

Implications of strong gravimagnetism for TGD inspired quantum biology

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Abstract

Physicists M. Tajmar and C. J. Matos and their collaborators working in ESA (European Satellite Agency) have made an amazing claim of having detected strong gravimagnetism with gravimagnetic field having a magnitude which is about 20 orders of magnitude higher than predicted by General Relativity.

Tajmar et al have proposed the gravimagnetic effect as an explanation of an anomaly related to the superconductors. The measured value of the mass of the Cooper pair is slightly larger than the sum of masses whereas theory predicts that it should be smaller. The explanation would be that actual Thomson field is larger than it should be because of gravimagnetic contribution to quantization rule used to deduce the value of Thomson field. The required value of gravimagnetic Thomson field is however 28 orders of magnitude larger than General Relativity suggests. TGD inspired proposal is based on the notion of gravitational Planck constant assignable to the flux tubes connecting to massive objects. It turns out that the TGD estimate for the Thomson field has correct order of magnitude. The identification $h_{eff} = h_{gr}$ at particle physics and atomic length scales emerges naturally.

A vision about the fundamental role of quantum gravitation in living matter emerges. The earlier hypothesis that dark EEG photons decay to biophotons with energies in visible and ultraviolet range receives strong quantitative support. Also a mechanism for how magnetic bodies couple bio-chemistry emerges. The vision conforms with Penrose's intuitions about the role of quantum gravity in biology.

1 Introduction

Physicists M. Tajmar and C. J. Matos and their collaborators working in ESA (European Satellite Agency) have made an amazing claim of having detected strong gravimagnetism with gravimagnetic field having a magnitude which is about 20 orders of magnitude higher than predicted by General Relativity [E2] . If the findings are replicable they mean a revolution in the science of gravity and, as

one might hope, force a long-awaited serious reconsideration of the basic assumptions of the dominating super-string approach.

Tajmar et al have proposed the gravimagnetic effect as an explanation of an anomaly related to the superconductors. The measured value of the mass of the Cooper pair is slightly larger than the sum of masses whereas theory predicts that it should be smaller. The explanation would be that actual Thomson field is larger than it should be because of gravimagnetic contribution to quantization rule used to deduce the value of Thomson field.

TGD explanation of the discrepancy accepting the theory of Tajmar et al comes from the proposal inspired by Nottale's observations suggesting that Bohr's rules apply in planetary system with Planck constant replaced by $h_{gr} = GMm/v_0$, where v_0 is of order of typical rotational velocity of inner or outer planets and M and m are the masses of Sun and planet. h_{gr} clearly characterizes the pair Sun-planet rather than being fundamental constant whereas the gravitational Compton length GM/v_0 depends on M only. In TGD framework one assigns gravitational Planck constant to the flux tube connecting the masses and along which the gravitational massless extremals mediating the gravitational interaction are mediated. By Equivalence Principle it is possible to apply the hypothesis only in elementary particle length scales (this does not exclude its application in longer scales) and in these scales $h_{eff} = h_{gr}$ makes sense.

Gravimagnetic Thomson field is proportional to the square of Planck constant and the obvious guess is that the replacement h with h_{gr} could explain the enormous discrepancy with GRT if gravimagnetism is in question. This predicts correctly the magnitude of the effect and one also ends up with the identification of the $h_{gr} = h_{eff}$ in elementary particle scales.

Also a vision about the fundamental role of quantum gravitation in living matter emerges. The earlier hypothesis that dark EEG photons decay to biophotons with energies in visible and ultraviolet range [K6, K5] receives strong quantitative support. This leads also to a simple model for how magnetic bodies control molecular transitions via dark cyclotron radiation with varying frequencies vary but universal energy spectrum since for a given magnetic field all charged particles gives rise to biophotons with same energy. The values of h_{gr}/m and endogenous magnetic field $B_{end} \simeq .2$ Gauss are such that the spectrum of biophotons is in the range of molecular binding energies. This vision would conform with Penrose intuitions about the fundamental role of gravitation in quantum biology.

2 The theory of Tajmar et al for the anomaly of Cooper pairs mass

The starting point of the theory of Tajmar and Matos [E3] is the so called Thomson magnetic moment generated in rotating charged super-conductors adding a constant contribution to the exponentially damped Meissner contribution to the magnetic field. This contribution can be understood as being due to the massivation of photons in super-conductors. The modified Maxwell equations are obtained by just adding scalar potential mass term to Gauss law and vector potential mass term to the equation related the curl of the magnetic field to the em current.

The expression for the Thomson magnetic field is given by

$$B = 2\omega_R n_s \times \lambda_\gamma^2, \quad (2.1)$$

where ω_R is the angular velocity of superconductor, n_s is charge density of super-conducting particles and $\lambda_\gamma = \hbar/m_\gamma$ is the wave length of a massive photon at rest. In the case of ordinary superconductor one has $\lambda_\gamma = \sqrt{m^*/q^*n_s}$, where $m^* \simeq 2m_e$ and $q^* = -2e$ are the mass and charge of Cooper pair. Hence one has

$$B = -2\frac{m^*}{2e}\omega_R. \quad (2.2)$$

Magnetic field extends also outside the super-conductor and by measuring it with a sufficient accuracy outside the super-conductor one can determine the value of the electron mass. Instead of the theoretical value $m^*/2m_e = .999992$ which is smaller than one due to the binding energy of the Cooper pair the value $m^*/2m_e = 1.000084$ was found by Tate [E1]. This inspired the theoretical work generalizing

the notion of Thomson field to gravimagnetism and the attempt to explain the anomaly in terms of the effects caused by the gravimagnetic field.

Note that in the case of ordinary matter the equations would lead to an inconsistency at the limit $m_\gamma = 0$ since the value of Thomson magnetic field would become infinite. The resolution of the problem proposed in [E3] is based on the replacement of rotation frequency ω with electron's spin precession frequency $\omega_L = -eB/2m$ so that the consistency equation becomes $B = -B = 0$ for a unique choice $1/\lambda_\gamma^2 = -\frac{q}{m}n$. One could also consider the replacement of ω with electron's cyclotron frequency $\omega_c = 2\omega_L$. To my opinion there is no need to assume that the modified Maxwell's equations hold true in the case of ordinary matter.

2.1 Gravimagnetic field

The perturbative approach to the Einstein equations leads to equations which are essentially identical with Maxwell's equations. The g_{tt} component of the metric plays the role of scalar potential and the components g_{ti} define gravitational vector potential. Also the generalization to the super-conducting situation in which graviphotons develop a mass is straightforward. Just add the scalar potential mass term to the counterpart of Gauss law and vector potential mass term to the equation relating the curl of the gravimagnetic field to the gravitational mass current.

In the case of a rotating superconductor Thomson magnetic moment is replaced with its gravimagnetic counterpart

$$B_{gr} = -2\omega_R\rho_m\lambda_g^2 . \quad (2.3)$$

Obviously this formula would give rise to huge gravimagnetic fields in ordinary matter approaching infinite values at the limit of vanishing gravitational mass. Needless to say, these kind of fields have not been observed.

Equivalence Principle however suggests that the gravimagnetic field must be assigned with the rotating coordinate frame of the super-conductor. Equivalence principle would state that seeing the things in a rotating reference frame is equivalent of being in a gravimagnetic field $B_{gr} = -2\omega_R$ in the rest frame. This fixes the graviphoton mass to

$$\frac{1}{\lambda_{gr}^2} = \left(\frac{m_{gr}}{\hbar}\right)^2 = G\rho_m . \quad (2.4)$$

For a typical condensed matter density parameterized as $\rho_m = Nm_p/a^3$, $a = 10^{-10}$ m this gives the order of magnitude estimate $m_{gr} \sim N^{1/2}10^{-21}/a$ so that graviton mass would be extremely small.

If this is all what is involved, gravimagnetic field should have no special effects. In [E3] it is however proposed that in superconductors a small breaking of Equivalence Principle occurs. The basic assumptions are following.

1. Super-conducting phase and the entire system obey separately their gravitational analogs of Maxwell field equations.
2. The ad hoc assumption is that for super-conducting phase the sign of the gravimagnetic field is opposite to that for the ordinary matter. If purely kinematic effect were in question so that graviphotons were pure gauge degrees of freedom, the value of m_{gr}^2 should be proportional to ρ_m and $\rho_m - \rho_m^*$ respectively.
3. Graviphoton mass is same for both ordinary and super-conducting matter and corresponds to the net density ρ_m of matter. This is essential for obtaining the breaking of Equivalence Principle.

With these assumptions the gravimagnetic field giving rise to acceleration field detected in the rest system would be given by

$$B_{gr}^* = \frac{\rho_m^*}{\rho} \times 2\omega \quad (2.5)$$

This is claimed to give rise to a genuine acceleration field

$$g^* = -\frac{\rho_m^*}{\rho} a \quad (2.6)$$

where a is the radial acceleration due to the rotational motion.

2.2 Explanation for the too high value of measured electron mass in terms of gravimagnetic field

A possible explanation of the anomalous value of the measured electron mass [E1] is in terms of gravimagnetic field affecting the flux Bohr quantization condition for electrons by adding to the electromagnetic vector potential term $q^* A_{em}$ gravitational vector potential $m^* A_{gr}$. By requiring that the quantization condition

$$\oint (m^* v + q^* A_{em} + m^* A_{gr}) dl = 0 \quad (2.7)$$

is satisfied for the superconducting ring, one obtains

$$B = -\frac{2m}{e} \omega - \frac{m}{e} B_{gr} . \quad (2.8)$$

This means that the magnetic field is slightly stronger than predicted and it has been known that this is indeed the case experimentally.

The higher value of the magnetic field could explain the slightly too high value of electron mass as determined from the magnetic field. This gives

$$B_{gr} = \frac{\Delta m_e}{m_e} \times 2\omega = \frac{\Delta m_e}{m_e} \times e m_e \times B . \quad (2.9)$$

The measurement implies $\Delta m_e/m_e = 9.2 \times 10^{-5}$. The model discussed in [E3] predicts $\Delta m_e/m_e \sim \rho^*/\rho$. The prediction is about 23 times smaller than the experimental result.

3 Is the large gravimagnetic field possible in TGD framework?

TGD allows top consider several alternative solutions for the claimed effect.

1. TGD predicts the possibility of classical electro-weak fields at larger space-time sheets. If these couple to Cooper pairs generate exotic weak charge at super-conducting space-time sheets the Bohr quantization conditions modify the value of the magnetic field. Exotic weak charge would however mean also exotic electronic em charge so that this option is excluded. It would also require that the Z^0 charge of test bodies used to measure the acceleration field is proportional to their gravitational mass.
2. According to the simplest recent view about Kähler-Dirac action [K4] the modes of Dirac operator are confined to 2-D string world sheets at which classical W boson fields vanish. This guarantees that em charge is well-defined for the modes. The stronger condition that also classical Z^0 field vanishes makes also sense and should hold at least in the length scales in which weak bosons do not appear. This guarantees the absence of axial couplings and parity breaking effects. In living matter parity breaking effects are large and one could consider the possibility that weak length scale is scaled up for $h_{eff} > h$ and that classical Z^0 fields are present below the weak scale.
3. One cannot exclude the possibility that the classical weak fields vanish for entire space-time surface. In this case spinor modes can still be seen as continuous superpositions of 2-D ones. In principle one can consider also other options - such as vanishing of induced Kähler form or classical em field besides that of W fields.

The conservative option is that classical weak fields vanish in the situation considered so that there is room for the strong gravimagnetic field. The following model starts from the model of Tajmar et al and generalizes it by replacing Planck constant with its gravitational counterpart.

3.1 Modification of the model of Tajmar et al by replacing h with h_{gr}

Gravimagnetic Thomson field is proportional to the square of Planck constant and the obvious guess is that the replacement h with h_{gr} could explain the enormous discrepancy with GRT if gravimagnetism is in question. This predicts correctly the magnitude of the effect and one also ends up with the identification of the $h_{gr} = h_{eff}$ in elementary particle scales. Also a vision about the fundamental role of quantum gravitation in living matter emerges,

1. The formula used by Tajmar et al [?] for the gravimagnetic variant of Thomson magnetic field is direct generalization for the Thomson field for ordinary super-conductor. The gravimagnetic field is proportional to the product $B_g = \omega_R r^2$ of the rotation frequency ω_R of super-conductor and square of the ratio $r = (\lambda_g/\lambda_{g,T})$ where $\lambda_g = \hbar/m_g$ is graviton wave length and $\lambda_{g,T}$ is gravimagnetic penetration length obtained as generalization of the magnetic penetration length for super-conductors by replacing charge with mass. The latter is purely classical quantity whereas graviton wave length depends on Planck constant. Graviton mass can be argued to result in gravitational Meissner effect and can be estimated from the value of cosmological constant Λ being essentially its square root. The resulting value of B_g is too small by 28 orders of magnitude.
2. Tajmar et al [E3] suggests that graviton mass is larger by a factor of order 10^{14} in conflict with the experimental upper bound of order 10^{55} kg for m_g . TGD proposal is that it is Planck constant which should be replaced with effective Planck constant $h_{eff} = nh$ equal to gravitational Planck constant h_{gr} for electron Cooper pair in Earth's gravitational field. The model for planetary orbits as Bohr orbits together with Equivalence Principle implies $h_{gr} = GMm/v_0$ at flux tubes connecting particle with mass m to Sun with mass M . v_0 has dimensions of velocity and has order of magnitude correlating with a typical rotation velocity of planetary orbit by Bohr quantization rules.
3. In the recent case the rotation velocity v_0 is the rotation velocity of Earth at its surface: $v_0(E)/c = 2.16 \times 10^{-6}$ to be compared with $v_0(S)/c \simeq .5 \times 10^{-3}$ for Sun-Earth system. The scaling of λ_g is given by $h_{gr}(E, pair)/h = (h_{gr,S,pair}/h) \times (M_E/M_S) \times v_0(S)/v_0(E)$. This gives

$$r \equiv \frac{h_{gr,S,pair}}{h} = \frac{\lambda(h_{gr,S,pair})}{\lambda(h,pair)} = \frac{\frac{GM}{v_0(S)}}{\lambda_c(pair)} = \frac{r_S}{\lambda_c(e)} .$$

Using $r_S = 3km$ and $\lambda_e = .243 \times 10^{-12}$ m and $v_0(S) \simeq 2^{-11}$, $M_E/M_S = 3.0 \times 10^{-6}$ one obtains $r \simeq 3.6 \times 10^{14}$. This happens to be correct order of magnitude! Maybe the model might have something to do with reality. Even better, also the value of h_{eff} is consistent with its value spectrum appearing in EEG if one requires that the energy of dark EEG photon with frequency of order 10 Hz is that of biophoton with frequency of about 5×10^{14} Hz. If this picture is correct the values of $h_{eff} = h_{gr}$ would come as proportional to the masses of particles and cyclotron energies proportional to heB/m would not depend on the mass of the particle at all.

4. What is nice that the model unifies the notions of gravitational Planck constant and dark Planck constant. The basic observation is that Equivalence Principle allows to understand the effects of h_{gr} by reducing it to elementary particle level interpreted in terms of flux tubes connecting particle to the bigger system. This allows to avoid gigantic values of h_{gr} and gives connection with TGD inspired quantum biology. The new quantum physics associated with gravitation would also become key part of quantum biology.

3.2 Could $h_{gr} = h_{eff}$ hold true?

The obvious question is whether the gravitational Planck constant deduced from the Nottale's considerations and the effective Planck constant $h_{eff} = nh$ deduced from ELF effects on vertebrate brain

and explained in terms of non-determinism of Kähler action could be identical. At first this seems to be non-sensical idea since $h_{gr} = GMm/v_0$ has gigantic value.

It is however essential to realize that by Equivalence Principle one describe gravitational interaction by reducing it to elementary particle level. For instance, gravitational Compton lengths do not depend at all on the masses of particles. Also the radii of the planetary orbits are independent of the mass of particle mass in accordance with Equivalence Principle. For elementary particles the values of h_{gr} are in the same range as in quantum biological applications. Typically 10 Hz ELF radiation should correspond to energy $E = h_{eff}f$ of UV photon if one assumes that dark ELF photons have energies of biophotons and transform to them. The order of magnitude for n would be therefore $n \simeq 10^{14}$.

The experiments of M. Tajmar et al [E2, E3] discussed in [?] provide a support for this picture. The value of gravimagnetic field needed to explain the findings is 28 orders of magnitude higher than theoretical value if one extrapolates the model of Meissner effect to gravimagnetic context. The amazing finding is that if one replaces Planck constant in the formula of gravimagnetic field with h_{gr} associated with Earth-Cooper pair system and assumes that the velocity parameter v_0 appearing in it corresponds to the Earth's rotation velocity around its axis, one obtains correct order of magnitude for the effect requiring $r \simeq 3.6 \times 10^{14}$.

The most important implications are in quantum biology and Penrose's vision about importance of quantum gravitation in biology might be correct.

1. This result allows by Equivalence Principle the identification $h_{gr} = h_{eff}$ at elementary particle level at least so that the two views about hierarchy of Planck constants would be equivalent. If the identification holds true for larger units it requires that space-time sheet identifiable as quantum correlates for physical systems are macroscopically quantum coherent and gravitation causes this. If the values of Planck constant are really additive, the number of parallel space-time sheets corresponding to non-determinism evolution for the flux tube connecting systems with masses M and m is proportional to the masses M and m using Planck mass as unit. Information theoretic interpretation is suggestive since hierarchy of Planck constants is assumed to relate to negentropic entanglement very closely in turn providing physical correlate for the notions of rule and concept.
2. That gravity would be fundamental for macroscopic quantum coherence would not be surprising since by EP all particles experience same acceleration in constant gravitational field, which therefore has tendency to create coherence unlike other basic interactions. This in principle allows to consider hierarchy in which the integers $h_{gr,i}$ are additive but give rise to the same universal dark Compton length.
3. The model for quantum biology relying on the notions of magnetic body and dark matter as hierarchy of phases with $h_{eff} = nh$, and biophotons [K6, K5] identified as decay products of dark photons. The assumption $h_{gr} \propto m$ becomes highly predictable since cyclotron frequencies would be independent of the mass of the ion.
 - (a) If dark photons with cyclotron frequencies decay to biophotons, one can conclude that biophoton spectrum reflects the spectrum of endogenous magnetic field strengths. In the model of EEG [K2] it has been indeed assumed that this kind spectrum is there: the inspiration came from music metaphors suggesting that musical scales are realized in terms of values of magnetic field strength. The new quantum physics associated with gravitation would also become key part of quantum biophysics in TGD Universe.
 - (b) For the proposed value of h_{gr} 1 Hz cyclotron frequency associated to DNA sequences would correspond to ordinary photon frequency $f = 3.6 \times 10^{14}$ Hz and energy 1.2 eV just at the lower limit of visible frequencies. For 10 Hz alpha band the energy would be 12 eV in UV. This plus the fact that molecular energies are in eV range suggests very simple realization of biochemical control by magnetic body. Each ion has its own cyclotron frequency but same energy for the corresponding biophoton.
 - (c) Biophoton with a given energy would activate transitions in specific bio-molecules or atoms: ionization energies for atoms except hydrogen have lower bound about 5 eV (http://en.wikipedia.org/wiki/Ionization_energy). The energies of molecular bonds are in the range 2-10 eV (http://en.wikipedia.org/wiki/Bond-dissociation_energy). If one

replaces v_0 with $2v_0$ in the estimate, DNA corresponds to .62 eV photon with energy of order metabolic energy currency and alpha band corresponds to 6 eV energy in the molecular region and also in the region of ionization energies.

Each ion at its specific magnetic flux tubes with characteristic palette of magnetic field strengths would resonantly excite some set of biomolecules. This conforms with the earlier vision about dark photon frequencies as passwords.

It could be also that biologically important ions take care of their ionization self. This would be achieved if the magnetic field strength associated with their flux tubes is such that dark cyclotron energy equals to ionization energy. EEG bands labelled by magnetic field strengths could reflect ionization energies for these ions.

- (d) The hypothesis means that the scale of energy spectrum of biophotons depends on the ratio M/v_0 of the planet and on the strength of the endogenous magnetic field, which is .2 Gauss for Earth (2/5 of the nominal value of the Earth's magnetic field). Therefore the astrophysical characteristics of planets should be tuned for molecular life. Taking v_0 to be rotational velocity one obtains for the ratio $M(planet)/v_0(planet)$ using the ratio for Earth as unit the following numbers for the planets (Mercury, Venus, Earth, Mars, Jupiter, Saturnus, Uranus, Neptune): $M/v_0 = (8.5, 209, 1, .214223, 1613, 6149, 9359)$. If the energy scale of biophotons is required to be the same, the scale of endogenous magnetic field should be divided by this ratio in order to obtain the same situation as in Earth. For instance, in Mars the magnetic field should be roughly 5 times stronger: in reality the magnetic field of Mars is much weaker. Just for fun one can notice that for Sun the ratio is 1.4×10^6 so that magnetic field should be by the inverse of this factor weaker.
4. An interesting question is how large systems can behave as coherent units with $h_{gr} = GMm/v_0$. In living matter one might consider the possibility that entire organism might be this kind of system. Interestingly, for larger masses the gravitational quantum coherence would be easier. For particle with mass m $h_{gr}/h > 1$ requires larger mass to satisfy $M > M_P^2/m_e$. The first guess that life has evolved from long to shorter scales and reached elementary particle last. Planck mass is the critical mass corresponds to the mass of water blob with volume of size scale of 10^{-4} m (big neuron) is the limit.
 5. The Universal gravitational Compton wave length of $GM/v_0 \simeq 864$ meters gives an idea about largest possible living matter system if Earth is the second body. Of course, also other large bodies are possible. In the case of solar system this length is 3×10^3 km. The radius of Earth is 6.37×10^3 km - roughly twice the Compton length. The radii of Mercury, Venus, Earth, Mars, Jupiter, Saturnus, Uranus, Neptunus are (.38, .99, .533, 1, 10.6, 8.6, 4.0, 3.9) using Earth radius as unit the value of h_{gr} is by factor 5 larger than for three inner planets so that the values are reasonably near to gravitational Compton length or twice it. Does this mean that dark matter associated with Earth and maybe also other planets is in macroscopic quantum state at some level of the hierarchy of space-time sheets? Does this mean that Mother Gaia as conscious entity might make sense. One can of course make same question in the case of Sun. The universal gravitational Compton length in Sun would be 18 per cent of the radius of Sun if v_0 is taken to be the rotational velocity at the surface of Sun. The radius of solar core, where fusion takes place, is 20-25 per cent of solar radius.
 6. There are further interesting numerical co-incidences. One can for a moment forget the standard hostility of scientist towards horoscopes and ask whether Sun and Moon could have somehow affect our life via astroscopic quantum coherence. The gravitational Compton length for particle-Moon or particle-Sun system multiplied by the natural value of magnetic field is the relevant parameter. For Sun the parameters in question are mass of Sun, and rotational velocity of Earth with respect to Sun, plus magnetic fields of Sun at flux tubes associated with solar magnetic field measured to be about 5 nT at the position of Earth and 100 times stronger than expected from dipole field behavior. This gives that the range of biophoton energies is scaled down with factor of 1/4 in good approximation so that Father Sun might affect terrestrial biology! If one uses for the rotational velocity of particle at surface of Moon as parameter v_0 (particle would be at Moon), biophoton energy scaled up by factor 1.2.

The general proposal discussed above is testable. In particular, a detailed study of molecular energies with those associated with resonances of EEG could be highly rewarding and reveal the speculated spectroscopy of consciousness.

3.3 What about $h_{em} = h_{eff}$?

The notion of h_{gr} generalizes to that for other interactions. For instance, in electromagnetic case the formation of strong em fields implying charge separation leads to systems in which $h_{em} = Z_1 Z_2 e^2 / v_0$ is large. Pollack's exclusion zone [L1] (<https://www.youtube.com/watch?v=i-T7tCMUDXU>) and its complement define this kind of system and TGD inspired identification is as prebiotic life form. I have proposed a TGD inspired model for the fourth phase of water [K3] [L1].

I have proposed that metabolic machinery generates large h_{eff} phase somehow. $h_{eff} = h_{em}$ hypothesis allows to develop this hypothesis in more detail.

1. The rotating shaft of a molecular motor associated with ATP synthase is proposed to play a key role.
2. What comes in mind is that the rotational velocity v_0 of the shaft appears in the formula for h_{em} . The electric field over the mitochondrial membrane generates charge separation and the product of charges of shaft and its complement should appear in the expression for h_{em} .
3. The value of v_0/c is expected to be of order 10^{-14} from the angular rotation rate of ADP synthase about few hundred revolutions per second. The lower bound for the magnitude for h_{em} is same as for h_{gr} associated with Earth-particle system.

Rotating magnetic systems are claimed to exhibit anomalous effects such as spontaneous acceleration and over unity energy production. I have discussed these in [K1].

1. The proposal is that rotating magnetic systems give rise to dark matter at magnetic flux tubes and sheets associated with the system and that the metabolic energy is needed to rotate the motor to generate the dark matter, which in turn makes possible negentropic entanglement characterized the density matrix proportional to unit matrix. This kind of matrix results if entanglement coefficients form a unitary S-matrix characterizing also quantum computation as unitary process.
2. The parameter v_0 appearing in the general formula for h_{eff} assigned with either em - or gravitational flux tubes is identifiable as the rotation velocity. One has $v_0/c \simeq 3 \times 10^{-8}$.
3. Since these systems are strongly charged, a natural guess is that large h_{em} system is in question.

3.4 Gravitational Mother Gaia and life

Negentropic entanglement (NE) is one of the key notions of TGD inspired quantum biology. For instance, it would seem that NE would look more natural metabolic resource than energy. Nutrients should carry it. NE is however not single particle property but between nutrient and some other system in the recent case. What can one say about this system? Can it be part of nutrient? Could it correspond to oxygen molecules? Or could it be Mother Gaia identified in some sensible manner?

If one believes on the presence of gravimagnetic flux tubes and their role as generator of macroscopic quantum coherence in biology then one is forced to consider seriously also NE between its ends. If this is the case then the view of religions about life might be nearer to truth than that of hard-born materialists.

To make this more concrete, let us first look what the transfer of NE could mean.

1. Suppose that nutrient N has NE with unknown system A which a priori could be part of nutrient. Assume that the transfer of NE of nutrient with A is formed by reconnection of U-shaped flux tubes associated with N (or glucose G produced from it) and A so that two parallel flux tubes connecting N and A are formed.

2. The basic operation allowing transformation of $N - A$ NE to $P - A$ NE is following. The two flux tube portions of U-shaped flux associated with the receiver R are reconnected with the two parallel flux tubes connecting N and A so that two flux tubes connecting R to A are formed. NMP strongly suggests that the entanglement remains negentropic in the process.
3. NE is first transferred to P using this process so that P and A are now NE-connected. After this P attaches to ADP to yield ATP and ATP attaches to B and the transfer process leads to NE between B and A .

For ATP synthase the h_{em} consisting two elementary charges is of the same order as h_{gr} . This is probably not an accident. Could this mean that this kind of flux tube can reconnect with gravitational flux tube? Could this make possible a reconnection transforming N-Earth NE to P-Earth NE? This looks plausible.

Consider now the identification of A .

1. If one assumes that the negentropic entanglement corresponds to gravitational flux tubes for N -Earth system then A should be gravitational Mother Gaia, whatever its precise definition might be. N (and glucose) molecules would be alive in the sense that they have NE with Mother Gaia.
2. Could oxygen have some deeper role? For instance, could O_2 molecules serve as analogs of cell membrane receptors for Mother Gaia meaning that gravitational flux tubes go through O_2 molecules? This does not look plausible since metabolism is possible also as fermentation involving no oxygen.
3. In this picture the role of breathing and fermentation would be to make possible the transfer of NE from nutrients to the living system.

This picture allows to imagine about what might happen in biological death. Biological death takes first place only at the highest level of self hierarchy assignable to the our biological body. Cells continue for some time their life even after the last breath. The notion of h_{gr} together with Equivalence Principle suggests that the entire biological body has gravitational flux tube connections to Mother Gaia (and possibly even to bigger systems) when alive. At the moment of biological death these flux tube pairs would suffer reconnection and split and biological body would separate from Mother Gaia. This would happen later at lower levels of biological self hierarchy such as organ and organelles and eventually for cells and biopolymers. On the other hand, new life forms using the decay products as nutrients would take the available NE to use during the decay process.

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