform with the assumption that dark microwave MEs modulated by audible frequencies induce the formation of plasma oscillations and these generate the sensation of hearing directly. This would suggest that the sensory input in ears could also generate microwave plasmoids as auditory mental images.

Microwave hearing allows to interpret the auditory hallucinations of schizophrenics as messages from various magnetic bodies, not necessarily the personal ones. Perhaps the immune system of schizophrenic fails to eliminate communications from non-personal magnetic bodies. Microwave hearing could also be involved with "God's voice" which according to the theory of Jaynes was a key element of the bicameral consciousness [K40], [J16]. That micro-wave hearing could also explain the strange buzzing sounds reported by the witnesses of the Fatima apparitions, which served as a clue to the TGD based model of this phenomenon [K24].

7.2.2 Microwave static and taos hum

Micro-wave static is a strange phenomenon starting after sunset and ceasing after sunrise. It is known to be of biological origin. Taos hum [I37] is in turn a painful auditory experience resembling the sound of diesel engine having all physiological correlates of the ordinary hearing sensation although it has not been possible to detect the sound using microphones. The heard sound also reflects the geometric properties of the acoustic environment.

The interpretation in terms of microwave hearing suggests itself [K23]. Microwave static has a strong correlation with taos hum [I37]: taos hum begins and ends at same time. Physiological evidence suggests that microwave static can generate a response in the entire body of the patient. Perhaps the electromagnetic immune system of the patient is unable to censor out the microwave static.

Why taos hum? Could animals use microwaves for "seeing" in absence of sunlight? But for what purpose plants would use microwaves? Could organisms send negative energy $h_{eff} = n \times h$ [K49] microwaves to environment and suck metabolic energy quanta with energy around .5 eV in this manner? Remote metabolism! Or maybe time reversed photosynthesis in dark! Biophotons indeed have energy spectrum in visible and UV as also sunlight does. This would require non-standard value of Planck constant.

This hypothesis would explain why the microwaves causing taos hum not hum are not observed directly. And if something is sucking metabolic energy from you, it is would be rather natural to experience very unpleasant feelings and try to find a place to hide as many sufferers of taos hum try to do!

7.2.3 Tectonic lights and microwaves

Observations interpreted in terms of UFOs are often made near the lines of the tectonic activity and they could represent a life-form using the tectonic dark micro-wave photons energy as their "food" (quartz crystals generate micro-waves) and therefore following the micro-wave beam emanating from the spot of the tectonic activity. This would explain their random looking butterfly like motion as being due to the random variation of the direction of the microwave beam. The decoherence of dark microwave photons to ordinary photons could in turn explain the observed but hard-to-understand luminous phenomena associated with tectonic lines.

7.3 X-Ray Images And Remote Realization Of Intentionality

M. Sue Benford has discovered rather fascinating and puzzling phenomenon in which some unidentified mechanism causes dots and tracks of size of order millimeter to X ray film [I45]. The interpretation in terms of tracks of ordinary charged particles is not possible. The intention of the experimenter or subject person seems to be strongly involved as well as a non-local information

transfer. In particular, the emotional state affects the size of the dots. What makes these experiments so fascinating is that they dramatically differ from the ideal Cartesian experiment in which experimenter's mind does not affect the result of experiment in any manner.

These experiments provide support for the many-sheeted space-time concept of TGD and for a concrete remote realization of intentions as changes on X ray sensitive film by a mechanism involving micro-waves also associated with the conformational dynamics of bio-molecules such as proteins. The mechanism which basically involves a transfer of ions between atomic space-time sheets and super-conducting magnetic flux quanta, relates closely to the many-sheeted models of metabolism, quantum control of homeostasis, and molecular machines.

There is a close connection with other well-established anomalous phenomena such as taos hum and micro-wave hearing. The mechanism is involved also with the anomalous phenomena in the field of free energy [K42]. TGD predicts the possibility of plasmoidic life forms and dark micro-wave photons would serve as "food" of this life forms. This leads to a model of UFOs and UFOs and UFO experiences: the model for Fatima Marian apparition witnessed by as many as 70.000 people was actually the key to the understanding of the role of micro-waves [K23]. The mechanism could also serve as a basic mechanism of psychokinesis and remote mental interactions [K38]. Also a remote information transfer might have been involved with the experiments. The sharing of mental images by quantum entanglement is a general TGD based mechanism making this possible [K38].

Holography type mechanism has been also suggested as a mechanism of remote mental interactions and is based on the idea that the fields generated by a living system form a representation for the system. In [I19] Benford has analyzed Dela Warr images [J7], and has shown that they possess hologram like aspects. There is indeed experimental evidence [**?**] that holography might be a basic representational mechanism allowing to represent information about body part in the radiation pattern generated by other body parts. The notion of conscious hologram discussed in [K5] allows to understand the hologram like aspects of delaWarr images and the mechanism of bio–holography. As a matter fact, remote quantum entanglement and self-organization induced by the leakage of supra currents and/or by the reduction of charge entanglement induced by W MEs are basic aspects of conscious holograms. The holographic aspects are not considered in the sequel but the model to be discussed is consistent with the notion of conscious holography since the mechanism generating the X-ray images generates also conscious holograms.

I want to thank for M. Sue Benford for very enlightening and detailed discussions concerning axion experiments as well to as yet unpublished experiments in which intentional action induces similar effects on X-ray film. I am also grateful for Keith Fredericks for discussions related to his findings about tracks in nuclear emulsions which he interprets as evidence for tachyons [I42] and for Lian Sidorov for telling me about the work of Keith Fredericks.

7.3.1 A brief summary of the empirical findings

The effects of several mechanisms to the photosensitive emulsion (X ray dental film) were studied in the experiments. Part of the data are yet unpublished and in the following only the published data are discussed. In the case studied [I45] the so called axion generator developed by a Russian physicist Shpilman was used. The torsion field believed to be generated by the generator is in TGD framework replaced by Bose-Einstein condensatse of dark photons associated with MEs. Exotic weak bosons and their dark variants induce long range parity breaking interactions possibly responsible for chiral selection in living matter.

The working hypothesis in [I45] was that the rotating axion generator generates so called axions, neutral pseudo-scalar elementary particles, which transform to X-rays in the presence of an external magnetic field and might be detectable in the photosensitive emulsion. The spectrum of the electromagnetic radiation generated by axion generator was found to contain MHz portion and micro-waves in the range $.1 - 2.5$ GHz. Microwaves modulated by MHz waves are produced also by Priore's machine [I46], which suggests that the model of Priore's machine might apply almost as such also here. Interestingly, the micro-waves in the frequency range $.1 - 3$ GHz are known to be associated with the micro-wave hearing.

It was found that the film contained dots and tracks. According to the specialists, the dots and tracks could not be due to any known elementary particle traversing through the emulsion. What was strange that the sizes of the dots had sizes of order millimeter. This size is much larger than the typical sizes of dots. The size of the silver grains is below micro-meter [I42] and the number of

grains along the track of a charged particle can be counted. This suggests that the interpretation in terms of an ordinary charged particle traversing the emulsion is not correct. What was also strange that the dots and tracks contained trace amounts of S, Mg and Al whereas the background region contained only C, N and O. Where did these elements come from?

In the case of charged particle very many X rays are emitted. The roughest estimate is one ionizing X ray per atom. In the case of axion only single X ray would result and it does not seem that the effect of single X ray could be so dramatic as to be much larger as the effect produced by very many X rays produced by a charged particle. Furthermore, if axion generates X rays it must have a mass measured in several electron volts. This does not conform with the cosmological bounds on axion mass (mass should be below 10^{-3} eV). Thus it would seem that the axion hypothesis is not supported by the experimental findings.

A further strange finding was that the intentional action of the experimenter affects the generation of dots and tracks and that their is a correlation with the emotional state of the experimenter and size of dots. The model for Priore's machine suggests that experimenter generated W MEs giving rise to plasmoids producing the tracks and dots, and that axion generator served as a source of metabolic energy in form of dark microwave photons.

7.3.2 The origin of the dots and tracks?

The model for the generation of dots and tracks is essentially same as that for the functioning of Priore's machine.

1. The role of axion generator could be analogous to that of Priore's machine: to produce dark microwave photons providing the energy needed to generate plasma wave oscillation quanta at microwave plasma frequencies making it possible to realize generalized motor actions using by generating plasma oscillation patterns.

2. In the present case the plasma oscillation patterns would be produced in the photographic emulsion. The reason why photographic emulsion can take the role of living matter could be that gelatin is one component of the X-ray emulsion. Gelatin consists of animal proteins and might have inherited some of the many-sheeted space-time structure of living matter making it possible to induce dark plasmoids provided the metabolic energy in form of dark microwave photons are present.

   The generalized motor action by the magnetic body of the experimenter would now affect the emulsion instead of brain of the experimenter, where 1 mm sized neuron blobs could correspond to the seats of microwave plasmoids. This picture conforms with the fact that also mere intentional action can affect photographic emulsions. The correlation of the size of dots with emotional state would be understood if the intensity of classical W boson field (number of W bosons in BE condensate) and perhaps also the thickness of W ME correlates with the emotional state.

3. Dots and tracks can be generated intentionally, even within a very brief time interval measured in minutes. The size scale 1 mm for dots suggests interpretation as a p-adic length scale associated with scaled dark length scale $L(163 + k_d) = \sqrt{r}L(163)$, where $L(163) = .64$ μm corresponds to the p-adic length scale assignable to Josephson radiation for ordinary value of Planck constant. The estimate for r is from this $r = 2^{k_d}$, $k_d = 21$. Using the previous formula for the dark energy of microwave photon this predicts for the energy of dark microwave photon with frequency $f = .1$ GHz $E = 8.6$ eV, which is somewhat too large. By replacing 1 mm with.5 mm one obtains $E = 2.15$ eV consistent with the model of EEG. For much higher microwave frequencies energies are are in UV and are not expecrted to couple to the cell membrane.

4. Dots and tracks contain S, Mg, Al which should not be there but they are in trace amounts. The phase transition transforming dark space-time sheets to ordinary ones involving possibly also the transformation of inherently dark S, Mg, and Al atoms to ordinary ones could explain this finding. Neither zero point kinetic energy nor atomic and molecular energies are changed in this process. The process involves the dissipation of the energy of plasmoid which could transform to UV photons and X rays by de-coherence.

The dependence of the dot size on emotional state of the experimenter supports the view that the experimenter is the intentional agent producing the dots and tracks. Neuronal columns with height and transversal size scale of order 1 mm are the basic information processing units in the cortex. This is consistent with the assumption that neuronal columns controlled from magnetic body by dark W MEs generating millimeter sized plasmoids via de-coherence. The control by highest levels of dark matter hierarchy could be of special importance in frontal lobes believed to be specialized to intentional actions.

7.3.3 Alternative model for dots and tracks

The original model for dots and tracks was based on the leakage of supra currents to atomic space-time sheets. If flux tubes connecting magnetic flux tubes to the atomic space-time sheets are formed in the millimeter sized regions then also super-conducting dark ions can leak to the atomic space-time sheets and transform to ordinary matter at the same time. The dots could have been caused by the ionizations caused by these super-conducting ions if they had sufficient energy.

Already the Nobel chemist Langmuir observed for 100 years ago effects with this interpretation when he was desperately to build vacuum tubes and realized that gas was flowing inside the tubes by an unknown [I18] [D7]. Crop circles [K11] are known to involve micro-wave explosions in growth nodes and the mysterious appearance of a layer of magnetized meteoric iron to the plants and soil proposed to involve currents from ionosphere. Leakage of dark ionic supra-currents from magnetic flux tubes explains the phenomenon and provides support for supra conductivity in astrophysical length scales [K11, K10].

The mechanism is involved also with the anomalous phenomena in the field of free energy and the recent experiments of Modanese and Podkletnov [H3] provide additional support for the leakage phenomenon [K42]. An interesting question is whether the dots and tracks in X-ray films disappear if the local magnetic field of Earth is artificially cancelled.

8 Activated Water, Homeopathy, And The Basic Mechanism Of Immunity

A considerable progress has occurred in the understanding of TGD inspired theory of consciousness and quantum biology during the first half of 2013. I have not however included separate sections about this progress since other chapters of "TGD Inspired theory of consciousness" already contain the relevant material. A detailed representation of the recent vision about TGD inspired theory of consciousness [K48] is recommended for the reader interested in details and various philosophical problems and their solutions in TGD framework. Also the chapter about the relationship between biophotons and dark photons is highly recommended.

The new picture allows also much better understanding of quantum biology. The work during the first half of 2013 has allowed to develop in detail several ideas about the role of the magnetic body. Magnetic flux tubes serve as correlates for the formation of quantum coherence and directed attention. The phase transitions changing the value of $\hbar_{eff}$ leading to a change of flux tube length and the reconnections of the flux tubes play a key role in bio-catalysis. The dark photons propagating along MEs parallel to the flux tubes make possible resonant interactions between the entities at their ends and the proposed view about sensory, memory, and cognitive representations relies on hypothesis that the braiding of flux tubes defines negentropically entangled systems representing information which is read consciously and non-destructively in good approximation by using interaction free quantum measurements. Dark photons transform to ordinary photons in energy conserving manner and bio-photons are identified as outcome of this process.

With this background one return to the old question "What is the exact mechanism of homeopathic healing?". I have considered already earlier answers to this question but they have not been completely convincing. It turns out that one manages to add the missing piece to the puzzle by making the simple question "What is the molecular cause of illness and how homeopathic remedy eliminates it?". Amusingly, I could have identified this piece for years ago but for some reason did not pose the correct question.

The resulting model of homeopathic healing is amazingly simple and at the same time a universal model of biocatalysis. The entity mimicking the invader molecules "steals" its cyclotron

frequencies by varying the thickness of magnetic flux tube and thus magnetic field strength and cyclotron frequency until reconnection with the molecule's magnetic body becomes possible and fusion to single quantum coherent system occurs. In TGD inspired theory of consciousness this process corresponds to directed attention and conscious recognition of the presence of the invader molecule. After this the mimicking entity freezes the thickness of the flux tubes in question becoming thus capable of mimicking the invader molecule and attach to the receptors of the invader molecule and steal the attention of the host organism and induce healing.

The results summarized in the book "Applied Biophysics of Activated Water" of Vysotskii et al [**?**] provide a test bench for the proposal and allow to formulate it in a more detailed manner. The basic message of the book is that the activation process yields water with anomalous physical properties including water memory and having highly non-trivial - in general positive - effects on living matter. The identification of activated water as ordered water appearing in cell interior is proposed.

This and the general features of the activation process inspire the question whether the analog of the activation process might have taken place during pre-biotic evolution and generated ordered water making DNA stable. Molecular mimicry making possibly immune system would have emerged at the same step and meant also the emergence of symbolic representations. Also the pairs formed by receptor molecules and molecules attaching to them would have emerged at this crucial step when dark matter enters the game. One of they key questions is whether it is dark water molecule clusters or dark DNA that performs the mimicry of various molecules. The results of the book lend support for the model based on dark DNA.

8.1 Short Summary About "Applied Biophysics Of Activated Water" Of Vysostkii Et Al

Applied Biophysics of Activated Water by Vysotskii et al [**?**] gives a nice summary about the experiments carried out by using what they call activated water. One can say that the experiments provide a strong support for the notion of water memory. In the following I present a short summary about the contents of the book with associations to TGD inspired view about water memory and homeopathy.

8.1.1 The anomalies of the ordinary water

It is well-known that ordinary water is characterized by a large number of anomalies and the existing standard physics models can at best can provide parameterization of the findings but cannot really explain the anomalies. The tough challenge is to not only predict the physical properties (mechanical, electromagnetic, spectral) of water but also to understand the effects of the activation of water on these properties plus the effects of the activated water on living organisms.

The authors describe so called clathrate model introduced already by Pauling. The assumption is that water molecules form tetrahedron like structures having at its vertices dodecahedrons built out of water molecules. This clustering means that the system can be seen as a two phase system consisting of these clusters and "free water".

The key challenge is to understand the relaxation times for various changes of water induced by say electromagnetic fields. The general order of magnitude for the relaxation of mechanical changes is given by so called Drude time, which is about 10^{-13} seconds according to quantum mechanics and thermodynamics. The duration for the changes induced by activation are measured in days to that the discrepancy is 18 orders of magnitude: quite a challenge for a theoretician refusing to consider the possibility that biology and even the physics of water might involve new physics. An interesting observation is that in TGD framework the values of $\hbar_{eff}/\hbar$ can have even order of magnitude of order 10^{18}. Note that the time period associated with photons with 2 eV energy is $.2 \times 10^{-14}$ seconds: this is by a factor 1/50 shorter than Drude time.

1. Could Drude time τ_D be scaled up like $\hbar_{eff}$? This is not possible. Drude time is thermodynamical parameter: essentially the time $\tau_D = a/v_{th}$ taken for proton to move distance of order interatomic distance $a \sim 1$ Angstrom with thermal velocity $v = \sqrt{2T/m_p}$. Drude time does not depend on Planck constant so that the scaling $\hbar \to \hbar_{eff} = N\hbar$ does not affect τ_D. Some other time scale should characterize the stability and duration of the structures

responsible for water memory. Moreover, these structures need not be made of ordinary water molecules. If so, dark protons - giving rise to what I have called dark DNA, RNA, ... - and their magnetic bodies define an a building brick of the needed structures. The earlier proposal inspired by anomalous stoichiometry of water in atto-second time scales indeed is that dark DNA sequences are formed in water.

2. An interesting observation relating to τ_D is that apart from a numerical factor of order one it happens to correspond to a photon energy of.041 eV, which is somewhat below the value of electrostatic energy associated with the membrane potential (and also the energy of thermal photon in physiological temperature). In TGD inspired biology cell membranes are Josephson junctions for electronic super-conductor and the model of high T_c superconductor predicts that the p-adic scaled up electronic Compton length $L_e(151) = 10$ nm defining cell membrane thickness are associated with both high T_c and bio-super-conductivity. The so called Josephson time defining the fundamental period of Josephson radiation given by $\tau_J = 1/f_J = \hbar_{eff}/ZeV$ and scales like $\hbar_{eff}$, and can therefore be very long. Also cyclotron times characterizing magnetic bodies are very long as compared to Drude time. Could these time scales replace Drude time?

3. Activated water is reported to contain polarized layered structures. The proposal is that activated water is actually ordered water appearing inside living cell. Living cell is filled by membrane like layered structures of thickness given by $L_e(151) = 10$ nm with voltage over the membrane given by membrane potential. Could the polarised layers of activated water be predecessors of cell membranes? Could Drude time be replaced with the fundamental period of Josephson radiation given by $\tau_J = 1/f_J = \hbar_{eff}/ZeV$ and by cyclotron times $\tau_c = 1/f_c$, $f_c = ZeB/2\pi m$ depending on charge and mass of charge superconducting object?

4. The electric field over cell membrane is very strong and one can argue that so strong an electric field cannot prevail in water. This might be the case. The problem could be however circumvented by assuming that the layers are thicker but have same voltage over them.

8.1.2 Basic notions related to water activation

In the second chapter authors discuss the basic conceptual framework behind water activation. They introduce the notions of fractalization, complementary, and the existence of a lattice like structure formed by membranes that act as barriers.

1. The notion of fractalization is rather easy to understand. Fractal growth reducing to a scaling of the overall size is basic example of this. The basic question concerns the mechanisms making possible fractal growth, and the replication of existing basic structures is a natural basic mechanism. For a layered structure this would mean the division of layer two two thinner layers, which then grow to the original size. This kind of mechanism might be at work also in the activation of water and in manufacture of a homeopathic remedy.

2. Complementary remained somewhat fuzzy notion to me. It is stated that it means minimization of contradictions: this brings to my mind Marxist philosophy and Hegelian dialectics. What comes in my mind are spin glass like systems characterized by large degeneracy of ground states with same energy. In TGD framework the vacuum degeneracy of Kähler action strongly suggests 4-D variant of spin glass degeneracy.

3. Biology is full of lattice like structures formed by membranes dividing the world into interior and external parts and serving as barriers. Cell membranes and endoplasmic reticulum [I2] inside cell are basic examples of this kind of structures.

8.1.3 MRET

MRET is a shorthand for Molecular Resonance Effect Technology used to activate water. Reader is encouraged to consult the book to get more detailed view about MRET.

1. Activation process involves irradiation of a cylinder containing polymer compound using optic pulses with frequency varying in ELF range 7-8 Hz arriving in vertical direction from above. One could also speak about slow modulation of visible light beam using ELF frequency. The cylinder contains transversal magnets generating magnetic fields inside the polymer compound. The vessel containing the water is below the cylinder.

2. The cylinder containing a complex polymer compound characterized by fractal volumetric matrix. This structure consists of linear polymers in parallel giving rise to lattice like structure. The polymers are liquid crystals and piezo-electrics transforming electromagnetic radiation to mechanical oscillations and vice versa. Epoxy is mentioned as an example of a polymer used in activation.

   There are three horizontal magnets inside the cylinder. The value of the magnetic field inside the polymer varies but is at most of order 100 Gauss. At distance of about 3 cm from the polymer the field in water has order of magnitude of 10 Gauss and is reduced rapidly with distance. In the approximation as a sum of three dipole fields created by horizontal magnets the field decreases as $1/r^3$ where r is the distance from the dipole approximating the three parallel horizontal magnets. In the first rough approximation the field lines of the magnetic field are horizontal in the water sample. In TGD framework the topological quantization of the magnetic fields is an important additional factor and could be highly relevant for understanding how the layered structure of the polymer is transferred to that of the activated water.

3. The structure of the polymeric compound is rather complex. The geometric structure is that of a fractal volumetric matrix - as authors state it. The structure contains nano-rings forming larger rings with 10 nm size scales and these in turn form larger rings. The sizes of the larger rings are reported to vary from 100 nm to 1000 nm. The polymer contains also various metal ions. The field patterns generated or modulated by this structure - in particular magnetic fields - should reflect the structure itself and could transfer some of it to the structure of the activated water.

8.2 Physical Effects Of Activation And Biological Effects Of Activated Water

8.2.1 Physical effects of the activation

The book reports the effects of the variation of various parameters on the properties of the activated water. Some variable parameters are the duration of the activation and the storage time. The general observation already mentioned and in blatant conflict with the quantum theory prediction is that the changes can last for days.

1. Long range correlations lasting for even days are induced in water. Layered structures consisting of polarized layers are generated with strong hydrogen bonding inside layers which have very weak mutual couplings. Mechanical, electrical, and spectral properties of water are affected. Viscosity can be anomalously low: this could be understood if the layer like structures having very weak coupling between them flow as almost independent units without mutual viscosity. Conductivity is reduced: for currents orthogonal to the layers this could be understood if charge carriers tend to be confined inside layers. Di-electric constant is modified at low frequencies. Long lasting pH oscillations of activated water are observed.

2. It is stated that that the stoichiometry of water is affected but details are not given. It is mentioned that the effect on water is probably on protons of the water atoms and the lattice structure formed by them. It is stated that the effect of activation is also on proton spins and currents associated with hexagons of water molecules.

3. The activation process is known to generate ELF em fields with frequency spectrum in the range $[f_1, f_2] = [.1\ Hz, 1\ kHz]$. The mechanism is not understood but the properties of the polymer compound must be partially responsible for this.

8.2.2 The biological effects of activated water

Most chapters of the book are devoted to the biological effects of the activated water. In general, the effects tend to be positive from the point of view of patient.

1. The effect of the activated water on plants - especially vegetables and crops - is studied. The activated water tends to promote their growth. One interesting finding is that activated water inhibits the growth of callus.

2. The effects on microbiological systems is investigated. The effect on cell cultures and cell cultures involving multifunctional symbiosis are studied. Both aerobic and anaerobic systems are considered. A general observation is that reductase activity grows. Reductase is an enzyme catalysing reductase (oxidation) reaction in which oxidation states of atoms are changed. Simple examples are oxidation of carbon to yield carbon dioxide and oxidation of glucose taking place in respiration. The effect of antibiotics is affected and can either increase of decrease. Bactericidal properties are enhanced: the growth of pathogenic cell cultures is inhibited, and the proposal is that activation could be used to sterilize water.

3. The effects of the activated water on prophylaxis (prevention of diseases) and on oncogenic diseases (cancer) are studied using animal models and cell cultures. It is found that the growth of certain kinds of tumours slows down and the life expectation increases. No negative side effects are found. There are also positive effects on immune system. The number of lymphocytes grows and the index characterizing cytotoxic activity increases. The dependence of effects in parameters like the duration of treatment by activated water and mode of treatment (before or after the incubation).

4. The effects of the activated water on staphylococcus infection are investigated in vivo using mice as an animal and in vitro using staphylococcus cell culture.

The general conclusion is that the treatment by activated water promotes healing, the antitumoral effect of lymphocytes with natural killing properties, and bactericidal properties. It inhibits the grows of tumor tissues, lengthens the life expectation of sick animals and prevents the growth of callus tissue. The conclusion is that activated water could have applications in both medicine, biology, biotechnology, and agriculture.

8.3 The Basic Ingredients Of TGD Inspired Model Of Water Memory

8.3.1 Magnetic body and the hierarchy of effective Planck constants characterizing dark matter

1. The notions of magnetic body and flux quantum - in particular flux tube carrying dark matter, and cyclotron frequencies whose collections serve as passwords are basic elements of TGD inspired quantum biology. The contraction of magnetic flux tubes in the phase transitions changing the value of $\hbar_{eff}$ and therefore the length of flux tubes is the first basic process. Reconnection is second basic process allows the magnetic bodies to get in contact and rearrange so that the two distant systems can fuse to single macroscopic quantum system.

2. The formation of flux tube connection is interpreted as a geometric correlate for attention in TGD inspired theory of consciousness and the proposal is that consciousness is present already at the bio-molecular level - maybe even at elementary particle level. Reconnection is possible if local magnetic fields and therefore cyclotron frequencies of the two flux tubes are identical so that resonance interaction by dark cyclotron photons follows as a consequence. The tuning of the local magnetic field by varying flux tube thickness would be an essential element in searching of molecules possibly present in environment. The finding of molecule would mean a generation of flux tube connection and resonant interaction and also consciously experience "sense of presence". After this a shortening of the flux tubes by $\hbar_{eff}$ reducing phase transition could take place and allow biomolecules or even more general entities to get in a contact allowing short range interactions such as chemical reactions. These would be the basic new physics elements in the TGD based description of bio-catalysis.

3. This picture allows also to understand the mechanism of water memory and homeopathy. Suppose that some structures in the water - perhaps water clusters with hydrogen bonds accompanied by flux tubes or dark DNA to be discussed - are able to vary the flux tube lengths of their dark magnetic body and in this manner consciously detect invader molecules. After having identified the invader they cold freeze the length of the flux tube fixed and gain the ability to mimic the biologically essential aspects of the invader molecule coded by its cyclotron frequencies coded in turn by the field strengths constant along flux tubes in the first approximation (this is of course only a simplifying assumption). For instance, they can effectively replace invader molecules in organism in the sense that the receptors usually accepting the invader accept also the fake invaders meaning that invaders loose the attention of the host organism. This could be the basic mechanism of homeopathic healing. The cheating mechanism has many variants since also fake variants of the ordinary biomolecules are possible. Dark DNA actually could be seen as example of this kind of structure.

4. Hydrogen bonds are certainly one factor making water so special. A natural candidate for the flux tube performing mimicry would be a flux tube accompanying hydrogen bond and one could consider the possibility that dark flux tube corresponds to a dark hydrogen bond between dark protons.

5. The original model for the water memory and homeopathic healing was more complex. The idea was that water molecule clusters or dark DNA "steals" the magnetic body of the invader molecule. The idea was that ordered water forms an "ice" layer around the invader molecule and magnetic body of the invader molecule attaches to this. After that the magnetic body associated with the layer would be "stolen". This is however un-necessarily complicated. For biological purposes (ability to reconnect with molecules able to reconnect with the invader) it is enough to steal/copy the cyclotron frequencies and the tuning mechanism makes this possible. The topologies and geometries of the two magnetic bodies can be quite different: only the identical values of local magnetic field is required.

6. One should keep mind open for a great variety of mimicries since dark magnetic body characterizes all ordinary matter systems, and the mechanism of attention making possible conscious recognition of other molecules and their subsequent mimicry is completely general. This would conform with the vision about Universe as a topological quantum computer and with the idea that the basic characteristic of a computer is ability to emulate, mimic. Note however that it requires $\hbar_{eff}/\hbar = N > 1$ and is not possible for ordinary matter: dark matter in TGD sense is required.

8.3.2 Negentropy Maximization Principle and dark matter hierarchy

In its recent form NMP [K26] is assumed to apply only in the rational intersection of the real and p-adic worlds, which for quantum states means that they are superpositions of pairs with identical entanglement probabilities $p = 1/N$. The number theoretic Shannon entropy indeed makes sense only in this intersection unless one identifies the integer valued p-based logarithm of p-adic norm as p-adic integer. For a generic entanglement one only requires that state function reduction gives rise to a measurement of the density matrix. This assumption implies that the final state is a maximally entangled system involving superposition of N states with identical and obviously rational entanglement probabilities $p = 1/N$.

According to the recent interpretation the hierarchy of effective Planck constants $\hbar_{eff} = N\hbar$ corresponds geometrically to N-furcations for space-time sheets made possible by the failure of the strict determinism of Kähler action and producing physically essentially identical copies of the system. The negentropic entanglement central in TGD inspired biology corresponds to entanglement of two systems of this kind with density matrix equal to $N \times N$ unit matrix (see **Fig.** `http://tgdtheory.fi/appfigures/cat.jpg` or **Fig. ??** in the appendix of this book). State function reduction as a measurement of density matrix can lead to this kind of density matrix stable under NMP. By NMP real-to-padic transitions giving rise to cognitive representations can take place only to p-adic sector for which the power of prime dividing N is largest among the prime power divisors and cognition is possible only for large for systems with $N > 1$ and therefore not for the ordinary matter.

Clearly, several ideas are unified: quantum criticality as a presence of N degenerate states realized by space-time sheets of N-furcation, negentropic entanglement, hierarchy of Planck constants, and the idea about life as something in the intersection of real and p-adic worlds ($p = 1/N$ is rational number). Furthermore, the measurement of density matrix automatically leads to exact criticality. In dynamics without state function reduction criticality is approached only asymptotically. Note that in self-organized criticality [**?**] the criticality corresponds to a minimum of potential with some flat directions in which the situation is non-deterministic at criticality.

8.3.3 How Akashic records are read?

The recent view about TGD inspired theory of consciousness [K48] involves besides dark magnetic bodies also dark photons. Dark photons have $h_{eff}/h = n > 1$. The model for sensory, memory and cognitive representation as a realization of the reflective level of consciousness identifies these representations as approximate invariants of quantum jump sequence formed by negentropically entanglement systems defining kind of Akashic records. The approximate invariance is guaranteed by NMP. In ZEO quantum jumps can occur at both boundaries of CD and can add additional tensor factors to the negentropically entangled system representing "Akashic records".

How could one read "Akashic records"? The original conjecture was that the so called interaction free measurement (see `https://en.wikipedia.org/wiki/ElitzurVaidman_bomb_tester`) could make this possible.

1. Interaction free measurement has been described in a concrete manner as a method to determine whether bomb is dud or active. There are four detectors at corners of a square abcd. The mirrors at a and d reflect and transmit. The mirrors at b and c only reflect. There are two detectors C and D at d and one can arrange that for a superposition of photon paths a destructive interference occurs at C (no firing) whereas D fires. If one has only path acd either C or D fires. For path abd bomb explodes as photon is absorbed.

2. Active bomb at path ab acts as an ordinary measurement apparatus and reduces a superposition of two photon paths abd and acd to either of them. If the resulting path traverses detector (abd), an explosion occurs. Otherwise (acd) not. Dud cannot absorb the photon - it cannot act as a detector - and leaves the super-position of photon paths un-affected. If C fires, one can conclude that the bomb was active. If bomb is dud D fires. Otherwise one cannot be certain. One can optimize the measurement so that ideally no explosions occur and all active bombs are detected.

   What is important that ordinary state function reduction occurs for the superposition of photon paths also in the interaction free measurement. What is deduced from the interaction free measurement is whether bomb can act as ordinary measurement instrument (active) or not (dud). In particular, one cannot determine entanglement without reducing it, as I erratically assumed first.

   The bomb serves as a metaphor for a two-state system with photons exciting the higher energy state provides the system. Higher energy state corresponds to the dud and lower energy state to active bomb.

3. I have given up the idea about interaction free measurement as a manner to determine what negentropic entanglement is. In the recent formulation of TGD inspired theory of consciousness one can and must assume that the reading of the "Akashic records" is a key aspect of conscious experience. In Zero Energy Ontology the negentropic entanglement is associated with the boundary of causal diamond (CD) not affected in the sequence of state function reductions leaving that state at it (Zeno effect) unchanged whereas the state at opposite boundary changes as also the position of the opposite boundary, whose distance from the lower one increases reduction by reduction: this gives rise to the experienced flow of time. The changing boundary contributes to the conscious experience sensory input and everything induced by it - "Maya". The un-changing boundary corresponds to experience about having unchanging self.

8.3.4 Dark DNA

I ended originally to the notion of dark DNA by what looks a pure accident. I considered a model for what dark proton (or nucleon) could be, and had in mind that nucleus would be a string of dark nucleons as a generalization of nuclear string model [L1] developed already earlier. The surprising finding was that the states of dark proton in the simple model correspond in a natural manner to DNA, RNA, tRNA, and amino-acids: in case of tRNA the number of states is predicted to be smaller than 64. Even more, vertebrate genetic code as an assignment of DNA codons to amino-acids followed from simple assumptions. This raised the question whether genetic code and the counterparts of biomolecules could be realized already at the level of dark nuclear physics as sequences of dark protons or neutrons or both. If this were the case, then biological life could be seen as a kind of chemical emulation of the life at this more fundamental level.

The natural question is whether the dark variants of biomolecules can be transformed to their ordinary counterparts and vice versa by processes analogous to transcription and translation. If so, one can consider a possibility of R&D department of biology performing experimentation with dark variants of biomolecules. The biological evolution in this framework would not be due to a random mutations followed by selection performed by environment but a guided and controlled process analogous to what happens in the evolution of technology. Basically the question is about whether the Nature so silly that it decides to develop a highly refined technological product such as computer by throwing some silicon and metals to jungle and patiently waiting for them to self-organize to a computer.

The basic unit of dark DNA would be proton. The states of single dark proton would corresponds to DNA, RNA, ..etc. One can imagine dark DNA double strands and the finding Hu and Wu [J14] that proton pairs with distance of 10 nm associated with opposite lipid layers of cell membrane correspond to an analog of cyclotron frequency in EEG range, suggest that the pairs of protons located at opposite sides of cell membrane give rise to dark DNA double strands. The protons would be connected by a "short" flux tube and also a "long flux" tube outside the structure is needed to obtain closed flux lines: this could be of course avoided by assuming wormhole flux tube consisting of parallel flux tube space-time sheets extremely near to each other and having same M^4 projection and carrying opposite fluxes. If the "long" portion of the flux tube is present as assumed in the model of "Akashic records", it carries the cyclotron Bose-Einstein condensate allowing to consciously read the records realized in terms of the braiding of the short portions of flux tubes. This is certainly not the only possible option. The flux tube portions connecting dark protons to ordinary DNA could also carry the braiding serving as a correlate for the negentropic entanglement. This alternative conforms with the vision about DNA as topological quantum computer [K14].

The stability of the highly charged sequence of dark proton pairs is of course a problem. The lipids could carry the stabilizing charge: phosphates serving as the energy carrying part of ATP are in general negatively charged and this could stabilize the system formed in this manner. Note that also DNA double strand is negatively charged due to the presence of phosphates: the stability is in fact a challenge for a theoretician. One possibility is that dark protons with large value of Planck constant participate in the stabilization of the double strand.

The anomalous stoichiometry of water at atto-second time scale could be due to the formation of dark sequences of protons. Suppose that the manufacturing of the homeopathic remedy produces ordered water having layered structure and that these layers are analogous to cell membranes and that double dark DNA strands are formed at the both sides of the layer. Coulombic stability is an important factor. For arrangement of type NP-NP-NP... the oppositely charged neighboring outer surfaces of the layers would stabilize the system. For PN-NP double layer the stabilization might be due to the presence of dark protons attached to the two outer surface of type N. In this case one would have a system analogous to two lipid layers. Note that also negative charges, presumably electrons would be required to stabilize the system.

If one takes homeopathy seriously, one can deduce an argument favoring not only dark DNA but requiring also its evolution: this argument will be discussed later. The basic problem is that continual dilution of the water in the preparation of the homeopathic remedy leads also to an extremely low density of the entities able to mimic the magnetic body of the molecules initially present. This is true also for dark DNA unless dark DNA is able to replicate or at least transcribe to dark RNA in turn transcribing to dark DNA. The replication mechanism could be similar to

that of ordinary DNA and rely on the reconnection of flux tubes.

8.3.5 Brain metabolic DNA as an indication for genomic R&D based on dark DNA

I learned a lot in SSE-2016 conference. For instance, the notion of brain metabolic DNA (BMD) about which Antonio Giudetta had a nice poster was a new notion to me. TGD suggests active R&D like process driving genetic evolution and I have been a little bit disappointed since epigenetics is too passive in this respect. BMD would fit with my crazy speculations.

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

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

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

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

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

1. The experiments of Montagnier et al [L3] [L3] suggest that remote replication of DNA involving sending information about the template strand using light is possible. Peter Gariaev's group has made similar claims much earlier. Together with Peter Gariaev we published an article in Huping Hu's journal DNADJ about remote replication of DNA before the work of Montagnier [K52] (see `http://tinyurl.com/gnj5bxh`.

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

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

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

   (a) The proposal is that genetic code has realization at the level of "dark" nuclear physics [L25] (see `http://tinyurl.com/jgfjlbe`). Dark DNA would correspond to dark proton sequences having interpretation as dark nuclei. Darkness would mean that the protons are in phase with non-standard value of Planck constant given by $h_{eff} = n \times h$, n integer which can vary. The value of h_{eff} learns as a kind of intelligence quotient since it tells the scales of long term memory and intentional action and also the size scale of the system). It could serve as intelligence quotient of cells and pyramidal neurons generating EEG as Josephson radiation (frequency of Josephson radiation is $f = 2eV/h_{eff}$ in terms of membrane potential V) could be the neuronal intellectuals).

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

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

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

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

8.3.6 Is dark DNA dark also in TGD sense?

I encountered a highly interesting article about "dark DNA" hitherto found in the genome of gerbils and birds, for instance in the genome of of the sand rat living in deserts (see `http://tinyurl.com/y8zdgnej`). The gene called Pdxl related to the production of insulin seems to be missing as also 87 other genes surrounding it! What makes this so strange that the animal cannot survive without these genes! Products that the instructions from the missing genes would create are however detected!

According to the ordinary genetic, these genes cannot be missing but should be hidden, hence the attribute "dark" in analogy with dark matter. The dark genes contain A lot of G and C molecules and this kind of genes are not easy to detect: this might explain why the genes remain undetected.

A further interesting observation is that one part of the sand rat genome has many more mutations than found in other rodent genomes and is also GC rich. Could the mutated genes do the job of the original genes? Missing DNA are found in birds too. For instance, the gene for leptin - a hormone regulating energy balance - seems to be missing.

The finding is extremely interesting from TGD view point, where dark DNA has very concrete meaning. Dark matter at magnetic flux tubes is what makes matter living in TGD Universe. Dark variants of particles have non-standard value $h_{eff} = n \times h$ of Planck constant making possible macroscopic quantum coherence among other things. Dark matter would serve as template for ordinary matter in living systems and biochemistry could be kind of shadow of the dynamics of dark matter. What I call dark DNA would correspond to dark analogs of atomic nuclei realized as dark proton sequences with entangled proton triplet representing DNA codon. The model predicts correctly the numbers of DNA codons coding for given amino-acid in the case of vertebrate genetic code and therefore I am forced to take it very seriously [L25, L24] (see `http://tinyurl.com/jgfjlbe` and `http://tinyurl.com/ydb2tfy8`).

The chemical DNA strands would be attached to parallel dark DNA strands and the chemical representation would not be always perfect: this could explain variations of DNA. This picture inspires also the proposal that evolution is not a passive process occurring via random mutations with survivors selected by the evolutionary pressures. Rather, living system would have R&D lab as one particular department. Various variants of DNA would be tested by transcribing dark DNA to ordinary mRNA in turn translated to amino-acids to see whether the outcome survives. This experimentaiton might be possible in much shorted time scale than that based on random mutations. Also immune system, which is rapidly changing, could involve this kind of R&D lab.

Also dark mRNA and amino-acids could be present but dark DNA is the fundamental information carrying unit and it would be natural to transcribe it to ordinary mRNA. Of course, also dark mRNA could be be produced and translated to amino-acids and even dark amino-acids could be transformed to ordinary ones. This would however require additional machinery.

What is remarkable is that the missing DNA is indeed associated with DNA sequences with exceptionally high mutation rate. Maybe R&D lab is there! If so, the dark DNA would be dark also in TGD sense! Why GC richness should relate to this, is an interesting question.

8.3.7 What replication could mean?

One can consider several meanings for replication central for living system.

1. Clays have been proposed by Cairns-Smith (see `http://en.wikipedia.org/wiki/Graham_Cairns-Smith#Clay_hypothesis` [I12] as a candidate for predecessors of life. The reason is that silicon which is the building brick of clay minerals has a chemistry similar to that of carbon and allows very rich repertoire of polymers. The division of clay layer to two layers growing after that to the original size could be seen as very simple replication mechanism. Similar mechanism might apply in ordered/activated water containing water layers.

2. The replication of dark DNA has been already mentioned. It could be analogous to a production of dark RNA in which only second strand serves as a template or genuine replication in which both strands replicate. The description would be in terms of reconnection the dark protons having flux loops come between the two dark DNA strands and reconnect with the flux tubes connecting the dark protons of strands. At the same time the analogs of valence bonds in longitudinal direction giving rise to dark nucleus as nuclear string emerge. After this a de-reconnection takes place and one obtains the analog of RNA strand besides the original DNA. A more complex process involves the same process for both strands and corresponds to DNA replication.

   Note that the intensity of the flux associated with flux tubes must be same for all dark DNAs coding same dark amino-acid and for dark DNA coding corresponding RNA. Therefore dark variants of fundamental biomolecules correspond to frequencies. If also ordinary biomolecules are coded by same frequencies, the analogs of transcription and translation processes between ordinary and dark variants of biomolecule become possible by reconnection-contraction mechanism.

   As noticed, the replication of dark DNA could induce the replication of corresponding layer, say, by inducing Coulomb instability.

8.4 TGD Inspired Model For Homeopathy

8.4.1 Does homeopathic remedy mimicking the pathogenic molecules prevent the chemical reaction causing the illness?

After a work of more than decade after the realisation that homeopathy might be understood in TGD Universe, I still find that I have not given an absolutely convincing answer to the question "What is the exact mechanism of homeopathy?". The basic rules is that "like cures alike". Why should this be the case? Let us go our arguments through once again.

1. Certainly the imprinting of water using molecules causing the illness - call these molecules just I for brevity - must be an essential part of the healing mechanism. The imprinting means imprinting of water with some frequencies in the low frequency spectrum of I. The TGD inspired idea is that the magnetic body of appropriate water cluster or even dark nucleon sequence representing DNA sequence, call this entity I^*, is able to mimic I in the sense that its cyclotron frequency spectrum is same.

2. This in turn strongly suggests that the molecules in the organism to be healed - call them P - have a long range interaction with molecules I induced by dark photons with cyclotron frequencies but having energies above thermal threshold. The interaction involves a formation of a magnetic flux tube accompanied by a parallel topological light ray/"massless extremal" (ME) along which dark photons at specific resonance frequencies propagate and induce resonant interaction between P and I. Thus both the formation of flux tube bridge and the resonant interaction made possible by it, would be essential for the homeopathic healing to take place. In fact, in TGD inspired theory of consciousness [K48], the formation of resonating flux tube connections makes possible the quantum coherence for the combined system $I + P$ and serves as a correlate for attention between I and P.

3. The presence of the entities I^* able to mimic the cyclotron frequency spectrum of I and forming resonant flux tube bonds with molecules H is however not enough to explain the healing effect (I have already considered some answers but they do not convince me). To understand this, one must be able to understand how I causes the illness. The answer of the standard medicine is that the mechanism is chemical and thus requires contact interaction

between I and P. It is easy to believe this. Standard medicine also tells that in order to prevent the chemical interaction between I and P, one must use some medicine molecules M, preventing this chemical interaction. It is easy to believe also this.

In TGD Universe there is indeed a very natural mechanism preventing the chemical interaction between I and P. The reduction of the value of the effective Planck constant associated with the flux tubes connecting I and P leads to a contraction of the flux tube length (proportional to $\hbar_{eff}$). This indeed makes possible a chemical contact interaction between both I and P causing the illness. In fact, I have proposed this mechanism as a completely general mechanism of catalyst action allowing biomolecules to find each other in the dense bio-molecular soup. But this holds true also for I^* and P! Using terms of "molecular psychology", the entities I^* mimicking I steal the attention of molecules P so that molecules I cannot cause the illness anymore!

This indeed looks extremely simple and natural and thus also convincing. What is important is that the proposed mechanism is not in conflict with standard medicine: it only makes possible the miracles of bio-chemistry and provides a completely new mechanism of healing. It is easy to imagine that a new kind of medicine using only water imprinted by the cyclotron frequency spectra of molecules responsible for the illness. This medicine would be completely free of the negative -basically chemical - side effects of the ordinary drugs. This mechanism would also use all the knowledge gained by ordinary biochemistry based medicine: if the relevant molecule I is known, it can be used to imprint water to get I^*.

Also the effect of vaccines could rely on the "like cures alike" mechanism albeit in different form. Now the molecules or organisms - call them just B - causing the disease would be injected directly into the body rather than water. Water memory could give rise to a mimicry of B: s and give rise to primitive immunity. A more refined mechanism proposed earlier would involve dark DNA mimicking B: s and translating to ordinary DNA sequences coding for proteins able to catch B: s by the same flux tube mechanism.

The proposed mechanism of homeopathic healing leaves open the exact mechanism behind the cyclotron mimicry. The entities I^* could be water clusters with magnetic bodies mimicking those of I, they could be water clusters which have stolen the magnetic bodies of I, or they could be even dark DNA accompanying water molecules and able to mimic I. Of course, the least science fictive option is that the possibly existing dark DNA couples only with ordinary DNA by the flux tube mechanism.

Above I have defined illness as something caused by the detrimental chemical activities induced by invader molecules attaching to the receptors at cell membranes. This definition is too restrictive since it excludes genetic diseases. In this case, the removal of the cause of disease requires genetic engineering. If the universal reconnect-and-contract mechanism makes is possible to transcribe dark DNA to DNA, a new kind of genetic engineering can be imagined since the dark variants of biomolecules connected by flux tubes to cell interior could leak through the cell membrane serving as a barrier for larger biomolecules. A mechanism replacing a portion or damaged DNA with an undamaged one would be needed besides reconnect-and-contract mechanism. Also this mechanism could use reconnect-and-contract as a basic building brick it is easy to see by considering single DNA nucleotide as a simplified example. These mechanisms would also transform evolution by random mutations in presence of environmental pressures to a guided and controlled process involving experimentation with dark DNA defining kind of virtual DNA. A slight-modification of this mechanism would transform damaged DNA portion to intron and add near it the transcription of dark DNA as exon. To transform exons to introns one must one understand the distinction between them. TGD inspired proposal is that exons carry an electric field parallel to them whereas for introns there is no electric field. The control of this field - perhaps by manipulating electric charges generating it - is what comes in mind.

The interpretation of bio-photons as decay products of dark photons in energy conserving phase transition $\hbar_{eff} \to \hbar$ [K46] suggests that the dark photons involved with the communications have rather large value of $\hbar_{eff}$ given by $\hbar_{eff} = f_h/f_l$. The simplest working hypothesis is that dark photons have same energy spectrum as bio-photons. The prediction would be that bio-photon spectrum from a homeopathic remedy - in particular its fluctuations - should correlate with the spectrum of the cyclotron frequencies. A weaker hypothesis is that the energies of dark photons are above thermal energy at physiological temperature.

8.4.2 What is the role of agitation in the preparation of the homeopathic remedy?

What could then be the role of agitation in the manufacture of the homeopathic remedy?

1. The mechanical agitation accompanying dilution could feed the energy forcing the replication of dark DNA. This process could be accompanied by the division of water layer to which dark DNA double strand is associated to two layers which eventually grow to the original size. Clearly, the division of the water layer involving replication of dark DNA would be the analog for cell division.

2. Could the mechanical agitation serve as an "environmental catastrophe" driving the evolution of dark DNA (and possible other dark variants of biomolecules evolving in the process). Could this evolution correspond to a gradual increase of $\hbar_{eff}$? This can be the case if the dark photons involved can have also sub-thermal energies. In this case the evolution would mean increase of the energy of dark protons so that it would be eventually that of ordinary visible photons. The proposal that amplitude modulation produces dark photons would however suggest that the value of $\hbar_{eff}$ is large from beginning.

   Of course, it is also possible that energy conserving transformations of dark photons to dark photons $\hbar_{eff} = N_1\hbar$ such that N_1 divides N are possible. One must be very cautious in making strong conclusions since the value of N for dark photons is very large and need not be identical for that for dark protons for which $\hbar_{eff} = N_p\hbar$ is expected to be roughly the ratio of cell membrane thickness to Compton length of ordinary proton and much smaller. It could well be that N_p is relatively small factor of N.

3. There is an interesting connection with Mersenne primes. The integers $P_n = (2^n - 1)2^{n-1}$, where $M_n = 2^{n-1}$ Mersenne prime, are known as perfect numbers which by definition are sums of their proper divisors: the number $P_3 = 28 = 1 + 2 + 4 + 7 + 14$ is an example. P_n contains very large number of divisors as is clear from the presence of a power of 2. Also Mersenne prime itself divides perfect number. Hence, if one wants to produce a dark system with very large number of different values of Planck constant, $N = P_n$ is the proper choice. The number of divisors proportional to power of 2 is large also for the modulus of the analog of perfect number associated with Gaussian Mersenne.

   What is especially interesting from the point of view of p-adic length scale hypothesis is that the values of Planck constant 2^k up to $k = n - 1$ are obtained. For $M_7 = 127$ powers of 2 put to $2^6 = 64$ are obtained and this might relate to genetic code. For M_{127} powers up to 2^{126} are obtained: this Mersenne corresponds to the proposed memetic code [K18].

   Mersenne primes are the most important p-adic primes in TGD framework and label various scaled variants of hadron physics, weak gauge bosons, as also electron and tau lepton. Muon is labelled by Gaussian Mersenne. Could it be that Mersenne primes are favored because they give rise to maximally complex dark matter systems giving rise to cognition?

8.5 TGD Based View About The Activation Of Water

There are several questions to be answered if one wants to understand what happens in the activation of water and the properties and effects of the activated water. Could the model for water memory and homeopathy apply to water activation and to the biological effects of the activated water? Could the water produced in homeopathic process be actually activated water (this should be easily testable)? Could the observations allow a more detailed model of homeopathy? Could the emergence of ordered water inside cell interior stabilizing DNA be understood as a process in which the environment manages to mimic the activation process and activates ordinary water. In the following these questions are considered in TGD framework.

The basic TGD based claims about activation process inspired by previous considerations are following.

1. Amplitude modulation produces dark photons and magnetic flux tubes containing dark particles and having at their ends dark protons. The emerging values of $N_i = \hbar_{eff}/\hbar$ are factors of corresponding integer defined by the ratio of modulated and modulating frequencies which should be integers with maximal number of factors to obtain optimal situation. Perfect

numbers associated with Mersenne primes are optimal in this respect. Also the analogs of perfect numbers defined as moduli of $P_{G,n} = ((1+i)^n - 1)(1+i)^{n-1}$ for Gaussian Mersennes $M_{G,n} = (1+i)^n - 1$ could be optimal choice since the modulus is proportional to $2^{(n-1)/2}$.

2. Activation produces ordered water with layered structure and dark DNA strands consisting of sequences of dark protons at opposite sides of the layer are formed. The flux tubes associated with them can have varying thickness and this makes possible conscious recognition (at level of dark DNA) of the external molecules via reconnection process and copying its cyclotron frequency. This in turn makes it possible for the molecule to mimic the invader molecule and attach to the same receptors as invader. This would be a fundamental biochemical process involving conscious experience and also intelligence!

3. The electrolysis of water and also cavitation produces what is known as Brown's gas which should consist of water vapour. The properties of Brown's gas [H2] however do not support this interpretation: for instance, Brown's gas has temperature of about 130 C but is able to melt metals so that some un-known mechanism liberating energy must be involved explaining also the claims about over-unity energy production in water splitting using electrolysis. TGD inspired model for Brown's gas [K22] suggests that activated water and Brown's gas correspond to same phase involving polymer sequences formed from exotic water molecules for which one hydrogen nucleus is dark and defining the analogs of basic biopolymers. The bond binding protons to a polymer like sequence would serve as the counterpart of covalent bond.

   One also ends up with a more detailed TGD inspired view about basic mechanism of metabolism in living matter predicting a tight correlation between p-adic length scale hypothesis and hierarchy of Planck constants. The model differs in some aspects from the rough models considered hitherto assuming that metabolic energy is liberated as zero point kinetic energy when particle drops to a larger space-time sheet or as cyclotron energy when cyclotron quantum number decreases. Now a phase transition increasing the p-adic length scale of the space-time surface would liberate either kinetic energy of cyclotron energy. Quantum numbers would not change: rather, t the scale appearing as a parameter in the expression of kinetic or cyclotron energy would change adiabatically and in this manner guarantee coherence. Also a phase transition in which the changes of scale due to a reduction of Planck constant and increase of the p-adic length scale compensate each other liberate metabolic energy.

8.5.1 Does the activation process generate dark photons?

As explained, the activation process involves irradiation of the polymer cylinder in vertical direction from above using optic pulses with frequency varying in ELF range 7-8 Hz in the arrangement described. One could also speak about slow modulation of visible light beam using ELF frequency.

I have proposed this kind of modulation process as a manner to produce dark photons with large value of $\hbar_{eff}$ given by $\hbar_{eff})/\hbar = N = f_h/f_l$ where f_h and f_l are the high and low frequency respectively. I have also proposed that the process transforming high frequency ordinary photons to ordinary photons with the same energy could be essential also for the imprinting of water by certain frequencies [J5]. Gariaev's finding about transformation of visible light to radio-waves could also take place via this process: now DNA would produce the low frequency radio-wave modulation modulating visible light beam and in this manner produce dark radio photons having biological effects. Biophotons would result in the reversal of this transformation for large $\hbar_{eff}$ photons. There is experimental evidence for a correlation between fluctuations of EEG spectra and biophoton spectra so that EEG photons would represent one example of dark photons [K46, K47].

The frequency band for ELF frequencies contains Schumann resonance $f_S \simeq 7.8$ Hz. This might not be an accident. In TGD inspired theory of consciousness self hierarchy is a basic prediction and "Mother Gaia" as a higher level in the self hierarchy corresponds to the Earth's topologically quantized magnetic field. The flux quanta of personal magnetic bodies would reside inside the magnetic flux quanta of Mother Gaia and this would give rise to interaction between Mother Gaia and individual conscious entities.

Besides the Earth's magnetic field also the magnetic field created by the magnets inside polymer is present in the water sample and a good guess it has a crucial role in water activation. These flux

quanta need not however correspond to the flux tubes responsible for the water memory. Rather, flux sheets could be in question and they could define templates for the layers of the ordered water.

The polymer compound has fractal layer structure and contains nano-rings, rings or rings with size 10 nm, and rings made of these having sizes in the range 100-1000 nm. This length scale hierarchy brings in mind the existence of as many as 4 Gaussian Mersenne primes $M_{G,n} = (1+i)^n - 1$, $n = 151, 157, 163, 167$ with corresponding p-adically scaled up electron Compton lengths in the range $L_e(151) = 10$ nm -$L_e(167) = 2.5$ μm. $L_e(151)$ corresponds to cell membrane thickness and also to the thickness of the coil formed by DNA. This scale appears repeatedly in biology. Also TGD inspired model for high T_c superconductivity involves this scale. The length scales corresponding to $L_e(k) = \sqrt{5}L(k)$, $k = 157, 163, 167$ are obtained from $L_e(151)$ by scaling with $2^{(k-151)/2}$. Note that $L_e(167) = 2.5$ μm corresponds roughly to the size of cell nucleus.

8.5.2 Effects on stoichiometry of water as indication for the presence of dark protons

It is stated that the stoichiometry of water is modified in the activation process but it is not stated what this actually means. The natural guess that this change reflects the transformation of protons to dark protons. I began to consider seriously the notion of hierarchy of Planck constants as I learned about the observations that in atto-second time scales the stoichiometry of water is anomalous: water behaves as $H_{1.5}O$ rather than H_2O in neutron diffraction and electron scattering as if 1/4 of protons were dark and not visible to the incoming neutron and electron.

8.5.3 Generation of ELF em fields in the activation process

The activation process is known to generate ELF em fields with frequency spectrum in the range $[f_1, f_2] = [.1\ Hz, 1\ kHz]$. Their presence can be deduced from the modification of the di-electric constant in this frequency range. The mechanism is not understood but the properties of the polymer compound must be partially responsible for this.

The TGD based explanation could be in terms of amplitude modulation producing dark photons with frequencies in the range 7-8 Hz, whose interaction with the magnetic field of the polymer compound produces other dark photons as cyclotron photons with large $\hbar_{eff}$ and energy proportional to $E_c = \hbar_{eff} \times ZeB/M$, where Z and M are charge and mass of the ion. For instance, the energies of various dark ions at the possibly dark magnetic flux tubes of the magnetic field created by the system are in the frequency range considered.

An alternative interpretation is encouraged by the TGD inspired model of water memory and homeopathy involving dark proton sequences as representations of DNA, mRNA, tRNA, and amino-acid sequences inspired by the observation that the states of dark proton are in one-one correspondence with states of these basic bio-polymers and that vertebrate genetic code follows naturally. The finding of Hu and Wu [J14] in turn leads to the proposal that dark DNA sequences are realized as dark DNA double strands assignable to cell membrane which is also layer like structure. Could it be that the water layers carry parallel pairs of dark DNA strands and that these generate the radiation in the frequency range $[f_1, f_2] = [.1\ Hz, 1\ kHz]$? These dark DNA sequences would give for the water its ability to mimic various molecules by reproducing their cyclotron frequency spectrum. This would require only the tuning of flux tube thickness to tune the value of magnetic field dictating the value of the cyclotron frequency.

The emergence of frequencies relevant to biology might be due the fact that all four biologically important Gaussian Mersennes might be involved with the fractal hierarchy of the rings. In any case, the first guess is that these frequencies are associated with dark photons with energy of visible photon (with energy say 2 eV for red light) and Planck constant varying in the range $\hbar_{eff}/\hbar = N \in [f_h/f_2, f_h/f_1] = [5 \times 10^{11}, 5 \times 10^{15}]$.

The notion of imprinting of water by frequencies of incoming radiation is essential in the attempts to understand water memory [J5]. Imprinting means that water generates radiation with frequencies used in imprinting and in this sense remembers them. Homeopathic effects can be indeed produced by using only certain imprinted frequencies characterizing the molecule causing the effects on water and stored in computer memory.

This raises some questions. Are the ELF frequencies in question imprinted from those produced by the polymer? Do they correspond directly to cyclotron frequencies assignable to the magnetic

field created by it? Does also the homeopathic treatment of water produce activated water with detectable layer structures?

8.5.4 Could the analog of activation process be involved with the emergence of ordered water in cell interior?

Suppose that the activated water is indeed ordered water as the authors of the book suggest. One of the basic steps of evolution is the formation of ordered water in cell interior stabilizing DNA. Could the structure of the activation process allow to guess what might have happened at this crucial step?

1. Earth's magnetic field should have played important role in the prebiotic evolution and the Schumann resonance frequency depending only on the inverse of the radius of Earth in the first approximation should correspond to the ELF frequency used in the activation process. Solar photons would replace the visible photons used in the activation process. A good guess is that Schumann resonance produces an ELF modulation of the visible light from Sun and produces ELF radiation with large value of $\hbar_{eff}$. If one takes seriously the proposed model of Expanding Earth, the radius of Earth would have been by a factor of 1/2 smaller than its recent radius during primordial period (and therefore equal to the radius of Mars) so that Schumann resonance frequency would have been around 15.6 Hz.

2. What could be the counterpart of the polymer compound? It is difficult to imagine any other candidate than polymers of Si, which is chemically very similar to carbon. Silicates and clay minerals represent basic example of this kind of polymer structure and have been proposed by Cairns-Smith (see `http://en.wikipedia.org/wiki/Graham_Cairns-Smith#Clay_hypothesis`) [I12] to be a predecessor of life. For instance, the shales of clay can replicate by dividing into two and this replication mechanism might have preceded more refined replication. During the primordial states the replication of layers of clay might have induced the replication of flux sheets in 1-1 correspondence with them.

3. If ordinary photons are transformed to dark photons, they can penetrate Earth's crust through without difficulties. This brings in mind also the TGD inspired vision about the evolution of life in water reservoirs inside Earth, where it is sheltered from cosmic radiation and meteoric bombardment [K17].

4. One can imagine that the irradiation producing dark photons and the presence of the Earth's magnetic field (and possible additional magnetic field) could transform the water to ordered water and provide it with the ability to store memories. If the dark variants of biomolecules are generated by the proposed mechanisms, water would learn to recognize and mimic various molecules. At this step also pairs formed by receptors and molecules binding to them having same cyclotron frequencies and able to attach together and react in the case that the surface geometries are consistent would have emerged.

8.5.5 Does the activated water inherit the layered fractal structure of the polymer compound?

There are several questions to be answered.

1. The complex structure of the polymer compound could be reflected in the structure of light emitted by it as a response to the incoming light. If the photons transform to dark photons in amplitude modulation, and if the polymer compound is ordinary matter, its structure need not be reflected in the structure of the spectrum of dark photons and basic factor is the decomposition of $\hbar_{eff}/\hbar = N$ to integers defining the spectrum of the $\hbar_{eff}/\hbar$. This is quite a strong prediction.

2. Does the thickness of the flux tubes and/or flux sheets emanating from the magnets depend on the magnets only or does the presence of polymer compound modify them? The layered structure of the polymer compound could indeed induce a layered structure of the magnetic field as parallel flux sheets continuing outside the polymer structure and to the ordered

water and induce to it a layered structure. The flux sheets would be parallel to the layers of ordered water. If the flux penetrates as flux tubes, the layers would be generated by some other mechanism and are most naturally be orthogonal to the flux tubes. The experimenters could probably tell what the orientation of the layers is.

Extrapolating to the case of cell membrane, one can ask whether cell membranes and also the complex fractal structure of endoplasmic reticulum corresponds to a magnetic flux penetrating into super conductor of type I near criticality as complex sheet like structure proposed earlier [K6] and whether these flux sheets can be assigned to the Earth's magnetic field.

The intensity of the magnetic field at sheets decreases with the distance from the dipole unless the density of sheets decreases. In an experiment involving rotating magnetic systems the concentration of the magnetic flux to flux walls with constant distance was observed [H4]: this would conform with the idea that flux sheets induce the layered structure of the activated water.

The flux tubes connecting dark protons of dark DNA would be orthogonal to the flux flowing along the flux sheets so that their origin would not be due to the external magnetic field. Of course, protons themselves generate these magnetic field so that this is not a problem. These flux tubes could also carry monopole flux.

3. Are the cyclotron frequencies assigned with the structures of polymer compound imprinted in water? This only requires that the flux tubes possibly emanating from the polymer preserve their thickness. This means obviously deviation from Maxwell's theory where field intensity decreases. For flux sheets the reconnection mechanism does not work.

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