Earhquakes and volcanic eruptions as macroscopic quantum jumps in zero energy ontology

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Abstract

This article describes a quantum model of earthquakes and volcanic eruptions as macrocopic quantum jumps "big" (ordinary) state function reductions as opposed to "small" state function reductions identied as counterparts of weak measurements . The occurrence of these phenomena correlates strongly with sunspot minima, cosmic rays seem to induce them but quite too deep below the Earth's surface, and electromagnetic activity in upper atmosphere precedes rather than follows these phenomena as one might expect. Zero energy ontology based view about macroscopic quantum jumps predicted by TGD explains these paradoxical looking findings. The pulsations of Earth - kind of mini earthquakes - occurring with a period of 26 seconds represent a mysterious phenomenon. The interpretation could be as an analog of alpha rhythm analogous to the 160 minute rhythm for which I have proposed an interpretation as a cosmic alpha rhythm [L5].

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1 Introduction

The understanding of Zero Energy Ontology (ZEO) has developed rapidly after I learned about direct experimental evidence for the prediction that the big state function indeed involves a change of arrow of time. This led to the understanding of Libet's strange findings about active aspects of consciousness challenging free will in standard ontology and to the realization that remote metabolism provides a universal purely thermodynamics mechanism of metabolism [L4].

Also the understanding of the differences between TGD based and Maxwellian views about magnetic fields has increased dramatically. In TGD the magnetic field are of two types. Flux tubes carrying monopole flux are not possible in Maxwell's theory and no current is needed to create them. The flux quanta which do not carry monopole flux are also possible but require currents. Monopole flux tubes solve several magnetic mysteries such as the existence of magnetic fields in cosmological scales not allowed by the standard model, the maintenance problem of the Earth's magnetic field [L1], and the mysterious magnetic field of Mars, which does not seem to exists except via Auroras and seems to have roughly the same dipole strength as the Earth's

magnetic field [L6]. This changes totally the view about geological evolution of Mars and about prospects for life possible in the interior of Mars.

In the sequel I apply this picture to develop a quantum model of earthquakes and volcanic eruptions as macrocopic quantum jumps "big" (ordinary) state function reductions as opposed to "small" state function reductions identied as counterparts of weak measurements [L2]. The occurrence of these phenomena correlates strongly with sunspot minima, cosmic rays seem to induce them but quite too deep below the Earth's surface, and electromagnetic activity in upper atmosphere precedes rather than follows these phenomena as one might expect.

These paradoxical findings serve as guidelines leading to a model based on zero energy ontology predicting a change of the arrow of time in "big" (ordinary) state function reductions and a connection with findings of Minev et all [L4] and Libet's findings [J1] about active aspects of consciousness emerges. There are good reasons to expect that the change of arrow of time occurs in very many macroscopic phenomena but due to ontological prejucides has remained un-noticed. These catastrophes provide also support for the notion of dark magnetic body as flux tubes carrying monople flux and allow to deduce more detailed picture about the dynamics of solar magnetic field.

The pulsations of Earth - kind of mini earthquakes - occurring with a period of 26 seconds represent a mysterious phenomenon without any obvious explanation (`https://cutt.ly/ogI6soU`). The interpretation could be as an analog of alpha rhythm analogous to the 160 minute rhythm for which I have proposed an interpretation as a cosmic alpha rhythm [L5].

2   TGD based quantum model for earthquakes and volcanic eruptions

In ZEO the signature of "big" (ordinary) state function reduction is the change of the arrow of time at some level of the hierarchy of space-time sheets (selves) and one could start to search evidence for this effect. Also "small" state function reductions are possible and correspond to "weak" measurements. I did not however have the change of the arrow of time in mind when I encountered a highly interesting article "*Cosmic-solar radiation as the cause of earthquakes and volcanic eruptions*" by Jamal Shrair (see `http://tinyurl.com/y3g3khtd`) telling about the findings related to earthquakes and volcanic eruptions challenging the rational mind making its deductions in standard ontology.

1. The occurrence of earthquakes up to 34 kilometers below the surface of Earth and volcanic eruptions up to 9 km below the surface has strong correlation with the sunspot minima (solar activity) and cosmic ray flux. One could think that the system consisting of tectonic plates or magma is critical and sensitive to small perturbations. But how do the cosmic rays get so deep in Earth interior without losing their energy?

    TGD based answer is simple. During sunspot minimum the dark monopole part of the magnetic field of Sun is strong and and the charged particles of solar wind arrive along the flux tubes and by reconnection end up to the flux tubes of the Earth's dark magnetic field (van Allen belts) and along them to the interior of Earth, where they end up to quantum critical system formed by magma or tectonic plates and induces the eruption of earthquake.

2. This however requires that the number of dark monopole flux tubes is large during sunspot minima. Sunspots would be formed in reconnections of very long U-shaped monopole flux tubes coming from Sun and carrying solar wind as dark particles. This would reduce the number of monopole flux tubes but generate ordinary magnetic field by creating currents creating them - monopole flux tubes do not need any current. Therefore the number of monopole flux tubes would be maximal during sunspot minima.

    Quite generally, cosmic rays would arrive to Sun along monopole flux tubes of flux tube network [L9] connecting galaxies and having flux tubes of stellar objects as sub-tangles and continue from Sun to Earth. The highly energetic dark cosmic rays preserving their energy as dark particles could end up to the Earth interior along monopole flux tubes and could induce eruptions and earthquakes. This mechanism would also take dark ions of solar wind to underground oceans in Earth interior in the model of prebiotic life [L3].

Consider now the observations in this framework.

1. In the model of Japanese researchers led by Toshikazu Ebisuzaki cosmic muons are assumed to induce volcanic eruptions. The assumption is that solar magnetic field repulses cosmic rays. When it is weak as believed to be during solar minima, the cosmic rays can arrive to Earth. Volcano would act as a volcanic bubble chamber in which the cosmic rays induce a phase transition (see `http://tinyurl.com/y3d52r7c`). The model however considered only the eruptions not deeper that 10 m below surface rather whereas most eruptions occur at depths up to 10 km. The objection is obvious: for the cosmic muons as ordinary particles it is difficult to get so deep into the interior.

2. NASA researchers reported that earthquakes are preceded by large fluctuations of densities of electrons and other charged particles in the upper part of atmosphere. Perturbations are detected at at heights 100-600 km above Earth's surface. For Earth quakes the depths vary down to 35 km. If cosmic rays induce the earth quakes, one would expect that the time order as indeed proposed by NASA researchers in their model. The problem is that electric perturbations precede the earthquakes rather than vice versa.

   Here ZEO comes in rescue: The time order was indeed opposite. Macroscopic quantum jump of a quantum critical system took place changing the direction of time. There is precise analogy with the findings of Minev et al in atomic systems showing that a deterministic and smooth time evolution seems to lead to the final state of quantum jump [L4] [L4]. The time evolution however has opposite arrow of time and starts from the final state. Libet's findings [J1] have the same explanation in terms of act of free will realized as state function reduction. Now the "big" state function reduction would correspond to the earthquake/volcanic eruption and would be induced by cosmic rays serving as stimulus. The bad news is that when the electromagnetic fluctuation are detected, the quantum jumps has already occurred and nothing can be done to prevent the catastrophe.

3. In Maxwellian picture one expects that the magnetic pressure of solar magnetic field is minimum during sunspot minimum: just the opposite is true as experiments show (see `http://tinyurl.com/y3g3khtd`! The stronger the solar minimum the stronger the magnetic pressure. This is indeed the case in TGD picture if the detected magnetic field corresponds to the sum of magnetic field associated with monopole flux tubes and ordinary flux tubes! This is what the QFT limit of TGD predicts since spacetime at this limit carries the sum of induced fields associated with the sheets of the many-sheeted space-time.

   These findings inspired the proposal of the article that motivated these comments (see `http://tinyurl.com/y3g3khtd`): the magnetic pressure of solar wind could induce the earthquake/volcanic eruption somehow but leaves the detailed mechanism open. In TGD this assumption is not needed. The dark cosmic rays from the monopole flux tubes of solar magnetic field reconnected to with similar flux tubes of the Earth's magnetic field would travel along them to the interior of Earth.

4. The article of Shrair also mentions earth lights, which are luminous phenomena associated with the lines of tectonic activity. I have proposed already earlier an explanation in terms of dark photons liberated from the regions with high tectonic stresses. These dark photons could be phase conjugate photons with non-standard arrow of time accompanying mini earthquakes already occurred with respect to subjective time. Even bigger earthquakes could be in question if the irradiation of phase conjugate dark pho tons with non-standard time direction continues for a long time after the earthquake, which will happen in our geometric future.

3 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 earth-

quakes 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.

3.1   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.

3.2   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 $h_{eff} \rightarrow nh_{eff}$ 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 $h_{eff} \rightarrow 2h_{eff}$ 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^{-n} sub-harmonic of the alpha rhythm 10 Hz, which suggests period doubling appearing in the approach to chaos as an explanation.

3.3   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 [L10] (`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 [L8] (`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 [L7] (`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 [L5] (`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 [**?**] (`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 $k_e = 127 \rightarrow 126$. 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 [**?**] 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 correspond to 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.

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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