26 second pulsation of Earth: analog for 8^{th} period doubling of EEG alpha rhythm?

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Abstract

The pulsations of Earth - kind of mini earthquakes - occurring with a period of 26 s represent a mysterious phenomenon. In TGD framework the interpretation would rely on the notions of magnetic body (MB) controlling ordinary matter, and dark matter as phases of ordinary matter labelled by $h_{eff} = nh_0$ and giving rise to quantum coherence at MBs in all scales. The strange findings about earthquakes suggestthat they correspond to macroscopic quantum jumps ("big" state function reductions (BSRs)) changing the arrow of time. Also classically the earthquake corresponds to a discontinuous process in which tectonic plates slide with respect to each other so that the identification as a macroscopic BSFR is natural in TGD framework. Could the periodic mini earthquakes correspond to a sequence of BSFRs?

Deep ocean waves hitting the shore should somehow induce this periodic microseism as a sliding of the tectonic plates with respect to each other. If there is a lattice like structure of incompressible cylindrical plates, the compression by sea waves arriving at shore induces a volume preserving vertical stretching of these cylinders inducing the detected Rayleigh wave.

Cyclotron periods of ions at MB are quantized and 26 s could be understood as a resonance period for the coupling between the tectonic dynamics and that of MB. The problem is that the periods associated with the deep ocean waves are below 20 s so that a linear coupling preserving frequency does not allow understanding of the 26 s period. However, non-linear coupling allows period doubling at the limit of chaos. Could 26 s period be seen as 8:th period doubling of

$T = .1$ s which corresponds to alpha rhythm in EEG and fundamental biorhythm, the secondary p-adic time scale of electron, and the cyclotron frequency of iron ion in the endogenous magnetic field $B_{end} = (2/5)B_E$ identified as monopole flux part of Earth's magnetic field B_E and playing a key role in TGD inspired quantum biology?

1 26 second pulsation of Earth: an analog of EEG alpha rhythm?

There is an interesting article in Discover Magazine with title "*The Earth Is Pulsating Every 26 Seconds, and Seismologists Don't Agree Why*" (https://cutt.ly/ogI6soU). That mini earthquakes would appear with a period of 26 seconds is a rather fascinating possibility and one can ask what the TGD based explanation for the poorly understood origin of the rhythm might be.

1.1 What has been observed?

The pulsations are Rayleigh waves in which the motion of the mass is vertical. The source of these pulsations can be located near the coast of the Gulf of Guinea. The amplitude of pulsations is largest during storms and during summer time, which suggests that ocean waves feed energy to some kind of waves.The first proposal is that deep ocean waves striking at the shore are the source

of the pulsations. The problem is that the periods of these waves vary up to 20 s and shorter than the period 26 s of the pulsations.

Second hypothesis suggests that these microseisms are a form of harmonic tremor associated with the magmatic activity beneath the South Atlantic Ocean. The source is located suspiciously near a large volcano on the island of Sao Tome in the Bight of Bonny proposed to be the source. Also some other volcanoes are accompanied by microseism but the problem is why not all volcanoes would serve as sources.

The popular article talks about periodic pulsations and calls them mini earthquakes. What does this imply if one assumes that the author of the article is using the words in precise sense?

1. Stresses in the Earth's crust are involved with seismic waves. There are three basic kinds of stresses. The stress can due to the compression or stretching: in this case one speaks of tension. This could cause an oscillation. Oscillating string is a very simple example. Pulsations would be oscillations in the vertical direction. This phenomenon could be purely classical and involve no quantum jumps.

2. Ordinary earthquakes are however generated by shear stress: in an earthquake two parallel layers of rock touch each other in a fault. Faults need not be non-horizontal. When a large enough external force parallel to the fault acts on the second layer, the friction fails to keep the pieces together, and the layers start to slip. This event would be naturally quantum jump by its discontinuity. A phenomenological description is in terms of catastrophe theory but there is no proper classical description for what really happens when slippage starts.

3. Periodic mini earthquakes result if these slippages are induced by a periodic force acting on the other piece of rock in the direction of the fault. The analog of local pulsation would require a nearly vertical fault. The challenge would be to explain this periodic force. Standard physics might satisfactorily explain the periodic force and provide an estimate for the period but the description of the discontinuous transition might require TGD based quantum theory.

For the purpose of building a simple mental model, consider a 2-D lattice like structure consisting of cylindrical tectonic plates touching each other. At the border of the abyss at which the water depth suddenly increases deep ocean waves would act as an oscillating pressure to a cylinder and force it to oscillate.

If pulsations are indeed in question, the resulting horizontal motion of cylinders should be transformed to vertical motion. How this could be achieved? The pressure of ocean waves causes a compression in the horizontal direction. Since the material in question is incompressible and therefore preserves its volume, the cylinder must stretch in the vertical direction. The non-linearity of the coupling making possible period doubling could be due to the fact that the vertical stretching is a secondary effect. In the situation considered the coupling could be especially strong and make possible period doubling. The nearness of the volcano could increase the strength of coupling.

1.2 Could period doubling be involved?

Pulsations represent a special case of microseismic waves.

> The microseism spectrum involves two parts: first part the period extends to 15 s as for deep ocean waves and for the second the frequencies are above 30 s and extend to 300s. However, 30 s is rather near to 26 seconds. If there is a coupling of deep ocean waves arriving at shore with microseism waves, one must explain how the almost period doubling results. In general linear coupling between oscillations preserves frequency so that non-linearity suggests itself. What comes in mind is that the system exhibits for frequency around $T = 13$ s a period doubling occurring universally in non-linear systems near chaos. Originally closed orbits in the configuration space of the system with period T are transformed in bifurcation to orbits with period $2T$. Why should $T = 13$ s be so special? In the TGD Universe, magnetic body carrying dark matter as $h_{eff} = nh_0$ phases acts as master controlling ordinary matter. The basic rule is that $h_{eff} \to nh_{eff}$ scales the energies $E = h_{eff}f$ of say phonons by n. The frequencies for the transitions preserving energy are scaled by $1/n$. Could the period

doubling correspond to a transition $h_{eff} \to 2h_{eff}$ at MB and occur for $T = 13$ s, which could correspond to a cyclotron frequency of 1/13 Hz for MB. Quite generally, the cyclotron frequencies of MB of Earth would couple resonantly to various frequencies appearing in the dynamics of ordinary matter with $h_{eff} = h = 6h_0$. This would make the control possible. For $B = 2^{-7}B_{end}$ with $B_{end}02/B_E/5$, $B_E = .5$ Gauss, the cyclotron period of iron ion would be near 13 s. 25.6 Hz is rather near to 26 Hz and corresponds to 2^8:th sub-harmonic of the alpha rhythm 10 Hz, which suggests period doubling appearing in the approach to chaos as an explanation: 8^{th} period doubling of EEG alpha frequency could be in question!

1.3 Trying to understand the pulsation frequency

Could one understand the origin of the frequency 26 s in TGD framework as reflecting the presence of magnetic body (MB)? First some background about TGD.

1. TGD based quantum theory relies on zero energy ontology [L4] (`https://cutt.ly/jgI6du1`) and predicts quantum coherence in all scales being assignable to the magnetic bodies of systems consisting of ordinary matter. MBs would carry dark matter as $h_{eff} = n \times h_0$ macroscopically quantum coherent phases.

2. Ordinary ("big") state function reductions (BSFRs) would change the arrow of time and this implies that they look like deterministic smooth time evolutions leading to the final state of BSFR. The world would be quantum coherent but look classical in all scales! The change of the arrow of time leads to a radically new view about self-organization and about biology and also self-organized quantum criticality emerges naturally and leads to the emergence of "breathing systems" so that the applications to living systems are natural. In fact, evidence for very simple "breathing" systems is emerging [L3] (`https://cutt.ly/QgI6fuE`).

   Earthquakes have some strange features and this led to the proposal that earth quarks could involve BSFR in macroscopic scales at the level of MB of Earth [L2] (`https://cutt.ly/ogI6gc3`). Could also these mini earthquakes involve BSFRs? Could they be interpreted as a sequence of life cycles for a conscious entity with a life time of about 26 seconds assignable to Earth?

3. It is known that electromagnetic activity accompanies Earth quarks and this activity is such that the interpretation in terms of time reversal suggests itself. Could 26 seconds define a period for an analog of alpha rhythm in EEG? There is also another strange rhythm with a period of 160 minutes assignable to astrophysical systems and I have proposed an interpretation as a "cosmic" alpha rhythm [L1] (`https://cutt.ly/SgI6h92`).

This picture leads to ask whether the p-adic length scale hierarchy predicted by TGD could provide some understanding concerning the period of $T = 26$ seconds associated with the pulsations.

1. TGD predicts a hierarchy of p-adic length scales $L_p \propto p^{1/2}$, $p \simeq 2^k$, $k > 0$ preferred integer, coming as half octaves. TGD does not deny the possibility of scaled variants of various particles. For instance, electron could correspond to several integers k with masses proportional to $2^{k/2}$).

2. Secondary p-adic length scales correspond to scales $p^{1/2}L_p \propto p$. There also tertiary etc. time scales forming a fractal hierarchy coming in powers of $p^{1/2}$ and by p-adic length scales as preferred half octaves.

3. For instance, electron corresponds to p-adic prime $p = 2^{127} - 1$ (the largest Mersenne prime, which does not yet correspond to super-astrophysical length scale). Secondary p-adic length scale corresponds to a period $T_e \simeq .1$ seconds. This is a fundamental biorhythm appearing in alpha band of EEG. Also quarks correspond to secondary p-adic length scales which correspond to human time scales.

   $T = 26$ seconds is rather precisely equal to $2^8 \times T_e$, $T_e = .1$ seconds: the relative error is 1/64 or about 2 per cent. A scaled version of electron with mass $m = m_e/2^4 \simeq 32$ keV would

correspond to 25.6 seconds. The p-adic prime $p \simeq 2^k$, $k = 127 + 8 = 135$ defining p-adic scale about .4 Angstrom. This is not far from Bohr radius $a_B = .53$ Angstrom for hydrogen atom.

Of course, the new dark particle need not be electron. One can consider more detailed attempts to understand the situation.

Option I:

The first attempt involves the notion of electropion or more generally, leptopion, see [K2] (`http://tgdtheory.fi/pdfpool/leptc.pdf`) for which there is empirical support and empirical evicence that ordinary pion allows p-adically scaled up variants.

1. The scenaro would be based on axion-like states proposed also as candidates for dark matter predicted by TGD. They would be indeed dark also in TGD but in TGD sense being particles having $h_{eff} = n \times h_0 > h$. This would explain why they are not seen in decay widths in particle accelerators (and excluding them).

2. There is evidence for electropion with mass $2 \times m_e$ (already from 1970's) decaying to an electron-positron pair but forgotten since it does not conform with the standard model (it would increase decay widths of weak bosons). TGD provides a model for this state and predicts similar states for muon and tau and evidence also for these states have been found but also forgotten.

TGD also suggest fractally scaled variants of pion states with different p-adic length scales $p \propto 2^k$ and there is empirical evidence for these states with masses both larger and smaller than pion mass.

1. One can also imagine scaled variants of electropion with different p-adic lengths scales. The primary p-adic time scale assignable to electropion scales corresponds to $k \leq 127$. How to estimate k?

   If the mass squared (conformal weight is additive in p-adic mass calculations then mass squared of electropion is $m^2 = 2m_e^2$ giving $m = 2^{1/2} \times m_e$ for $k = 127$. Correct mass requires $k_e = 127 \to 126$. Compton time of electropion would be $T(electropion, 126) = T_c(126, e)/2$, where $T_c(126, e)$ is the Compton time of electron with $k = 126$.

   The secondary p-adic time Compton time associated with the scaled variant of $k = 126$ electropion corresponds to $T(electropion, 126 + \Delta k) = 2^{\Delta k} T_e/2$. One must have $\Delta k = 8 + 2 = 10$ and $k = 137$. Amusingly, $k = 137$ corresponds to atomic length scale and to fine structure constant. This co-incidence could be regarded as a cosmic joke.

Why this atomic length scale, or rather the corresponding secondary p-adic length scale of scaled electropion, would be associated with the Earth's pulsations? Electropions should be dark and perhaps form a coherent state as in the model for the production of anomalous electron-positron pairs based on electropion involving in an essential manner non-orthogonal electric and magnetic fields of colliding nuclei?

Option II: The second proposal is based on TGD inspired quantum biology involving Bose-Einstein condensates of Cooper pairs of electrons, protons, and fermionic ions and also of bosonic ions at magnetic flux tubes and characterized by effective Planck constant $h_{eff} = nh_0$, $h = 6h_0$, making possible quantum coherence in length scales longer than Compton length.

1. Consider the Bose-Einstein condensate of electron Cooper pairs. Electron Cooper pairs has Compton length equal to $L_{2e} = L_e/2$, L_e the electronic Compton length. Secondary Compton time equals to $T_{2e}^{2)} = 2^{127/2} T_e/2 = .05$ s. Superconductivity in longer length scales than Compton length requires $h_{eff} > h$. The scaled up Compton scale $L_{n,2e} = nL^{2e}$ gives the coherence length of a superconductor and the secondary Compton time scales to $nT_{2e}^{2)} = .05n$ s. This time equals to $T = 25.6$ s for $n = 2^9$.The interpretation in terms of period doubling can be considered.

2. The general hypothesis [K1] is that there is resonance between dark and p-adic length scales so that this dark scale would correspond to identical p-adic length scale which would correspond to $L(k = 127 + 18 = 145) \sim 1.25$ nm equal to the transversal length scale for DNA.

3. TGD predicts that ordinary dark DNA in aqueous environment is accompanied by dark DNA realized as flux tubes carrying dark proton triplets realizing genetic code. Also amino-acids would be accompanied by these dark proton triplets and electrons would neutralize proteins charge which would be 3 proton charges per amino-acid. This would suggest that this scale relates to dark DNA, RNA, and proteins, which would involve space-time sheets which are electronic super conductors, and that the 26 second rhythm reflects the presence of water.

Option III: This alternative is nearest the idea about 260 Hz rhythm as analog of alpha rhythm. Iron ion has cyclotron frequency 10 Hz in B_{end}. Period doublings could correspondto the scalings of B_{end} by powers 2^{-n} of two scaling the cyclotron frequency by factor 2^{-2n}. The area of the flux tube would be scaled up by 2^n. If h_{eff} is scaled by 2^n, the energies are unaffected. For $n = 8$ the cyclotron frequency of iron ion would be near to 25.6 s. Could also the powers $2^{-n} \times 10$ Hz appear in the microseismic spectrum as period doubled alpha rhythm in the approach to chaos?

Could 26 second rhythm be kind of a bio-rhythm for Earth analogous to heart-beat or breathing? These two rhythms are highly varying and assignable to self-organization. EEG alpha rhythm is however universal. Could the Earthly bio-rhythm be analogous to the alpha band in the analog of EEG of Earth with frequencies scaled down by factor 1/256?

Each period would correspond to a mini earth quake. Also the ordinary EEG would involve similar BSFRs as an analog of sleep-awake rhythms and all bio-rhythms could be this kind of sleep-awake rhythms. One could of course check whether the 26 second rhythm has an electromagnetic analog?

There exists also another analogous rhythm, the 160 minute rhythm assignable to many astrophysical objects. I have proposed an interpretation as a kind of cosmic alpha rhythm.

1. 160 minute period is obtained from 26 second rhythm by scaling by a factor about $369 \simeq 2^{8.5}$ with error of 2 per cent - half octave again.

2. For the electro-pion option, one can think that one scales electropion with $k = 127$ having mass $2^{1/2} \times m_e$ to $k = 127 \to 127 + 17 = 144$ to get secondary Compton time scale $2^{16+1/2)}T_e = 154.5$ minutes not too far from 160 seconds. The interpretation as 17^{th} period doubling for $k = 127$electro-pion with $T_c = \sqrt{2}T_e$ could make sense. There is indeed evidence for the period doubling of pion-like state. $f_c = f_e/\sqrt{2} \simeq 7.1$ Hz is lower than the nominal value $f_S = 7.8$ Hz of the lowest Schumann frequency. The cyclotron frequency of K^+ in B_{end} is 7.7 Hz and rather near to f_S.

3. For the Cooper pair option one could argue that since h_{eff} is integer valued, one can allow a value of n near to $2^{17.5} \simeq 185364$: this would give p-adic length scale $L(162)$, $L(163)$, which corresponds to one of the miracle length scales $k \in \{151, 157, 163, 167\}$ defining scales assignable to DNA coiling, would have been a more desired outcome.

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