Crop Circles and Life at Parallel Space-Time Sheets: Part I

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Abstract

Crop circles as a hoaxis a good candidate for one of the great illusions of century created by the market economy media serving as a voice of pseudo skeptics. That this cannot be the case has been known for a long time. For instance, microwave induced explosions in growth nodes of crops are regularly involved. Also meteoric material is often associated with the crop formations but not to the region exterior to them: this is absolutely impossible if the formations were made by human artists. Routine laboratory tests allow to judge whether the formation is man-made.

Models involving plasma flows from the ionosphere to the crop field formation have been developed. The regions where the soil has a high content of calcium carbonate (chalk) helping to charge it electrically are the places where the circles appear predictably from year to year. There is also evidence suggesting that this interaction exists during the entire growth period so that there would be a continual connection to the ionosphere.

Simplest crop circles have a form similar to plasma self-organization patterns. Small plasma balls have been observed in the fields both before and after the appearance of the crop formation. There are also irregular, "non-geometric" patterns of downing which must have been created by same mechanism as crop circles involving the interaction with the ionosphere. These are ideal bits of data for developing in detail hypothesis that any living system, even plants and plant populations, has a magnetic body, and that also magnetosphere is a conscious and intelligent entity receiving information from and controlling the bio-sphere.

Dark matter hierarchy leads to a quantitative vision about how magnetic body controls biological body and receives sensory input from it, and this vision can be applied to crop circles interpreted as an outcome of generalized motor actions of magnetic body. The resulting model encourages to consider the view about crop circles as an attempt of (geo-, planeto-, helio-, or some other) magnetospheric conscious entities to tell about their existence to us.

1 Introduction

Crop circles as a hoaxis a good candidate for one of the great illusions of century created by the market economy media serving as a voice of pseudo skeptics. Crop circles as a hoax is one of the illusions of century created by the market economy media. Strangely, this claim which was made without a single thread of evidence, was generally accepted, and has remained a general belief. This despite the fact that already for more than half decade it has been known that all crop circles cannot be hoaxes. The articles in the BLT homeopage [H1] provide detailed scientific information about crop formations and the reading of these articles changed also my own attitudes thoroughly.

1.1 Strange Phenomena Associated With Crop Formations

For instance, micro-wave induced explosions in growth nodes of crops are regularly involved [H11]. Also meteoric material is often associated with the crop formations [H10] but not to the region exterior to them: this is absolutely impossible if the formations were made by human artists. Routine laboratory tests allow to judge whether the formation is man-made.

Models involving plasma flows from the ionosphere to the crop field formation have been developed [H9]. The regions where the soil has a high content of calcium carbonate (chalk) helping to charge it electrically are the places where the circles appear predictably from year to year. There is also evidence suggesting that this interaction exists during the entire growth period so that there would be a continual connection to ionosphere [H4]. Living matter involves plasma phases and the experimental work of Pollack [I6] leads to the notion of gel like fourth phase of water containing negatively charged exclusion interpreted in TGD framework as having lost part of their protons to magnetic flux tubes where it is as dark matter identified as having large value of effective Planck constant $h_{eff} = n \times h$.

Simplest crop circles indeed have a form similar to plasma self-organization patterns but there are also differences suggesting that the formations are not natural. Small plasma balls have been observed in the fields both before and after the appearance of the crop formation [H4]. There are also irregular, "non-geometric", patterns of downing which must have been created by same mechanism as crop circles involving the interaction with the ionosphere [H4]. These are ideal bits of data for developing in detail hypothesis that any living system, even plants and plant populations, has a magnetic body, and that also magnetosphere is a conscious and intelligent entity receiving

information from and controlling the biosphere. The resulting model supports the view about crop circles as an attempt of (geo-, planeto-, helio-, or some other) magnetospheric selves to tell about their existence to us.

1.2 Model For The Generation Of Crop Circles

A model for the generation of crop circle formation is developed. Next chapter [K7] is devoted to the attempt to understand Chilbolton and Crabwood crop circles as messages providing biological information (including genetic codes) about some unknown life forms. Especially the question where where life forms might live is discussed.

The model for crop circle formation relies on the model for magnetic bodies, in particular magnetosphere, as an intentional agent able to control biological bodies. As in the earlier model magnetosphere uses plasmoids to construct the crop circles. The general model for bio-control relying on dark matter hierarchy is the fundamentally new element now common to all applications of quantum TGD to biology, which raises the hope that the model could be nearer to truth even at the level of details. The updated model indeed differs considerably from the earlier model as far as the detailed mechanism generating crop circles is considered.

A second central element of the model is the model for the dark plasmoid as a rotating magnetic system, very much analogous to Searl machine [A2]. the model of which is developed in [K21]. The model of plasmoid explains various mysterious looking findings such as microwave induced expansion of growth nodes, the presence of magnetized iron having meteoric origin, and the amorphous glass spheres found near crop circles. Additional support for the picture comes from the finding that plasmoids generated in laboratory seem to have the basic characteristics assigned to living matter [I16]. Here a connection with Pollack's work is highly suggestive.

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` [**?**]. Pdf representation of same files serving as a kind of glossary can be found at `http://tgdtheory.fi/tgdglossary.pdf` [**?**].

2 Some Aspects Of TGD Based Vision About Living Systems

In this section the relevant aspect of TGD based vision about living systems are discussed with a particular emphasis on the implications of the dark matter hierarchy. The section summarizes material from many sources. The chapters [K3, K4] of [K16] discuss the high T_c superconductivity which is key element of the picture. The chapters [K10, K8, K9] of this book discuss the implications of dark matter hierarchy for biology. The chapters [K2, K12, K13] in turn discuss remote metabolism, the vision about living matter as a conscious hologram, and the detailed role of water for life and the implications of dark matter hierarchy are also now very strong.

2.1 Magnetic Bodies And Magnetosphere As A Living System

TGD based view about classical fields differs radically from the Maxwellian one. Topological field quantization means that classical fields and matter form a Feynman diagram like structure consisting of lines representing matter (say charged particles) and bosons (say photons). The matter lines are replaced by space-time sheets representing matter (elementary particles, atoms, molecules, ...), and virtual bosons are replaced by topological light rays ("massless extremals", MEs). Also magnetic flux tubes appear and together with MEs they serve as correlates for bound state quantum entanglement.

The classical fields associated with MEs interfere only at the nodes, where they meet, and one has a hologram like structure with nodes interpreted as the points of a hologram. Thus one avoids the loss of information caused by the interference of all signals everywhere. This aspect is crucial for understanding the role of em fields in living matter and brain. The MEs corresponding to "real photons" are like laser beams entering the hologram and possibly reflected from it. What is new that the nodes can be connected by "virtual photon" MEs also analogous to laser beams. Hence

also "self-holograms" with no laser beam from external world are possible (brain without sensory input).

The hologram has a fractal structure: there are space-time sheets at space-time sheets and high frequency MEs propagating effectively as mass-less particles inside low frequency MEs serving as quantum entangling bridges of even astrophysical length. The particle like high frequency MEs induce "bridges" between magnetic flux tubes and atomic space-time sheets at the receiving end. This makes possible the leakage of supra currents from magnetic flux tubes to atomic space-time sheets analogous to the exposure of film producing hologram. The leakage induces dissipation, self-organization, and primitive metabolism as a cyclic flow of ionic currents between the two space-time sheets, and thus a Darwinian selection of the self-organization patterns results. The low frequency MEs are responsible for bound state entanglement, macroscopic quantum coherence and co-operation whereas high frequency MEs are responsible for self-organization and competition.

TGD framework differs from Maxwellian also in that it is possible to assign to a given physical system a magnetic body having usually a size much larger that of the system itself. The magnetic body provides kind of a monitor screen at which higher level information about the system is represented and defines thus sensory representations about the system. Magnetic body as a manual for a system is also a useful metaphor. Besides our own magnetic bodies (of astrophysical size), the magnetosphere of Earth is especially interesting magnetic body, and can be regarded as a living system receiving sensory input from biosphere, in particular our brains [K14].

Also the magnetosphere in the Earth's interior is highly interesting. Especially interesting are various boundary layers since energy currents occur here and make complex self-organization patterns possible. Magnetosphere contains many layers or this kind and in the Earth's interior mantle-core and core-inner core layers are of special interest as possible seats for intelligent life and the life-forms responsible for the crop formations might be ITs (intra-terrestrials).

The magnetospheric sensory representations associated with the life-forms in questions (say ITs) could induce the interaction between ionosphere and bio-matter and make also the plasma leakage possible. These magnetic bodies would be there all the time and this conforms with the finding that alterations to crop stem below head must have occurred long before the crop formation emerged.

2.2 Mersenne Hypothesis

The hierarchy of dark matter levels is labeled by the values of Planck constant having quantized but arbitrarily large values TGD inspired quantum biology and number theoretical considerations suggest preferred values for $r = \hbar/\hbar_0$. For the most general option the values of $\hbar$ are products and ratios of two integers n_a and n_b. Ruler and compass integers n expressible as $n = 2^k \prod_n F_{s_n}$, where $F_s = 2^{2^s} + 1$ is Fermat prime and each of them can appear only once, are number theoretically favored values for n_i because the phases $exp(i2\pi/n_i)$, $i \in \{a, b\}$, in this case are number theoretically very simple and should have emerged first in the number theoretical evolution via algebraic extensions of p-adics and of rationals. The known Fermat primes are $F_0 = 3, F_1 = 5, F_2 = 17, F_3 = 257, F_4 = 2^{16} + 1$. p-Adic length scale hypothesis favors powers of two as values of r.

The hypothesis that Mersenne primes $M_k = 2^k - 1$, $k \in \{89, 107, 127\}$, and Gaussian Mersennes $M_{G,k} = (1+i)k - 1$, $k \in \{113, 151, 157, 163, 167, 239, 241..\}$ (the number theoretical miracle is that all the four caled up electron Compton lengths $L_e(k) = \sqrt{5}L(k)$ with $k \in \{151, 157, 163, 167\}$ are in the biologically highly interesting range 10 nm-2.5 μm) define scaled up copies of electroweak and QCD type physics with ordinary value of $\hbar$ and that these physics are induced by dark variants of corresponding lower level physics leads to a prediction for the preferred values of $r = 2^{k_d}$, $k_d = k_i - k_j$, and the resulting picture finds support from the ensuing models for biological evolution and for EEG [K9]. This hypothesis - to be referred to as Mersenne hypothesis - replaces the earlier rather ad hoc proposal $r = \hbar/\hbar_0 = 2^{11k}$ for the preferred values of Planck constant. The background necessary for understanding what is involved is described in [K3, K4, K9].

2.3 Fractal Hierarchy Of Magnetic Flux Sheets And The Hierarchy Of Genomes

The notion of magnetic body is central in the TGD inspired theory of living matter. Every system possesses magnetic body and there are strong reasons to believe that the magnetic body associated with human body is of order Earth size and that there could be an entire hierarchy of these bodies with even much larger sizes. Therefore the question arises what one can assume about these magnetic bodies. The quantization of magnetic flux suggests an answer to this question.

1. The quantization condition for magnetic flux reads in the most general form as $\oint(p-eA)\cdot dl = n\hbar$. If supra currents flowing at the boundaries of the flux tube are absent one obtains $e\int B\cdot dS = n\hbar$, which requires that the scaling of the Planck constant scales up the flux tube thickness by r^2 and scaling of B by $1/r$. If one assumes that the radii of flux tubes do not depend on the value of r, magnetic flux is compensated by the contribution of the supra current flowing around the flux tube: $\oint(p-eA)\cdot dl = 0$. The supra currents would be present inside living organism but in the faraway region where flux quanta from organism fuse together, the quantization conditions $e\int B\cdot dS = n\hbar$ would be satisfied.

2. From the point of view of EEG especially interesting are the flux sheets which have thickness $L(151) = 10$ nm (the thickness of cell membrane) carrying magnetic field having strength of endogenous magnetic field. In absence of supra currents these flux sheets have very large total transversal length proportional to r^2. The condition that the values of cycloctron energies are above thermal energy implies that the value of r is of order 2^{k_d}, $k_d = 44$. Strongly folded flux sheets of this thickness might be associated with living matter and connect their DNAs to single coherent structure. One can of course assume the presence of supra currents but outside the organism the flux sheet should fuse to form very long flux sheets.

3. Suppose that the magnetic flux flows in head to tail direction so that the magnetic flux arrives to the human body through a layer of cortical neurons. Assume that the flux sheets traverse through the uppermost layer of neurons and also lower layers and that DNA of each neuronal nuclei define a transversal sections organized along flux sheet like text lines of a book page. The total length of DNA in single human cell is about one meter. It seems that single organism cannot provide the needed total length of DNA if DNA dominates the contribution. This if of course not at all necessarily since supra currents are possible and outside the organism the flux sheets can fuse together. This implies however correlations between genomes of different cells and even different organisms.

These observations inspire the notion of super- and hyper genes. As a matter fact, entire hierarchy of genomes is predicted. Super genes consist of genes in different cell nuclei arranged to threads along magnetic flux sheets like text lines on the page of book whereas hyper genes traverse through genomes of different organisms. Super and hyper genes provide an enormous representative capacity and together with the dark matter hierarchy allows to resolve the paradox created by the observation that human genome does not differ appreciably in size from that of wheat.

2.4 Does A Dark Copy Of Earth's Magnetic Field Exist?

For years I erratically believed that the magnitude of the magnetic field assignable to the biological body is $B_E = .5$ Gauss, the nominal value of the Earth's magnetic field. Probably I had made the calculational error at very early stage when taking Ca^{++} cyclotron frequency as a standard. I am grateful for Bulgarian physicist Rossen Kolarov for pointing to me that the precise magnitude of the magnetic field implying the observed 15 Hz cyclotron frequency for Ca^{++} is .2 Gauss and thus slightly smaller than the minimum value.3 Gauss of B_E. This value must be assigned to the magnetic body carrying dark matter rather than to the flux quanta of the Earth's magnetic field. This field value corresponds roughly to the magnitude of B_E at distance 1.4R, R the radius of Earth.

Dark matter hierarchy leads to a detailed quantitative view about quantum biology with several testable predictions [K9] . The applications to living matter suggests that the basic hierarchy includes the hierarchy of Planck constant

In the case of magnetic flux simplest quantization suggests the scaling $B \to B/r$ for the magnetic fields. This is assumed to hold true also in more general case when the quantization condition reads as $\oint(p - ZeA)dl = n\hbar$ and involves currents flowing at the boundaries of flux quanta so that magnetic flux need not be anymore quantized to a multiple of Planck constant. For axonal membranes the flux quantization with $n = 0$ is natural since the size of flux quantum does not depend on the value of Planck constant. Assuming flux quantization and standard value of Planck constant $B_{end} = .2$ Gauss would give flux tube radius $L = \sqrt{5/2} \times L_e(169) \simeq 1.58 L_e(169)$, which does not correspond to any p-adic length scale as such.

Concerning the interpretation of B_{end} there are two options. It could correspond to a personal magnetic body or to a dark variant of the Earth's magnetic field. At this moment it is impossible to say which if any hypothesis is right. However the fact that the ELF fields have no direct effect on conscious experience mildly supports the identification as the dark variant of B_E.

2.5 Basic Vision About Living Matter

2.5.1 General mechanisms of bio-superconductivity

The many-sheeted space-time concept provides a very general mechanism of superconductivity based on the "dropping" of charged particles from atomic space-time sheets to larger space-time sheets. The first guess was that larger space-time sheets are very dry, cool and silent so that the necessary conditions for the formation of high T_c macroscopic quantum phases are met.

The possibility of large $\hbar$ quantum coherent phases makes however the assumption about thermal isolation between space-time sheets un-necessary. At larger space-time sheet the interactions of the charged particles with classical em fields generated by various wormhole contacts feeding gauge fluxes to and from the space-time sheet in question give rise to the necessary gap energy. The simplest model for Cooper pair is space-time sheet containing charged particles having attractive Coulomb interaction with the quarks and antiquarks associated with the throats of the wormhole contacts.

A crucial element is quantum criticality predicting that new kind of superconductivity, "boundary superconductivity", appears at the fluctuating boundaries of competing ordinary and large $\hbar$ phases for nuclei besides large $\hbar$ variant of ordinary superconductivity in the interior. The Cooper pairs of interior and boundary supra currents are different with interior Cooper pairs being BCS type. These two superconducting phases compete in certain narrow interval around critical temperature for which body temperature of endotherms is a good candidate in the case of living matter. Also high T_c superfluidity of bosonic atoms dropped to space-time sheets of electronic Cooper pairs becomes possible besides ionic super conductivity. Even dark neutrino superconductivity can be considered below the weak length scale of scaled down weak bosons.

Magnetic and Z^0 magnetic flux tubes and sheets are especially interesting candidates for supra current carries. In this case the Cooper pairs must have spin one and this is indeed possible for wormholy Cooper pairs. The fact that the critical magnetic (Z^0 magnetic) fields can be very weak or large values of $\hbar$ is in accordance with the idea that various almost topological quantum numbers characterizing induced magnetic fields provide a storage mechanism of bio-information.

This mechanism is extremely general and works for electrons, protons, ions, charged molecules and even exotic neutrinos and an entire zoo of high T_c bio-superconductors, super-fluids and Bose-Einstein condensates is predicted. Of course, there are restrictions due to the thermal stability it room temperature and it seems that only electron, neutrino, and proton Cooper pairs are possible at room temperature besides Bose-Einstein condensates of all bosonic ions and their exotic counterparts resulting when some nuclear color bonds become charged [K20].

2.5.2 Bose-Einstein condensates at magnetic flux quanta in astrophysical length scales

The basis elements of the model is dark magnetic field $B_{end} = 2B_E/5 = .2$ Gauss explaining the effects of ELF em fields in brains of vertebrates in terms of cyclotron transitions of biologically important ions. B_{end} could be a dark companion of the ordinary magnetic field of Earth or represent personal magnetic body.

The new model for the topological condensation at magnetic flux quanta is based on the dark matter hierarchy with levels characterized by the values of $\hbar$ consistent with Mersenne hypothesis or more general ruler and compass integer hypothesis.

1. There are several levels of dynamics. In topological condensation the internal dynamics of ions is unaffected and $\hbar$ has the ordinary value. The formation of Cooper pairs involves dynamics at relatively low level of dark matter hierarchy. Also the dynamics of ionic Cooper pairs remains unaffected in the topological condensation to magnetic flux quanta obeying $k_d > 1$ dynamics.

2. Cyclotron energies scale as as $r = 2^{k_d}$ so that for a sufficiently high value of k thermal stability of cyclotron states at room temperature is achieved. Spin interaction energy $\mu \cdot B \propto S \cdot B$ scales as $1/r$ since four-momentum and angular momentum are by Poincare symmetry invariant under the scaling of $\hbar$ (the highly non-trivial implications of the invariance of angular momentum are discussed in [K23]). Hence spin interaction energy has the ordinary value. Unless thermal isolation is assumed, spin degrees of freedom are thermalized, and only cyclotron degrees of freedom can be quantum coherent. This is a testable prediction distinguishing between the new and old model.

3. If the flux quanta of B_{end} correspond to $k_d = 44$ level of dark matter hierarchy, cyclotron energies $E = (\hbar/2\pi) \times ZeB/Am_p$ are scaled up by a factor $r = 2^{44}$ from their ordinary values and are above thermal energy at room temperature for $A \leq 233Z$, where Z is the charge of the ion. Even for $Z = 1$ this includes all stable nuclei. Bose-Einstein condensates of bosonic ions are thus possible at room temperatures at Earth's surface. Cooper pairs of fermionic ions are possible only for $A \leq 4$ leaving in practice only protons into consideration. Also bosonic molecular ions can suffer BE condensation.

2.6 Dark Matter Hierarchy And Big Leaps In Evolution

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

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

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

Certainly also other scalings of Planck constant than those summarized in tables are possible but these scalings are of primary interest. This intuition is supported by the observation that electron is completely exceptional in this framework. Scaled up electron Compton lengths $L_e(k) = \sqrt{5}L(k)$, $k = 167, 169$, assignable to atomic and molecular physics and to the Gaussian Mersennes

$M_{G,k} = (1+i)^k - 1$, $k \in \{151, 157, 163, 167\}$ are in the length scale range between cell membrane thickness 10 nm and nucleus size 2.58 μm. The corresponding length scales $L_e(k)$, the number of which is 23, are excellent candidates for the scales of basic building bricks of living matter and vary from electron's p-adic length scale up to 2.58 m ($k = 167$ defining the largest Gaussian Mersenne in cell length scale range). The corresponding Compton time scales avary from.1 seconds for electron defining the fundamental biorhythm to 9.6×10^{14} years which is by 4-5 orders longer than the age of the observed Universe. For $k = 167$ the time scale is 1.1×10^{11} years and is by one order of magnitude longer than the age of the observed Universe estimated to be 1.37×10^{10} years [E1].

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

2.6.1 A sketch about basic steps in evolution

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

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

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

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

1. Elementary particle level

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

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

The first step would have been the emergence of $k_{eff} = 107$ weak bosons inducing $\hbar_0$ weak physics in $k = 107$ length scale characterizing also ordinary hadrons. This in turn would have led to the emergence of exotic nucleons possibly corresponding to almost vacuum extremals. The reduction of the model for the vertebrate genetic code to dark hadron physics [K22] is one of the most unexpected predictions of quantum TGD and assumes the existence of exotic- possibly dark- nucleons whose states with a given charge correspond to DNA, RNA, mRNA, and tRNA. The $\hbar_0$ variants of these nucleons would interact via weak bosons with hadronic mass scale. The exotic variants of the ordinary $k = 113$ nuclei would correspond to the nuclear strings consisting of exotic nucleons [K5, K22] and define nuclear counterparts for DNA sequences. Their dark

counterparts could define counterparts of DNA sequences in atomic physics length scales. Therefore a justification for the previous observation that genetic code could be realized at the level of hadron physics and that chemical realization would be higher level realization finds justification. The anomalous properties of water could be also partly due to the presence of dark nucleons and the proposal was that the presence of exotic nuclei is involved with water memory [K12]. The possible existence of the analog of DNA-RNA transcription between ordinary DNA and its nuclear counterpart would have dramatic implications. For instance, one can imagine a mechanism of homeopathy based on this kind of transription process which would also allow a modification of genome by using dark nuclei to communicate the DNA sequences through the cell membrane to the target nuclei.

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

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

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

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

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

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

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

Dark $k_{eff} = 151$ electrons appearing in the TGD inspired model of high T_c super-conductivity would have been a by-product of this step. Whether dark electrons could have transformed to light $\hbar_0$ electrons (of mass.25 keV) with a common mass scale of order 10^2 eV with exotic weak bosons is an interesting question. The model of high T_c super-conductivity predicts the presence of structures analogous to cell membrane. This would suggest that cell membranes emerged and chiral selection emerged at this step so that one could not distinguish the emergence of molecular life as a precedessor for the emergence of cell membrane like structures. This would conform with the fact that DNA molecules are stable only inside cell nucleus. Note that for $k_{eff} = 151$ electron's CD has time scale $2^{24} \times .1$ seconds -that is 19.419 days (day=24 hours).

The smallest nanobes [I3] appearing in rocks have size 20 nm and could have emerged at this step. The size of the viruses [I4] is between 10-300 nm covers the entire reange of length scales assignable to Gaussian Mersennes, which suggests that smallest viruses could have emerged at this step. Also the smallest [I2] [I2], which by definition have size smaller than 300 nm could have appeared at this stage.

6. The remaining steps

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

By their smallness also double and triple steps defined by $k_d = k_{i+n} - k_i$, $n > 1$, are expected to be probable. As a consequence, electrons can appear as dark electrons at all the Gaussian Mersenne levels. At these steps the dark electrons corresponding to primes $k_{eff} = 137, 139$ would

appear. For $k = 137$ dark electron appears with CD time scale equal to 128 seconds- rather precisely two minutes. The model for EEG suggests that the exotic weak bosons appear in the scales $k_{eff} = 136, 137, 138$.

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

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

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

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

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

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

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

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

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

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

2.6.3 Biological evolution

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

1. The emergence of cells having organelles

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

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

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

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

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

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

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

3. The emergence of organs and animals

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

4. The emergence of nervous system

k_{eff} in the range $(187, 189, 195, 201, 205)$ allowing dark electrons and weak bosons gives size scales $(.25, .5, 4, 32, 128)$ cm, which could correspond to the scales of basic units of central nervous

system. What would be of special interest would be the possibility of charged entanglement based on classical W fields in macroscopic length scales. The emergence of the new level means also the integration of axonal microtobuli to "text lines" at the magnetic flux sheets making possible logistic control at the multineuronal level. The conformational patterns of the microtubular surface would code nerve pulse patterns to bit patterns representing declarative long term memories. An interesting question is whether the reverse coding occurs during memory recall.

2.6.4 The evolution of magnetic body

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

1. The emergence of EEG

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

1. Besides the maximal p-adic scale $k = 205$ for which electron and weak bosons appears as dark variants the model allows also levels at which only gauge bosons appear as dark particles. From Table 9 one finds that levels $k \in \{207, 211, 213, 217, 219, 221, 223, 225, 229, 235\}$ are allowed. Could it be that these levels and possibly some highest levels containing both electrons and gauge bosons as dark particles are a prerequisite for EEG as we define it. Its variants at higher frequency scales would be present also for invertebrates. The lowest Josephson frequency coded by the largest value of $\hbar$ in the cell membrane system determines the Josephson frequency.

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

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

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

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

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

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

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

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

Table 1: The Compton frequencies obtained by scaling $2^{k_d/2}$ from the basic triplet $k_{eff} = (239, 240, 241)$. The values of k_d correspond to those predicted by the model based on Mersenne primes.

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

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

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

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

3. Long term memory and ultralow Josephson frequencies

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

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

2. Does Josephson frequency define the relevant time scale? In this case the long term memory would require the analog of EEG in the time scale of memory span. $k_{eff} = 205$ would give 6 ms time scale for memory from the assignment of $k_{eff} = 163$ to the Josephson photons

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

4. Cultural evolution

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

2.7 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 [I16]. 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 precedessors of biological life [**?**]. The notion has been already applied in the model of nerve pulse [K18]. 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.

2.7.1 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 [A2], [H8] discussed in [K21] 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 [A2]. According to TGD based model of Searl device [K21], 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.

2.7.2 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 $E_p = \hbar f_p$ would scale as $\hbar$ 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 $\hbar_0$ 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 $r = \hbar/\hbar_0$ 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. In the following only the "dropping" option is discussed.

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 [I19]. Bio-photons could be produced as de-coherence products of dark microwave photons. Interestingly, SiO_2^{--} ion has cyclotron frequency 10 Hz for $B_{end} = .2$ Gauss 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.

2.7.3 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.

2.8 Field Representations Of Information Using Codes

As already mentioned, the work of Benveniste [I9, I10], Gariaev [I12], and Persinger [J2] provides evidence for the existence of field codes and for the view that water can learn associations [I5]. 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 [K11] assuming strict duration of the memetic codons could be un-necessarily restrictive.

2.8.1 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 [I9] [I9, I10] and the report of Smith about context specified 7-bit code for frequency importing [I7] provide support for the associative learning in water.

Flexibility implies that an associative learning of the code is required. There are two diametrically opposite ways 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 [K15] 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 [K6] 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.

2.8.2 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 in some finite temperature range for which a good guess is 36-37 °C [K9]. The upper limit of the temperature range would be critical temperature for super-conductivity and lower limit the temperature above which almost vacuum extremal property is possible.

This model allows to develop a model of sensory perception using the patterns of Josephson radiation. The model of Comorosan effect [I20] 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 [K19] 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 extent below the Earth's surface where the field strength increases. Also the model for EEG leads to the same conclusion: the Josephson junction associated with $k_d = 44$ level is through the layer formed by ionosphere and litosphere [K9].

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.

2.8.3 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.

2.8.4 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 [J1]. According to [I11], 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 [I8, I15] could be understood as a genetic self engineering rather than genetic engineering by more advanced civilizations (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 [K11] is that corals seem to possess genes responsible for higher level psychological functions in mammals [I13]: 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 $B_{end} = .2$ Gauss. 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.

3 Model For Crop Circles

In this section a model for the generation of crop circle formation is constructed. The model relies strongly on the notion of many-sheeted space-time and is deduced from the above described model for living matter in which organisms are quantum controlled by a hierarchy of magnetic bodies.

3.1 Why Crop Circles Need Not Be Hoax?

There are several findings making it very difficult to believe that all crop circles are hoax, and on basis of these findings it is possible to deduce with high reliability whether a hoax can be in question in a particular case.

1. There are clear alterations in growth nodes in the crop formation areas [H11]. In particular, an expansion of growth nodes relative to normal is observed: this expansion is about 115 per cent for regular and 200 per cent for the irregular crop formations. Also tufts of standing plants within formation have node expansions equal to or exceeding the expansion level in flattened plants.

   Expanded nodes contain expulsion cavities which can be understood as resulting from a rapid and intense heating by micro-waves causing pressure buildup [H11]: cellular components have literally blown out through epidermal cell walls. Node expansion is also accompanied by a bending. This suggests that the node expansion makes possible the downing of the crops. It is difficult to believe that artificial generation of crop circles by mechanical means could produce expanded nodes or generate micro-waves.

2. Magnetic material confined to localized, dust coated vortices of radius about.5 meters has been found in two thirds of all cases studied [H9]. In the case studied in [H10] these vortices were located within the boundaries of two larger more typical circular sites of downed plants approximately 15 meters in diameter and 60 meters. Magnetic iron "glaze" of thickness 400-600 microns is composed of fused iron oxide particles of size 2-200 microns and causes coatings of the soil and within interstices of leaves and stems.

   The iron particles most probably originate from the fusion crust of a meteor resulting from the heating caused by the entry into the atmosphere. The congealed droplets are known to drift to Earth several days after the major shower and are found surrounding the known iron meteorite falls. The case studied in [H10] occurred few days after Perseid meteor shower 1993. Since the phenomenon is concentrated entirely within the crop formation, it is difficult to believe that crop circle could be a hoax.

3. The growth characteristics have been compared for the seeds taken from the heads inside crop formations and outside them and differences depending on the time of the formation have been found [H11]. For instance, for seeds taken from the crop formations occurring near the late maturity states rate and the uniformity of plant growth were significantly enhanced. Also this is difficult to understand if hoax were in question.

3.2 Further Facts About Crop Formations

A lot of data about crop formations have been gathered. In the sequel some of the newest data items which can be also found from [H9, H4] are listed.

1. Crop formations need not be only regular, "geometric" formations. Also randomly downed crop formations caused by the interaction with the ionosphere are possible and are actually more frequent than the regular ones [H4]. These two types can be seen as reflecting the

character of magnetic flux tube structures in question. Node length increase is 115 *resp.* 200 per cent for the regular *resp.* chaotic formations.

2. Expulsion cavities, lengthening and bendings associated with the growth nodes are common to all formation, and it seems that the bending is caused by the softening of the growth nodes. It has been found that the stems are charged immediately after the emergence of the crop formation and the bending is proportional to the amount of charge. This supports the view that downing is caused by an electromagnetic mechanism. Over-fertilization does not explain downing. Germination abnormalities were mentioned already.

3. A new and very important plant abnormality has been identified. A massive spiralling and twisting of the somatic tissues in the peduncle (stem at the base of the seed head) could not have occurred at the same time as the flattening of the crop [H4]. A continual exposure to radiation, and possibly also an interaction with the ionosphere already at the very early developmental stage, suggests itself.

4. Balls of light (BOLs) have been also observed in crop formation regions: soccer ball sized balls of orange light and tennis ball sized balls of white opaque light in particular [H9, H4]. The witnesses got the impression that BOLs are inspecting the crop formation. BOLs have been observed also before the formation of the crop circles. It would not be surprising if more complex structures formed from BOLs where responsible for the formation of crop circles.

5. Failures of electrical and mechanical equipment in near or flying over crop circles occur more often than normally [H4]: cameras, recording devices, cell phones and even tractors fail to function properly. Electric perturbations caused by the plasmoids are the most plausible cause.

6. Animal and human reactions to crop formations have been studied [H4]. Many animals tend to avoid the formations and animals behave abnormally during the appearance of the crop formations. There are also effects on people: dread, euphoria, experiences of peace and oneness, and feeling of love have been reported. Sound sensations like buzzing noise and crackling footsteps have been reported: these could be induced by micro-wave audition [I14]. That the buzzing noise has been tape recorded once does not however fit with the hypothesis of endogenous micro-wave hearing. Sensations of presence have been reported. Always newly formed crop circles are in question.

3.3 Existing Models For Crop Formations

Existing models seem to catch a lot about the physics behind the crop circle formations. The standard belief is that ionic currents between ionosphere and Earth's surface are not possible, and some hitherto unknown mechanism allowing this must be postulated. The models proposed do not address this question but assume plasma currents.

3.3.1 Micro-waves induce the node growth and damage

The heat generated during the crop formation should explain the lengthening of the growth nodes and the appearance of the expulsion cavities. The effect is strongest in the growth nodes and weakest in the hollow parts of the stem. The reason is that growth nodes contain a lot of water increasing the value of the dielectric constant and therefore the effectiveness of the micro-wave heating. That crop stem is not scarred can be understood as resulting from the insulating layer of water provided by the plant itself. To get the idea what happens one can put a tomato in micro-wave oven.

Node damage decreases from the center to the edges of the flattened area. The absorption of the micro-wave energy radiated from the center of the flattened area explains this and the exponential decrease of the damage outside the central area defined by the small vortex of diameter about.5 meters. The absorption of radiation by air and water vapour explains the weakening of the effect. There should be a source of micro-wave radiation in the middle, naturally a plasmoid structure. The damage caused for the growth nodes of the standing crops is larger than for those of flattened crops. The angle of incidence for the micro-wave radiation explains this.

3.3.2 Plasma leakage between ionosphere and Earth as a basic mechanism

The presence of the iron coating in the soil and parts of crop stem having meteoric origin two thirds of the cases studied [H10, H9] provides an extremely valuable hint for the model builder.

1. The model proposed in [H10] relies on a plasma vortex structure extending from the ionosphere to the crop field and containing spiral like magnetic fields [H10, H9]. The plasma in question cannot be hot. The ionosphere contains however cold plasma in temperature range $10^2 - 10^3$ K. This plasma vortex would be essentially ordinary air containing swirling ions if it indeed penetrates to Earth. The magnetic field patterns associated with the plasma attract the meteoric iron [H10, H9] and iron glaze would be due to the molten iron created by the reheating of the semi-molten state of iron at the time of the crop impact [H10].

2. This leads naturally to the proposal that the shapes of crop formations reflect the shape of plasma structures involved. Self-organization leads to preferred plasma patterns and the shapes of the simplest crop formations consisting of spirals and circles resemble typical plasma patterns. Also chaotic plasma patterns are possible and explain the irregular crop formations. It has been proposed that the plasmoid structures extend from ionosphere to Earth. Spiral aurorae contain arcs evolving into pairs of counterclockwise vortex sheets that are never stable and never unwind. Spiral auroras map down to along geomagnetic field lines into the ionosphere. Two counterclockwise vortices are involved. Also the so called sprites which connect ionosphere at 100 km height to the height of about 10 km where thunderstorms are generated have been suggested as being associated with the formation of the crop circles.

3. The leakage might be more probable at night time when ionosphere extends to lower heights. Remarkably, at night time the plasma of ionosphere is known to make attempts to penetrate through the boundary of the ionosphere and this induces magnetic perturbations: the Schumann resonances generated in this manner would be essential for generating entanglement between sleeping brains giving rise to multi-brained "stereo consciousness" (compare with the fusion of visual fields of different brain hemispheres giving rise stereo vision).

3.3.3 Criticism

One can represent counter arguments against the proposed models.

1. Are the ion currents really plasma currents?

The strongest objections against the proposed models relate to the idea that the plasma structures involved extend from ionosphere to Earth.

1. The existing models assume that the magnetic structure is generated when a plasma leakage from the ionosphere to Earth occurs. However, small plasma balls are seen (BOLs) and the stems of crops have been altered before the occurrence of the crop formation. This would suggest that the magnetic structures responsible for the connection with the ionosphere exist already before the occurrence of the crop formation and that the ionic current is not ohmic.

2. The plasma in question must be cold: the temperature should be around $200 - 300$ Kelvins if it equals to the temperature of the lower ionosphere (D and E regions). It is not clear (to me) whether the overall important heating to at least 700 K, required by the melting of the meteoric iron, could really occur at the surface of the soil and at growth nodes. One can also wonder whether the plasma could penetrate down to Earth through the atmosphere without dissipating its energy completely in collisions with the atoms of the atmosphere. An electric field is needed to make the penetration possible and it is not clear whether the field generated by the charge density in the soil is really strong enough. Large horizontal gradients of the electric field would be certainly required in order that a well-defined pattern would result. One could also argue that the plasma becomes neutralized during the travel to Earth's surface unless the electric field is so strong that it causes ionization. In this case one would have electric discharge analogous to lightning and probably having much higher temperature of about 10^4 K for lightning and generating visible light.

3. There is rather fascinating almost explanation for why the crop formations occur repeatedly in some preferred areas, in particular in England [H9]. When water percolates through any porous rock, it loses negative charge to the rock. The soil in England contains a lot of calcium carbonate (chalk). Calcium carbonate enhances this process and generates currents in the soil. Crop formations occur just in these regions. The magnetic fields caused by these currents have been measured both before and after a crop formation and it is found that the magnetic fields disappear after the crop formation. This is just what one might expect to result from the neutralization resulting from the plasma leakage.

   This is of course not an explanation for why the crop circles occur in the areas where the soil is negatively charged. As a matter fact, the generation of negative charge tends to lower the potential difference between ionosphere and Earth surface and reduce the probability for the generation of plasmoids connecting ionosphere and soil. On the other hand, if the plasmoids are small sized, say with sizes of order the size of the crop formation, the presence of electrons in the soil could favor their formation. plasmoids with sizes of order micro-wave wave length have been indeed seen! This strongly suggests that the plasmoid like structures are small and cannot be involved with the currents from ionosphere to Earth.

4. There is a strong correlation between sunspot activity and appearance of crop circles [H9]. The density of electrons in the ionosphere increases by a factor 100 from sunspot maximum to minimum. Also this tends to reduce the potential difference between soil and ionosphere: just the opposite would be however expected if the plasma leakage occurs as ohmic current through the ionosphere

5. If the crop formations correspond to the cross sections of plasmoid structures of a vertical size of order 100 km, it is difficult to understand why their sizes vary in so narrow length scale range which is of same order of magnitude as micro-wave wave lengths. The most natural looking proposal would be that plasmoid structures are local, and consist of basic units of size of order micro-wave wave length, and they have been indeed observed (BOLs). This hypothesis however leaves open the mechanism of the ionic leakage from ionosphere to Earth.

2. Do the shapes of crop formations indeed correspond to the shapes of plasma patterns?

Although the simplest crop formations resemble plasma patterns, there are also very complex formations, whose generation is difficult to understand. The most famous is the formation coding a rather precise analog of a two-dimensional pattern sent to the interstellar space as a signal and representing information about human civilization. If this case is not a hoax, one must seriously consider the possibility, that conscious intelligence is involved with the generation of the patterns somehow.

3. What about strange experiences?

The models do not explain the strange experiences reported by humans nor the avoidance behavior of animals in the vicinity of the crop formations.

3.4 TGD Based Interpretation Of Crop Circles

The general model for how magnetic bodies control biological body using plasma oscillations of plasmoids allows straightforward interpretation of crop circles.

3.4.1 Do crop circles represent a message?

One cannot avoid the feeling that crop circles might represent a message by conscious entities much above us in evolution and having several meanings. Perhaps the main intention is to initiate a thought process challenging the existing dogmas about what life can be in the minds of those individuals who take the enigma of crop circles seriously.

1. What kind of message the mere appearance of crop circles contains?

Crop circles could contain several messages besides the obvious visible message. If one forgets the interpretation as fraud, the obvious message is that there must exist intelligent entities responsible for their construction. Various hints suggest that magnetosphere (or perhaps solar magnetosphere) is this entity. If one takes seriously the Chilbolton [H2, H3] and Crabwood [H5, H6] messages, one must however consider the possibility that we are not the only form of biological life controlled by these entities.

2. What kind of messages plasma wave patterns contain?

The surface message is the patterns identifiable in terms of sacred geometry for which length ratios involve only rational numbers and square roots of integers. Chilbolton and Crabwood messages contain also surface message as figure and a text written using ASCII code, and according to the proposal of this chapter, also a message telling about the conscious entities responsible for the message, in particular about their genetic codes. Plasma wave patterns could be interpreted in TGD framework also as generalized motor actions, in particular those involving hyper-gene expression of some kind so that also an implicit message about basic control mechanisms of biology would be involved.

3. What the presence of amorphous SiO_2 spheres tries to tell?

Amorphous SiO_2 spheres are observed around crop circles resulting when molten quartz cools down rapidly.

1. One part of the message could be that quartz, possibly in transparent liquid or amorphous form, is fundamental for life. Since microwaves are also involved with crop circles the message could be that dark microwaves generated by dark quartz crystals serve as sources of metabolic energy.

2. Amorphous SiO_2 is typically created by lightning strikes in sand. This suggests that lightning strike creates dark plasmoids of which ball lightnings are one particular case and that dark plasmoids melt the sand particles by de-coherence of highly energetic dark microwave photons to ordinary photons. Also magnetized iron of meteoric origin has been found around crop stems. Fe^{++} ions would be structural elements of plasmoids. This suggests a model of plasmoids as a Searl machine, that is rotating magnet consisting of meteoric iron.

3. Microwave photons with wavelength of 5 cm at $k_{em} = 2$ level would have energy of 100 eV and de-coherence to ordinary photons would melt quartz. Perhaps the existence of dark photons is one of the messages. The microwave photons could originate from magnetostatic waves or from decay of plasma oscillations.

4. The region above mantle contains molten quartz and the glass spheres could be interpreted as a message about the possibility of IT life based on dark atoms and molecules.

4. What it means that the cyclotron frequencies of ions involved with crop circles are in alpha band?

The cyclotron frequencies of biologically bosonic ions tend to be in alpha band for $B_{end} = .2$ Gauss. This is true also for some atomic and molecular ions associated with crop circles.

1. SiO_2^{--} ion has cyclotron frequency 10 Hz for the nominal value $B_{end} = .2$ Gauss. Also CO_3^{--} ions associated with calcium carbonate (limestone contains $CaCO_3$) have cyclotron frequency of 10 Hz. This frequency equals to the fundamental bio-rhythm and the p-adic frequency $f(2, 127)$ associated with the memetic code.

2. The observed magnetized Fe^{++} ions believed to have meteoritic origin have cyclotron frequency of 10.7 Hz.

10 Hz frequency characterizes also effectively 2-dimensional waves closed inside the ionospheric cavity: for l^{th} harmonic the frequency is

$$f = \frac{\sqrt{l(l+1)}}{2\pi R_E} \quad ,$$

R_E Earth's radius, and $l = 1$ gives 10 Hz frequency. All this could be seen as a signal that Earth's magnetosphere (and/or its dark variant) and ionospheric cavity are involved in essential manner.

10 Hz is the alpha frequency and corresponds to generalized EEG at $k_{em} = 4$ level of dark matter hierarchy from the requirement that EEG frequencies correspond to energies above thermal threshold at room temperature. A possible interpretation is that plasmoids responsible for crop circles and having $k_{em} = 2$ are used as motor instruments by $k_{em} = 4$ level of dark matter hierarchy which should be also responsible for the control of gene expression. This could also mean that dark quartz plasmoids are a life form inhabiting the Earth's interior.

5. What is the message of claimed genetic modifications?

There is evidence that the crops from crop circles have experienced genetic modifications and this raises the possibility that magnetic body could be performing genetic self engineering. $CaCO_3$ is the basic building material of corals (and eye lens by the way) and the presence of genes in corals coding for higher psychological functions [I13] has been already mentioned, and the possibility that electromagnetic field patterns could by imprinted by genomes and could modify the genomes of target organisms [J1] has been already discussed. The question is therefore: Could it be that menetic code words with duration of.1 seconds allow to realize a modification of genome in presence of ions with 10 Hz cyclotron frequency (SiO_2^{--} and CO_3^{--})?

3.4.2 Crop circles as dark plasma wave patterns representing generalized motor actions

Crop circles could result as generalized motor actions of say magnetic body of Earth realized in terms of plasma oscillation patterns associated with plasmoids generated by exotic ionization induced by W MEs. Macroscopic quantum phenomenon would be in question since the phenomenon would become visible only after state function reduction selecting the exotically ionized branch.

Crop circles would be analogous to nerve pulse patterns and physiological effects induced by Ca^{++} wave patterns induced by exotic dark ionization by the generalized Faraday law at visible space-time sheets. Generation of Ca^{++} waves could indeed occur since crop circles tend to appear at limestone rich regions containing calcium carbonate $CaCO_3$ giving rise to Ca^{++} ions. Limestone rich regions are also negatively charged and this could give rise to electronic Cooper pairs responsible for the negatively charge and high T_c super-conductivity of plasmoids.

Plasma wave patterns are in TGD framework responsible for the generalized motor control, in particular genetic expression. The notion of hyper-genome predicting collective gene expression at the level of say crop field, the vision about great leaps of evolution as the emergence of new levels of dark matter hierarchy at the level of individual organisms, and the fact that $k_{em} = 4$ level of dark matter hierarchy corresponding to EEG and size of Earth's magnetosphere is necessarily present (time scale of DNA translation corresponds to EEG time scale) suggest that crop circles could also represent patterns of Ca^{++} waves as well as Mg^{++} waves involved with collective gene expression or even genetic self engineering.

Crop circles could be interpreted as cross sections of scaled up variants of cell structures. The thickness of cell membrane comes as $\lambda^k L(151)$ for them and $k_{em} = 2$ would correspond to 5 cm length length scale, the wave length of 6 GHz microwaves, assignable naturally to the plasma balls observed near crop circles. The upper bound for the cell size given by $\lambda k + 1 L(151)$ would correspond to 80 m, which is the size scale for the largest crop circles. One possible interpretation is that crop circles represent an evolutionary leap bringing in plasma wave patterns and quantum control in a new length scale.

3.4.3 TGD based model for plasmoids involved with crop circles as Searl machines?

The model for plasmoids must answer to several questions. Where plasmoids draw their metabolic energy? The patterns of bent crops suggest that plasmoids radiate radially microwave photons inducing the bending of crops. Hence plasmoids should carry the source of microwave photons with them. What could be this source of the microwave radiation? How plasmoids are able to defy force of gravitation and move? Do plasmoids enter from ionosphere or Earth's interior or are they created at ground?

I have already earlier proposed that plasmoids are essentially Searl machines and that even ADP-ATP machinery could involve Searl machine like molecular device [K13]. Rotating magnets are the essence of the Searl machine. Magnetized iron believed to have meteoric origin has been found around the crop formations and could thus be one building element of the plasmoid. This iron would be naturally at magnetic flux quanta of Earth and would be magnetized by Earth's magnetic field and concentrate around crop stems since flux quanta traverse DNA. Plasmoids need not therefore come from ionosphere.

Magnetostatic waves for electrons in magnetized iron (dark or not) are in the microwave region and could generate dark microwave photons in turn inducing the formation of dark plasma oscillation patterns. The metabolic energy of plasmoid would basically result from dropping of electrons and ions of radial ohmic currents associated with the rotating magnet to larger space-time sheets.

In many-sheeted space-time (see **Fig.** `http://tgdtheory.fi/appfigures/manysheeted.jpg` or **Fig.** 9 in the appendix of this book) 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 early version of the model assigning metabolic energy quantum to the dropping of protons is considered. In [K17] a model of metabolism associating the metabolic energy quantum to the change of cyclotron energy is discussed.

Note that in the case of Searl machine the distances of order.5 m between magnetic walls and their thicknesses of order 5 cm correspond to microwave wavelengths. The scales are same as in the case of crop circles, which supports the view that plasmoids are essentially Searl machines.

1. Basic picture about plasmoids?

Plasmoids are magnetic flux quanta containing Bose-Einstein condensates of various dark ions and electronic Cooper pairs. The flux lines of magnetic field associated with plasmoids are rotating since charged particles in cyclotron Bose-Einstein condensate rotate in the magnetic field whose lines are frozen with the rotating dark plasma. The space-time sheets parallel with the dark space-time sheets of plasmoids contains the rotating return flux which generates a radial electric field with a non-vanishing divergence in turn inducing radial ohmic current and making ordinary space-time sheet negatively charged. It is plausible that these space-time sheets contain rotating magnetic material: dark meteoritic iron from ionosphere is the recent case.

Dark microwave photons provide the metabolic energy for plasma wave patterns. Plasmoid must be able to generate the microwave radiation by some mechanism. Magneto-static waves of electrons in magnetized iron define an excellent candidate for the source of microwave radiation. It seems that dark variants of these waves must be considered now so that dark iron atoms should be in question unless ordinary microwave radiation is able to cohere into dark microwave radiation.

One must understand how plasmoids are able to defy gravitation and move. The negative charge generated by the rotation of magnet provide the plasmoid with a net negative charge and the repulsive force experienced in the electric field of Earth could make it possible to overcome the gravitational force of Earth as it partially does in the case of Searl's machine [K21].

1. Quartz crystal oscillations cannot serve a source microwave photons in the case of plasmoids

Plasmoids must use microwaves as a source of metabolic energy making possible the generation of plasma wave patterns. Plasmoids can be generated even in microwave ovens by using some "seed" having organic origin [H7]. Dark microwave photons could quite generally serve as a source of metabolic energy of plants. 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 [I19]. For instance, 2 eV bio-photons could be produced as de-coherence products of dark microwave photons of wavelength about 1.25 mm. The mechanism would also explain the featureless spectrum of bio-photons.

Dark piezoelectric quartz crystals could act as sources of dark microwave photons. Microwave photons with wavelength of 5 cm at $k_{em} = 2$ level would have energy of 100 eV whereas at $k_{em=1}$

level the energy would be.05 eV rather near to the energy associated with the action potential. The Josephson frequency of the scaled up dark variant of cell membrane is rather near to this frequency too.

If plasmoids generate microwave photons by using oscillating quartz crystals, they should carry the quartz crystals with them. Since quartz crystals should have size scale of microwave wave length, this option does not look plausible.

2. Magnetostatic waves of electrons in magnets as source of microwave photons?

Magnetostatic oscillation frequencies do not depend on the spatial pattern of the magnetostatic wave which thus recurs again and again in similar shape. Therefore magnetostatic oscillations are ideal for generating microwave photons responsible inducing plasma oscillation patterns. Magnetostatic frequencies are of order electron's cyclotron frequency. For electron in a magnetic field of order Tesla associated with magnetized iron the cyclotron frequency would be of order 12 GHz corresponding to a wavelength of 3 cm so that orders of magnitude come out correctly. Note that the order of magnitude for the density of dark ions in plasmoid is fixed to a high degree from the requirement that plasma frequency corresponds to the magnetostatic frequency.

Thus plasmoids could consist of rotating magnetized iron blobs of meteoric origin. Lightings are known to induce the formation of amorphous quartz spheres in sand. This could be understood if lightnings involve plasmoids quite generally. Plasmoids could arrive from the thunder cloud or be created at the ground since meteoric iron can be present at flux quanta everywhere. Ball lightnings would represent a particular case of plasmoid gaining its metabolic energy from the dropping of charged particles to larger space-time sheets.

The size scales for plasma patterns imply that plasmoids must correspond to $k_{em} = 2$ level of dark matter hierarchy for which microwave photons with 5 cm wavelength correspond to energy of about 100 eV much above the melting temperature of ordinary quartz (note that the cyclotron frequency associated with the magnetized iron determines the size of plasmoid). Hence the dark microwave photons de-cohering to ordinary photons generated by plasmoids can easily melt quartz and explain the generation of amorphous quartz spheres.

4. Where plasmoids receive their metabolic energy?

The dropping of charged particles to larger space-time sheets liberating zero point kinetic energy is the mechanism giving rise to the universal metabolic energy quanta in TGD inspired model of living matter and should be at work also now. The radial ohmic currents induced to a rotating magnet generate charge to the magnet which increases until di-electric breakdown occurs. The charging of the rotating magnet provides it with electrostatic energy which in turn can be used as metabolic energy. The actual energy source is the dropping electrons of the ohmic current to larger space-time sheets, which liberates zero point kinetic energy of ~ 1 keV. This mechanism explains the formation of ordinary plasma by ionization of air in the case of Searl machine and could work also now.

I have proposed that Searl machine sucks energy from the dark matter at the magnetic walls. The model for magnetic body as a controller of biological body using ordinary metabolic energy suggests just the opposite. Even if this is the case, the model would still explain the accelerating rotation in terms of the transfer of angular momentum between the Searl device and magnetic walls.

3.4.4 Who decides about the geometry of the crop formations?

The geometry of crop formations should be determined by the intentional action of magnetospheric conscious entities expressed by micro-wave sized plasmoid like life forms (BOLs). It could be also constrained by the geometry of the magnetic flux quanta connecting the crop field to the magnetosphere.

Thus plasmoids would act as intelligent messengers quantum entangled with higher level life forms and carry out only the hard job. This would mean that the crop formation could be build gradually and even refined in the course of time as the appearance of BOLs indeed suggests. This option is the most plausible one, and suggests that crop formations are an attempt of a conscious magnetospheric (with Earth's interior included) intelligence to tell about its existence.

3.4.5 What is the mechanism causing the crop formations?

The big picture is following. Magneto-spheric self would be the intentional responsible for the generation of crop circles. It would generate plasmoids by charge entanglement mechanism. The plasmoids propagating along the pattern determined by W MEs would be somewhat analogous to nerve pulses and Ca^{++} waves.

The basic observations helping to build the model are following.

1. The light balls observed around crop formations have a natural interpretation as plasmoids. The stems of crops are charged after the emergence of the formation and the amount of charge and the bending of the crop correlate. This conforms with the fact that plasmoid is charged and that the time of presence of plasmoid determines the amount of the bending and the charge transferred to the stems. The prediction is that crop stems should be negatively charged if the charge originates from air. If it corresponds to dark ions transformed to ordinary ions in the region of the plasmoid, the sign of the charge could be also positive.

2. The expansion of the growth nodes involving the generation of expulsion cavities causes the softening of the growth nodes and makes bending possible irrespective of the details of the bending mechanism. Plasmoid could soften first the growth nodes in the crop circle pattern and some other mechanism could course the bending.

1. Is plasma pattern generated by rotational flow of air associated with plasmoids

Plasmoids involve rotating magnetic field both at dark space-time sheets with the return flux along ordinary space-time sheets. Also ordinary ions are expected to rotate since they experience Lorentz force. This motion could induce the rotation of ordinary air molecules. For centuries it is known that plasma discharge in air causes also a flow of ordinary air known as a corona wind [D4]. Corona wind is believed to be caused by the scattering of plasma ions with the neutral atoms of air. If this belief is correct, the rotating ions of the plasmoid could induce a rotating corona wind.

If so, the purely mechanical explanation for the formation of the crop circle would be in terms of the swirling air containing the ions would cause the downing much like ordinary wind. A model of vortex with rigid body rotation in core region and curl free rotation outside the core region with velocity behaving as 1/distance has been discussed in [H11]. Downing would occur inside the core region where the plasma is.

The model allows also the formation of narrow ridges in the interior of flattened regions. Two co-operating plasma vortices with opposite directions generate strongly reduced pressure in the region between them and this raises the crops up in this region.

The basic prediction is that the direction of bending should be along the local direction of the corona wind so that the downing pattern should mimic the flow pattern of the vortex: I do not know whether this is the case.

2. Two-step model for the formation of crop circles

It is not clear whether the pattern of bent crops is consistent with a rotational flow or not. Hence one must consider a more refined model based on an alternative mechanism of corona wind discussed in [K21]. The model is inspired by the experimental finding of Modanese and Podkletnov [H12] that plasma discharge generates unknown radiation with induces motion of test particles but is not attenuated so that the effect is not caused by the absorption of the energy of radiation.

The model relies on the recoil effect resulting from the dropping of electrons of air to larger space-time sheets. The unknown radiation emitted by plasma discharge is identified in terms of (dark) MEs or scalar wave pulses. At least (dark) MEs serve as correlates for Bose-Einstein condensate of (dark) photons. MEs or scalar wave pulses would induce flux tubes to larger space-time sheets inducing the transfer of electrons of ionized air to larger space-time sheets, and the corona wind would result as a recoil effect. This would most naturally induce corona wind having a constant direction rather than a swirling of the air.

Crop circle would be created in steps decomposing into two sub-steps.

1. Plasmoid moves through some distance and induces the softening of the growth nodes by microwave heating along its track.

2. Plasmoid generates a plasma discharge inducing MEs or scalar wave pulses bending the crops along the direction of its propagation provided it is same as the local direction of the track. If not, nothing occurs. Rotating plasmoids are indeed negatively charged and their charge grows by the presence of radial ohmic current caused by the rotating magnetic field until plasma discharge occurs. Thus this option fits nicely with the model of plasmoid as a Searl machine. The fact that lightnings generate SiO_2 balls in sand could be understood if lightnings create plasmoids.

3.4.6 What causes the strange experiences?

As already explained, some animals tend to avoid the crop formations and humans have altered states of consciousness in their vicinity, in particular sense of presence. If crop formation involves the presence of a conscious magnetic body, these experiences could be understood to result from the telepathic sharing of mental images by quantum entanglement perhaps mediated by plasmoids playing the role of a medium as in the model of UFO experiences. This view is consistent with the idea that crop circles are messages of magnetospheric conscious entities to human kind about their existence. Telepathic sharing of mental images would involve charge entanglement by by W MEs responsible also for the generation of plasma patterns.

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4 Dark Matter Hierarchy, Genetic Machinery, And The Un-Reasonable Selectivity Of Bio-Catalysis

One of the most fascinating outcomes of ideas related to the dark matter hierarchy is the notion of inherently dark fractional atom (molecule) generalizing the notion of Bose-Einstein condensate to the fermionic case. These notions might provide an elegant manner to understand the mysteries of DNA replication, transcription, and translation, and more generally, the incredible selectivity of bio-catalysis.

As often, the original idea was not quite correct. I spoke about N-atoms rather than fractional atoms. In particular, the mass of N-molecule was N times larger than that of the ordinary molecule apart from corrections from binding energy. The more precise view about dark matter hierarchy led to the realization that fractionization of all quantum numbers occurs. In the most general case one can have fractional particles with particle number $n = k/r$, $k = 1, .., r$, $r = \frac{\hbar}{\hbar_0}$. This leaves the model essentially as such at formal level. The model is however much more realistic than the original one since fractional atoms have mass which is never larger than that of ordinary atom and also conforms with the recent view about the origin of the hierarchy of Planck constants.

4.1 Dark Atoms And Dark Cyclotron States

The development of the notion of dark atom involves many side tracks which make me blush. The first naïve guess was that dark atom would be obtained by simply replacing Planck constant with its scaled counterpart in the basic formulas and interpreting the results geometrically. After some

obligatory twists and turns it became clear that this assumption is indeed the most plausible one. The main source of confusion has been the lack of precise view about what the hierarchy of Planck constants means at the level of embedding space at space-time.

The rules are very simple when one takes the singular coverings assigned to the many-valuedness of the time-derivatives of embedding space coordinates as functions of canonical momentum densities as a starting point.

1. The mass and charge of electron are fractionized as is also the reduced mass in Schrödinger equation. This implies the replacements $e \to e/r$, $m \to m/r$, and $\hbar \to r\hbar_0$, $r = n_a n_b$, in the general formula for the binding energy assigned with single sheet of the covering. If maximal number $n_a n_b$ are present corresponding to a full "Fermi sphere", the total binding energy is r times the binding energy associated with single sheet.

2. In the case of hydrogen atom the proportionality $E \propto m/\hbar^2$ implies that the binding energy for single sheet of the covering scales as $E \to E/(n_a n_b)^3$ and maximal binding energy scales as $E \to E/(n_a n_b)^2$. This conforms with the naïve guess. For high values of the nuclear charge Z it can happen that the binding energy is larger than the rest mass and fractionization might take place when binding energy is above critical fraction of the rest mass.

3. In the case of cyclotron energies one must must decide what happens to the magnetic flux. Magnetic flux quantization states that the flux is proportional to $\hbar$ for each sheet separately. Hence one has $\Phi \to r\Phi$ for each sheet and the total flux scales as r^2. Since the dimensions of the flux quantum are scaled up by r the natural scaling of the size of flux quantum is by r^2. Therefore the quantization of the magnetic flux requires the scaling $B \to B/r$. The cyclotron energy for single sheet satisfies $E \propto \hbar qB/m$ and since both mass m and charge q become fractional, the energy E for single sheet remains invariant whereas total cyclotron energy is scaled up by r in accordance with the original guess and the assumption used in applications.

4. Dark cyclotron states are expected to be stable up to temperatures which are r times higher than for ordinary cyclotron states. The states of dark hydrogen atoms and its generalizations are expected to be stable at temperatures scaled down by $1/r^2$ in the first approximation.

5. Similar arguments allow to deduce the values of binding energies in the general case once the formula of the binding energy given by standard quantum theory is known.

The most general option option allows fractional atoms with proton and electron numbers varying from $1/r$ to 1. One can imagine also the possibility of fractional molecules. The analogs of chemical bonds between fractional hydrogen atoms with $N - k$ and k fractional electrons and protons can be considered and would give rise to a full shell of fractional electrons possessing an exceptional stability. These states would have proton and electron numbers equal to one.

Catalytic sites are one possible candidate for fractal electrons and catalyst activity might be perhaps understood as a strong tendency of fractal electron and its conjugate to fuse to form an ordinary electron.

4.1.1 Connection with quantum groups?

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 [K1]. 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 [K23].

Only singular coverings are allowed if the hierarchy of Planck constants and corresponding hierarchy of singular coverings follows from the basic TGD. If the integer n characterizing the quantum phase allows identification with with $r = \hbar/\hbar_0$, living matter could be perhaps 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 relate to the mystery of living matter and predict an entire hierarchy of new forms of matter.

4.1.2 How to distinguish between fractional particles and ordinary particles?

The unavoidable question is whether bio-molecules in vivo could involve actually fractional atoms molecules as their building blocks. This raises a series of related questions.

1. Could it be that we can observe only the fusion of of dark fractional fold molecules to ordinary molecules or its reversal? Is the behavior of matter matter in vivo dictated by the dark matter commentn and of matter in vitro by ordinary matter? Could just the act of observing the matter in vivo in the sense of existing science make it ordinary dead matter?

2. If fractional atoms and molecules correspond to the maximum number of fractional quanta their masses are same as for ordinary atoms and molecules and only the different binding energy photon spectrum distinguishes between them. Situation changes all fractional states are possible and one obtains scaled down spectrum as a unique signature.

3. The fusion of fractional molecules to ordinary molecules in principle allows to conclude that fractional molecule was present. Could this process mean just the replacement of DNA in vivo with DNA in vitro?

4.2 Spontaneous Decay And Completion Of Dark Fractional Atoms As A Basic Mechanisms Of Bio-Chemistry?

The replication of DNA has remained for me a deep mystery and I dare to doubt that the reductionistic belief that this miraculous process is well-understood involves self deceptive elements. Of course the problem is much more general: DNA replication is only a single very representative example of the miracles of un-reasonable selectivity of the bio-catalysis. I take this fact as a justification for some free imagination inspired by the notion of dark fractional molecule.

4.2.1 Dark fermionic molecules can replicate via decay and spontaneous completion

Unit particle number for fractional atom or molecule means that the analog of closed electronic shell are in question so that the state is especially stable. Note that the analogy with full Fermi electronic sphere makes also sense. These atoms or molecules could decay to fractional atoms or molecules. with fractional particle numbers k/r and $(r-k)/r$.

Suppose that a fractional molecule with unit particle number decays into k/r-molecule and $(r-k)/r$-molecule. If r is even it is possible to have $k = r-k = r/2$ and the situation is especially symmetric. If fermionic $k/r < 1$ fractional atoms or molecules are present, one can imagine that they tend to be completed to full molecules spontaneously. Thus spontaneous decay and completion would favor the spontaneous replication (or rather fractionization) and dark molecules could be ideal replicators (fractionizators) The idea that the mechanisms of spontaneous decay and completion of dark fractional particles somehow lurk behind DNA replication and various high precision bio-catalytic processes is rather attractive.

4.2.2 Reduction of lock and key mechanism to spontaneous completion

DNA replication and molecular recognition by the lock and key mechanism are the two mysterious processes of molecular biology. As a matter fact, DNA replication reduces to spontaneous opening of DNA double strand and to the lock and key mechanism so that it could be enough to understand the opening of double strand in terms of spontaneous decay and lock and key mechanism in terms of spontaneous completion of fractional particle (-atom or -molecule).

Consider bio-molecules which fit like a lock and key. Suppose that they are accompanied by dark fractional atoms or molecules, to be called dark fractional particles in sequel, such that one has $k_1 + k_2 = r$ so that in the formation of bound state dark molecules combine to form r-molecule analogous to a full fermionic shell or full Fermi sea. This is expected to enhance the stability of this particular molecular complex and prefer it amongst generic combinations.

For instance, this mechanism would make it possible for nucleotide and its conjugate, DNA and mRNA molecule, and tRNA molecule and corresponding amino-acid to recognize each other. Spontaneous completion would allow to realize also the associations characterizing the genetic code

as a map from RNAs to subset of RNAs and associations of this subset of RNAs with amino-acids (assuming that genetic code has evolved from RNA $\rightarrow$ RNA code as suggested in this chapter).

As such this mechanism allows a rather limited number of different lock and key combinations unless r is very large. There is however a simple generalization allowing to increase the representative power so that lock and key mechanism becomes analogous to a password used in computers. The molecule playing the role of lock *resp.* molecule would be characterized by a set of n fractional particles with $k_1 \in \{k_{1,1}, ...k_{1,n}\}$ *resp.* $k_2 \in \{k_{2,1} = r - k_{1,1}, ..., k_{2,n} = r - k_{1,n}\}$. The molecules with conjugate names would fit optimally together. Fractional molecules or fractional electrons or atoms appearing as their building blocks would be like letters of a text characterizing the name of the molecule.

The mechanism generalizes also to the case of $n > 2$ reacting molecules. The molecular complex would be defined by a partition of n copies of integer r to a sum of m integers $k_{k,i}$: $\sum_i k_{k,i} = r$.

This mechanism could provide a universal explanation for the miraculous selectivity of catalysts and this selectivity would have practically nothing to do with ordinary chemistry but would correspond to a new level of physics at which symbolic processes and representations based on dark fractional particles emerge.

4.2.3 Connection with the number theoretic model of genetic code?

The emergence of partitions of integers in the labelling of molecules by fractional particles suggests a connection with the number theoretical model of genetic code [K6], where DNA triplets are characterized by integers $n \in \{0, ..., 63\}$ and amino-acids by integers $0, 1$ and 18 primes $p < 64$. For instance, one can imagine that the integer n means that DNA triplet is labelled by n/r-particle. $r = 64$ would be the obvious candidate for r and conjugate DNA triplet would naturally have $n_c = 64 - n$.

The model relies on number-theoretic thermodynamics for the partitions of n to a sum of integers and genetic code is fixed by the minimization of number theoretic entropy which can be also negative and has thus interpretation as information. Perhaps these partitions could correspond to states resulting in some kind of decays of n-fermion to n_k/r-fermions with $\sum_{k=1}^{r} n_k = n$. The n_k/r-fermions should however not correspond to separate particles but something different. A possible interpretation is that partition corresponds to a state in which n_1/r particle is topologically condensed at $n_2/r \geq n_1/r$ particle topologically condensed....at $n_k/r \geq n_{k-1}/r$-particle. This would also automatically define a preferred ordering of the integers n_i in the partition.

An entire ensemble of labels would be present and depending on the situation codon could be labelled not only by n/r-particle but by any partition $n = \sum_{i=1}^{k} n_i$ corresponding to the state resulting in the decay of n/r-particle to k fractional particles.

4.2.4 Reduction of DNA replication to a spontaneous decay of r-particle

DNA replication could be induced by a spontaneous decay of r-particle inducing the instability of the double strand leading to a spontaneous completion of the component strands.

Strand and conjugate strand would be characterized by k_1/r-particle and $(r - k_1)/r$-particle, which combine to form r-particle as the double strand is formed. The opening of the double strand is induced by the decay of r-particle to k_1/r- and $(r - k_1)/r$-particles accompanying strand and its conjugate and after this both strands would complete themselves to double strands by the completion to r-particle.

It would be basically the stability of fractional particle which would make DNA double strand stable. Usually the formation of hydrogen bonds between strands and more generally, between the atoms of stable bio-molecule, is believed to explain the stability. Since the notion of hydrogen bond is somewhat phenomenological, one cannot exclude the possibility that these two mechanisms might be closely related to each other. I have already earlier considered the possibility that hydrogen bond might involve dark protons [K10]: this hypothesis was inspired by the finding that there seems to exist two kinds of hydrogen bonds [D6].

The reader has probably already noticed that the participating fractional molecules in the model of lock and key mechanism are like sexual partners, and if already molecules are conscious entities as TGD inspired theory of consciousness strongly suggests, one might perhaps see the formation of entangled bound states with positive number theoretic entanglement entropy accompanied by

molecular experience of one-ness as molecular sex. Even more, the replication of DNA brings in also divorce and process of finding of new companions!

4.3 The New View About Hydrogen Bond And Water

Concretization of the above scenario leads to a new view about hydrogen bond and the role of water in bio-catalysis.

4.3.1 What the fractional particles labelling bio-molecules could be?

What the dark fractional particles defining the letters for the names of various bio-molecules could be? Dark fractional hydrogen atoms are the lightest candidates for the names of bio-molecules. The fusion could give rise to the hydrogen atom appearing in hydrogen bond. One could say the fractional hydrogen atoms belong to the molecules between which the hydrogen bond is formed. In absence of bond the fractional atoms would define active catalyst sites. This mechanism would also conform with the belief that hydrogen bonds guarantee the stability of bio-molecules.

This idea is not a mere speculation. The first experimental support for the notion of dark matter [K10] came from the experimental finding that water looks in atto-second time scale from the point of view of neutron diffraction and electron scattering chemically like $H_{1.5}O$: as if one fourth of protons are dark [D7, D5, D9, D3]. Dark protons would be identifiable as fractional protons. Of course, also dark hydrogen atoms can be considered.

One can imagine also a second option. The model for [I1] [K12] leads to a rather concrete view about how magnetic body controls biological body and receives sensory input from it. The model relies on the idea that dark water molecule clusters and perhaps also dark exotically ionized super-nuclei formed as linear closed strings of dark protons [K10] perform this mimicry. Dark proton super-nuclei are ideal for mimicking the cyclotron frequencies of ordinary atoms condensed to dark magnetic flux quanta. Of course, also partially ionized hydrogen fractional ions could perform the cyclotron mimicry of molecules with the same accuracy.

One can consider the possibility fractional molecules/atoms correspond to exotic atoms formed by electrons bound to exotically ionized dark super-nuclei: the sizes of these nuclei are however above atomic size scale so that dark electrons would move in a harmonic oscillator potential rather than Coulombic potential and form states analogous to atomic nuclei. The prediction would be the existence of magic electron numbers [K10]. Amazingly, there is strong experimental evidence for the existence of this kind of many-electron states. Even more, these states are able to mimic the chemistry of ordinary atoms [D8, D2, D1]. The formation of hydrogen bonds between catalyst and substrate could be the correlate for the fusion of fractional hydrogen atoms.

If the fusion process gives rise 1/1-hydrogen, its spontaneous decay to ordinary hydrogen would liberate the difference of binding energies as metabolic energy helping to overcome the energy barrier for the reaction. The liberated energy would be rather large and correspond 3.4 eV UV photon even for $r = 2$ which suggests that it does not relate with standard metabolism. For larger values of r the liberated energy rapidly approaches to the ground state energy of hydrogen. Note that the binding energy of ordinary hydrogen atom in state $n = r$ has in the lowest order approximation same energy as the ground state of dark hydrogen atom for $\hbar/\hbar_0 = r$ so that one can consider the possibility of a resonant coupling of these states.

Fractional protons and electrons have effective charge $\pm ke/r$ so that the binding regions of catalysts and reacting molecules could carry effective fractional surface charge.

This might relate in an interesting manner to the problem of how poly-electrolytes can be stable (I am grateful for Dale Trenary for pointing me the problem and for interesting discussions). For instance, DNA carries a charge of -2 units per nucleotide due to the phosphate backbone. The models trying to explain the stability involve effective binding of counter ions to the polyelectrolyte so that the resulting system has a lower charge density. The simulations of DNA condensation by Stevens [I18] however predict that counter ion charge should satisfy $z > 2$ in the case of DNA. The problem is of course that protons with $z = 1$ are the natural counter ions. The positive surface charge defined by the fractional protons attached to the nucleotides of DNA strand could explain the stability.

4.3.2 The hydrogen atoms in hydrogen bonds as fractional hydrogen atoms and $H_{1.5}O$ formula for water

The simplest assumption is that the hydrogens associated with hydrogen bonds are actually associated with 1/1 type dark hydrogen atoms. This hypothesis has interesting implications and could explain the formula $H_{1.5}O$ for water in atto-second time scales suggested by neutron diffraction and electron scattering [D7, D5, D9, D3].

The formation of hydrogen bond would correspond to a fusion of name and conjugate name between $H_{k/r}$-O-H atom and its conjugate $H_{(r-k)/r}$-O-H atom. The resulting pairs would obey the chemical formula H_3-O_2. Hence the formation of hydrogen bonds would predict the $H_{1.5}O$ formula suggested by neutron diffraction and electron scattering in atto-second time scale. This holds true only if one has complete pairing by hydrogen bonds. A more plausible explanation is that just the presence of fractioanl hydrogens implies the effect. Furthermore, the fraction of dark protons can depend on temperature.

4.3.3 The roles of water and ordered water in catalysis

The new view about hydrogen bond allows to understand the role of water in biology at qualitative level. For instance, one can

1. tentatively identify "ordered water" as a phase in which all $H_{k/r}$ atoms and their conjugates have combined to $H_{1/1}$ atoms,
2. understand why (or perhaps it is better to say "predict that") water containing $H_{k/r}$ atoms acts as a catalytic poison so that the binding sites of catalysts and reactants must be isolated from water unless the water is ordered,
3. justify the belief that gel phase involving ordered water is necessary for biological information processing,
4. understand why hydration causes hydrolysis,
5. understand the instability of DNA against decay to RNA outside nucleus.

A more more detailed sketch looks like following.

1. Suppose that at least part of water molecules appear in form $H_{k/r}$-OH and $H_{(r-k)/r}$-O-H. These molecules and the molecule $H_{1/1}$-OH_2 formed in their fusion has much smaller binding energy than ordinary water molecule and is expected to be unstable against transition to H_3O. This would suggest that the feed of metabolic energy is needed to generate the dark hydrogen atoms.

   Fractional dark water molecules can join pairwise to form H-O-($H_{1/1}$)-O-H$\equiv H_3O_2$ with $H_{1/1}$-atoms replacing hydrogen in hydrogen bond. Also $H_{k_1/r}$-O-$H_{k_2/r}$ molecules are possible and could form closed strings obeying the chemical formula $O_n(H_{1/1})_n$. Also open strings with H-O: s at ends are possible. This phase of water might allow identificaton as "ordered water" believed to be associated with gel phase and be crucial for quantal information processing inside cell. Liquid crystal phase of water could correspond to a bundle of open vertical segments H-$O_n(H_{1/1})_{n-2}$-H forming a 2-dimensional liquid (vertical freezing).

2. Exotic water molecules could spoil the action of both catalyst and reactant molecules by attaching to the "letters" in the name of catalyst or reactant so that the letters are not visible and catalyst and reactant cannot recognize each other anymore. Hence binding sites of catalyst and reactant must be isolated from water containing fractional water molecules. This is what Sidorova and Rau [I21] suggest on basis of comparison of specific and non-specific catalysts: non-specific catalysts contain water in an isolated binding volume whereas for specific catalysts this volume is empty. An alternative mechanism hindering water molecules to attach to "letters" is that water is "ordered water" with no fractional water molecules present.

3. DNA is known to be stable against decay to RNA via hydration inside the cell but not outside. Hydration could correspond to the joining of fractional water to sites of DNA transforming it to RNA. Inside nucleus this cannot occur if water is in ordered water phase permanently.

4.3.4 How the first self-replicators emerged?

The identification of the first self replicator can be seen as perhaps the most fascinating and challenging problem faced by the pre-biotic model builders. Self replicator is by definition an entity which catalyzes its own replication. The analogy with the self-referential statement appearing in Gödel's theorem obvious.

In TGD framework self replication would reduce to a spontaneous decay of $H_{1/1}$-atom to $H_{k/r}$- and $H_{(r-k)/r}$-atoms and their subsequent completion to $H_{1/1}$-atoms

The picture about emergence of self-replicators would be roughly following.

1. The first self-replicating entities would have been plasmoids [I17] generating $H_{1/1}$ atoms whose presence would have made possible the emergence of the first molecular self replicators. The generation of $H_{1/1}$ atoms requires metabolic energy feed. In the first approximation the decay of $H_{1,1}$ to fractional hydrogen atoms does not liberate nor require energy.

2. $H_{k/r}$ atoms would have replaced some ordinary H-atoms in some negatively charged molecules M_i (perhaps MXTP, $X = A, U, C, G$) leading to a spontaneous emergence of linear negatively charged polymers consisting of M_i. One can imagine a coding in which each X corresponds to fixed value of k or collection of the (2 hydrogen bonds or 3 hydrogen bonds depending on X). This would make the attachment of X and its conjugate to form a hydrogen bond a highly favored process.

3. $H_{k/r}$ atoms would have taken also the role of active binding sites. In ordered water conjugate molecules $M_{c,i}$ having $H_{(r-k)/r}$ atoms as labels would have had high probability to attach to the polymers made of M_i.

4. RNA molecules are good candidates for self-replicators in the presence of ordered water. The phase transition from ordinary to ordered water (which would have developed later to sol-gel phase transition) would have been an essential element of replication.

4.3.5 The role of water in chiral selection

In the latest New Scientist (when I am writing this) there was a news telling that chiral selection occurs in water but not in heavy water [C1]. The L form of amino-acid glutamate is more stable than R in ordinary but not so in heavy water so that water environment must be responsible for the chirality selection of bio-molecules. The proposed explanation for the finding, whose importance cannot be over-estimated, was following.

1. Water molecules have two forms: orto- and para, depending on whether the nuclear spins of protons are parallel or opposite. Deuterium nuclei are spinless so that heavy water has only single form. In thermal equilibrium the fraction of orto water is 3/4 and para water 1/4.

2. Ortho-water is magnetic and if L form of amino-acid is slightly more magnetic than R, chirality selection can be understood as result of the magnetic interaction with water.

One can of course wonder how extremely short ranged weak interactions could produce strong enough effect on the magnetic moment. The situation is not made easier by the fact that magnetic interaction energies are inherently very weak and deep below the thermal threshold.

It is interesting to find whether these findings could be explained by and allow a more detailed formulation of the TGD based model for water based on the notion of fractional hydrogen atom, the new view about hydrogen bond, and the notion of dark protonic strings forming atomic sized super-nuclei carrying exotic weak charges.

1. Dark matter brings in long ranged exotic weak interactions which can produce large parity breaking effects in atomic and even longer length scales. The long ranged parity breaking weak interactions of the dark protonic super nuclei assignable to amino-acids and water could explain the chiral selection.

2. The magnetic interaction energy is scaled up by r, so that magnetic interactions could indeed play a key role. Ordinary classical magnetic fields are in TGD framework always accompanied by Z^0 magnetic fields. If amino-acids possess exotic em charge implying also exotic weak charge, one can understand the chiral breaking as being induced by the Z^0 magnetic interaction of aminocids with the dark magnetic fields generated by water molecules or their clusters possessing a net magnetic moment. In heavy water these fields would be absent so that the experimental findings could be understood.

3. The experimental evidence that water behaves as $H_{1.5}O$ in atto-second time scales means that 1/4: th of protons of water are effectively dark. The notion of fractional hydrogen atom leads to a model of hydrogen bond predicting correctly $H_{1.5}O$ formula and the dropping of 1/4: th of protons at larger possibly dark space-time sheets. The model also predicts that the mass of $H-O-H_r-O-H \equiv 2H_{1.5}O$ hydrogen bonded pairs is very near to the mass of 2 water molecules since there are $r \simeq m_p/m_e$ electrons involved. The paired molecules have three protons and non-vanishing net nuclear spin and thus generate a magnetic field and make hydrogen bonded water a magnetic system. The natural identification would be as dark magnetic field accompanied by Z^0 magnetic field responsible for the chiral selection.

   In the case of $D-O-D_r-O-D$ mass would be by about one proton mass m_p lower than mass of two D_2O molecules so that this D-bonded heavy water would look like $D_{1.25}O$ as far as masses are considered and $D_{1.5}O$ as far neutron diffraction and electron scattering are considered. In this case no magnetic field is generated since the nuclear spin of D vanishes and no chiral breaking results. This picture explains the experimental findings. The model is not equivalent with the proposal of the experimentalists.

4. The model predicts that the protons liberated in the formation of hydrogen bonds drop to larger space-time sheets but does not specify their fate. A strong constraint comes from the requirement that the dropped particles have exotic weak charges acting as sources of the geometrically unavoidable classical Z^0 magnetic field at dark space-time sheets causing the large parity breaking. This constraint is satisfied if the protons form super-nuclei (scaled up variants of nuclei) consisting of protonic strings connected by color bonds involving exotic quark and antiquark at its ends and some of these bonds are charged (of type $u\overline{d}$ or $d\overline{u}$: this could also generate the em charge needed to make the protonic string stable.

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