Matter antimatter asymmetry in TGD Universe

M. Pitkänen
Email: matpitka6@gmail.com.
http://tgdtheory.com/.

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Abstract

Contents

1 Introduction

TGD visio: Matter antimatter asymmetria: antimateria isoille saikeille ja tavallinen galakseihin. CP!! Mmpulssimomentit materialle ja antimaterialle vastakkaiset.

Antimateria Cooper pareina. U:n muotoiset saieparit. Litistyneet loopit. Skaalaus alkeishiukkastasolta. Iso h_{eff}. $L = n\hbar_{eff}$. Alussa impulssimomentti nolla. P-rikko impulssimomentit antimaterialle pyrkivt olemaan saman suuntaisia. Kokonais-J on nolla. Isossakin skaalassa J.

* Rekonnektiot tuottavat tavallista ainetta.

* $J(M^4)$ tuottaa CD kohtaisen symmetria-akselin! Magneettikentt.

*Radiaaliset magneettikentt: myos radiaaliset vuoputket mukana ja valittvt gravitaation. Materian ja antimaterian separoituminen. CP rikko. Onko kokonais B , L ja J nolla.

*Virrat kosmisen sikeen sisll luovatko B:n. Miten sen kenttviivat ovat kuvattavissa. Sylintersymmetrinen verkosto.Sylinterien seinill kiertaa B. Radiaalinen monopoli B. Argumentti magneettisesta paineesta joka ajaa ainetta ulospain. Voidit. Analogia Lambdalle!

?Mit nm Cooper parit ovat. Koostuvatko ne alkeishiukkasista. h_{eff} : onko yksikk impulssimomentille iso! Vai tapahtuuko fraktionisoituminen. Merkitseek monihiukkastiloja. Kondensaatit hiukkasina. rettmt alkuluvut.

Huom longitudinaalinen B on lsn. Tavallinen kuva suprajohtavuudesta ei toimi. Mit Meisner efekti tarkoittaisi.

Mit avaruusaikapinnan rotatoiminen tarkoittaa TGD:ss!! Impulssi momentti kenttn liittyen. Puhtaasti L:aa. Ei fotonin spin kontribuutiota niin MED:ssa. QCC: sana tulos fermioni-sektorista spinista. Voko olla totta. Spin kontribuutio normaalisti ajatellaan pieneksi verrattuna L:aan.

2 Kähler form of M^4

Twistor lift of TGD forces to assume the analog of self-dual covariantly constant Kähler form $J(M^4)$ for Minkowski space M^4 contributing to the Kähler form (or rather for causal diamond of M^4). $J(CD)$ corresponds to the presence of parallel constant $U(1)$ electric and magnetic fields coupling to fermion number. This is the just prerequisite for charge separation in CME!

1. Does the M^4 Kähler form contribute to the $U(1)$ of em field or does it represent a classical field of its own? $J(CD)$ couples to fermion number. In particular, it has also a coupling to right-handed neutrinos! Since neutrinos are em neutral this allows only the interpretation as an additional $U(1)$ field coupling to fermion number. Right-handed neutrinos are known to be extremely weakly interacting, which demands that the preferred extremals are such that the electric component of $J(CD)$ is small. Alternatively, the corresponding gauge coupling is very small: a reasonable guess inspired by the size of CP breaking of K mesons is that the coupling is some power of l_P^2/R^2 [**?**].

2. In TGD the induced $J(CD)$ field created by the density of nuclear baryonic number replaces the electromagnetic field created by a constant charge density in HN-HN collisions. For the canonical imbedding of M^4 the induced $J(CD)$ would be self-dual and charge separation would be forced by $J(CD)$ in the direction defined by the $M^4 = M^2 \times E^2$ decomposition defined by $J(CD)$. There is strong temptation to think that matter-antimatter asymmetry is basically due to CME along $U(1)$ magnetic flux tubes connecting the regions containing matter and antimatter.

3. $J(CD)$ couples to fermion number defined as $F = B + L$. Since leptons and and baryons have opposite fermion numbers, $U(1)$ flux tubes as counterparts of field lines can connect baryons and leptons. Note that atoms have vanishing $U(1)$ charge F.

4. What is important that space-time surfaces themselves satisfy the analogs of field equations for point like particles in $U(1)$ field. They are obtained by replacing point like particles 3-D objects. This is one of the key predictions of twistor lift of TGD predicting that 4-D action contains a volume term besides Kähler action. The volume term alone would give the analog of geodesic motion and Kähler action adds coupling to $U(1)$ force. Asymptotic state are minimal surfaces analogous to geodesics having vanishing $U(1)$ force. $U(1)$ force appears only in transient situations like particle scattering events. The first interpretation of volume term would be in terms of cosmological constant. It however seems that the more plausible interpretation of the entire action is in terms of cosmological constant.

2.1 Atomic physics and possibility of long range $U(1)$ force

1. Atomic nuclei have baryon number equal the sum $B = Z + N$ of proton and neutron numbers and neutral atoms have $B = N$. Only hydrogen atom would be also $U(1)$ neutral. The dramatic prediction of $U(1)$ force would be that neutrinos need not be so weakly interacting particles as has been though. If the quanta of $U(1)$ force are not massive, a new long range force is in question. $U(1)$ quanta could of course become massive via $U(1)$ super-conductivity causing Meissner effect.

2. Suppose that $U(1)$ force is long ranged. Could $B = N$ be neutralized by neutrinos? Could the cosmic background of neutrinos neutralize the $U(1)$ charge of matter? Could this occur even at the level of single atom or does one have plasma like state?

   I have earlier considered Z^0 atoms but these are are excluded in the recent model of elementary particle in which weak isospin is screened by neutrinos in the scale of Compton length of particle. Interestingly, for Z^0 force neutrino Bohr radius would be of order $a_0 = \hbar/\alpha_Z m_\nu$ and for $m_\nu = .1$ eV it would be of 12 μm, which corresponds to cell length scale.

What about $U(1)$ force? Suppose α_1 is of order of $\alpha_1 = l_P/R = 2^{-12}$ (l_P is Planck length and R is CP_2 radius as the arguments related to cosmological constant [**?**] and to the size scale of CP breaking [**?**] suggest. The Bohr radius of the neutrino atom would be for $m_\nu = .1$ eV about $a_0 = .8$ mm. Ground state binding energy would be about $E_0 = \alpha_1^2 m_\nu/2$ giving $E_0 = .34 \times 10^{-8}$ eV: this is below the thermal energy of cosmic neutrinos estimate to be about 1.95×10^{-4} eV (see `http://tinyurl.com/ldu95o9`). Thus matter would be $U(1)$ plasma. $U(1)$ superconductor would be second option. If right-handed neutrinos generate $\mathcal{N} = 2$ SUSY then $U(1)$ charge would break this symmetry.

3. One could neutralize $U(1)$ charge in atomic scale using also electrons giving exotic ions. For $\alpha_1 = 2^{-12}$ Bohr radius would be something like cell membrane size scale $a_0 = 43$ nm. Note that the diameter would roughly $L(157) \simeq 8$ nm, $MG, 157 = (1+i)^{157} - 1$ is one of the miraculous Gaussian Mersennes associated with $k = 151, 157, 163, 167$ in the range of biologically most important length scales between 10 nm and 2.5 μm. The resulting state would be negatively charged and one can ask whether the negative charges of DNA and cell could relate to the formation of $U(1)$ neutral states. Binding energy for would be around $E_0 = .03$ eV, which rather near to membrane potential. These exotic ions could be thermally stable for $Z \geq 2$ due to the presence of N^2 factor.

2.2 Flux tube network and $U(1)$ force

The idea about flux tube network would suggest network of U(1) flux tubes connecting nodes, which have non-vanishing $F = B + L$. Given flux tube could be of type $B - L$, $\overline{B} - \overline{L}$, $\overline{B} - B$ or $\overline{L} - L$. The annihilation of fermions and antifermions would delete links $\overline{B} - B$ and $\overline{L} - L$ and tend to annihilate matter and antimatter. The reconnection of $\overline{B} - B$ and $L - \overline{L}$ bonds is not present in the ordinary kinetics and would transform matter-antimatter bonds $\overline{B} - B$ or $\overline{L} - L$ to $B - L$ and $\overline{B} - \overline{L}$ and vice versa and could reduce the number of bonds between antimatter and matter. Matter antimatter separation would take place if the process leads to disjoint networks having only $B - L$ bonds and $\overline{B} - \overline{L}$ bonds and vanishing total $B + L$ remain from the process. Due to CP breaking these networks could have different space-time realizations. It is also possible that antimatter is dark.

2.3 Criticism

One can represent an objection against the assumption that only covariantly constant $J(CD)$ are allowed: one can imagine also spherically and cylindrically symmetric and Lorentz invariant $J(CD)$s. Consider the $U(1)$ Coulomb field of point charge.

1. Should one assign the $U(1)$ electric flux with radial flux tubes? One would assign to each flux tube M^4 Kähler form $J(CD)$ for which the directions of electric and magnetic fields are in the direction of the flux tube. Every flux tube would be accompanied by its own CD and $J(CD)$! A lot of CDs, which also overlap! Isn't this too complex? Also the simple minimal surface solutions serving as models for stellar objects are lost if only covariantly constant $J(CD)$s are allowed and can appear as approximations only.

   One should have a good explanation for why so much CDs are allowed. The proposed explanation is that CD represents the perceptive field of a conscious entity and the preferred directions of CD fix the rest system and spin quantization axis associated with it [**?**]. CDs would represent the analog for the covering by open sets defining topological space or manifold. In TGD the notion of adelic/monadic manifold requires an analogous covering with CDs associated with the discrete set of points of space-time surface with the property that the coordinates belong to an extension of rationals [**?**].

2. Or should one accept also non-covariantly constant self-dual $J(CD)$s with radial electric and magnetic fields necessarily having electric charge and magnetic monopole at the time-like line connecting the tips of CD? Self-dual $J(CD)$ with $J_{\theta\phi} \propto sin(\theta)$ and $J^{0r} = \epsilon 0 r\theta\phi J_{\theta\phi}$ (note that$\epsilon 0 r\theta\phi$ is permutation symbol divided by $1/\sqrt{g_4}$ having em charge and magnetic monopole charge at the line connecting the tips of CD would satisfy the conditions. Genuine

monopole singularity is not an attractive idea. Lorentz invariant solution in Robertson-Walker coordinates (a, r, θ, ϕ) is completely analogous. Cylindrically symmetric variant would have fermion charge density along 2-D surface within CD M^2 and is unphysical.

Clearly, the first option suggesting deep connection between the notions of topological space and manifold, number theory, and consciousness is the more plausible one.

3 Could the violations of CP, P, and T correlate?

If CP, P, and T were symmetries they would transform self-dual $J(CD)$ to antiself-dual form. If these variants are not allowed in the moduli space of $J(CD)$ one obtains simultaneous violation of all these symmetries. This suggests that there are strong correlations between violations of CP, P, and T in cosmic scales.

3.1 Matter antimatter asymmetry and $J(M^4)$

Could matter antimatter asymmetry be due to the CP breaking in the scale of given space-time sheets due to $J(M^4)$ projection? Could matter antimatter asymmetry be due to the separation of matter and antimatter along flux tubes of $J(M^4)$ and be analogous to the so called chiral magnetic effect inspired originally by QCD? What would be needed would be parallel electric and magnetic fields. $J(CD)$ would provide these fields and fermions and antifermions would be driven to opposite directions along the flux tubes.

3.2 Parity violaton and rotation in long length scales

Could the violation of parity symmetry in galactic scales and even in cosmic scales - as suggested by CMB anomalies - relate to the breaking of P caused by $J(CD)$. Could $h_{gr} = h_{eff} = n \times h$ phases with quantum coherence even in cosmic scales relate to the generation of correlations for spin directions? Could the many-sheeted space-time implying a hierarchy of CDs asignable to flux tubes with increasingly large cross section allow to understand the generation of net angular momentum at given level of hierarchy? Could flux tubes carrying dark matter be an essential part of mechanism?

Ordinary matter would naturally rotate around the flux tubes in its gravitational field and have flat velocity spectrum asymptotically. If hydrodynamic approximation makes sense the rotation direction would be same for all subsystems and net angular momentum would be generated. Could dark matter at flux tubes have a compensating angular momentum so that opposite angular momenta for matter and antimatter would be generated in the formation of bound states of matter and antimatter.

The parity breaking associated with chiral magnetic effect (CME) a rotation of quarks and antiquarks in opposite directions takes place in the collisions of nuclei and in turn leads to the separation of quarks and antiquarks. Could the analog of this mechanism have role in the separation of matter and antimatter? Could h_{eff} changing phase transition lead to the separation of matter and antimatter to phases with different value of h_{eff}?

Pyrivt systeemit elvss aineessa: metabolismi. Roschin and Godin: pyrivt magneettiset systeemit. Mit tapahtuu pyriville magneettisille vuoputkille. Kyk niin ett ajan suunta muuttuu isolla kvanttihypyll? Biologiassa taas ATP synthase pyrivin voimalaitoksena! Biomolekyylit!

Necklace model. Collisions.

3.3 Cosmic T violation and dominant arrow of time

Voisiko kosminen P rikko liittya T rikkoon ja materia-antimateria asymmetriaan ja voisiko kvanttitasolla kausaali-indefiniitiys ZEOssa vastata tt?

1. Materialla ja antimaterialla vastakkaiset dominoivat ajan suunnat. Kokonaisimpulssimomentit summautuvat nollaan. Myos $\hbar_{eff}$ erilainen. Niiden fysiikat olisivat erilaiset. Kosmiset saikeet kontra voidien reunat. Varaus-separoituminen. Kaikki ongelmat pitisi kyet ratkaisemaan yhdell iskulla. Vuorovaikutusenergia $J(M^4)$:n kanssa eri merkkiset. Tstk ero materian

ja antimaterian vlill? Repulsio ja attraktio kosmisesta sikeest. Pitkin radiaalisia sikeit. Ja mys kosmisia sikeit pitkin.

2. Olisiko mahdollista lyt jokin elegantti tulkinta ajan suunnan erilaisuudelle ZEOssa. Olisiko materialla ja antimaterialla sittenkin vastakkaiset stabiilit ajan suunnat? T ja CP rikko! Toinen suunta olisi toden-nkisempi siin mieless ett hyvin vhn aikaa kulutetaan toisessa ajan suunnassa.

Can macroscopic T violation have classical space-time correlates?
TGD vision about closed geodesics and P violation.

1. Suljetut geodeettiset viivat edellyttisivt ainakin euklidisia avaruusaika-alueita piss. Onko tm mahdollista fermioniviivalle vai onko tuloksena hviv energia? Tuskin. Vaadittaisiin, ett M^4 aikakoordinaatin derivaatta muuttaa merkki.

   Tm ei ongelma: GRT-rajalla tilanne voi olla toinen ja heijastaa kvanttitasoa.

2. Voisiko paralleeleihin avaruusaikalehtiin liitty eri ajan suunta? Periaatteessa tllaista voisi ajatella ja olen siihen syyllistynytkin.

4 Matter antimatter asymmetry and $B-L$ separation as $U(1)$ charge separation due to $J(CD)$

One can image two kinds of $U(1)$ charge separations: matter-antimatter separation and B-L separation. Podkletnov effect involving separation of negative and positive charges could correspond to B-L separation. Protons would become dark and go to the magnetic flux tubes. Matter antimatter separation based on the same idea: some fraction of antimatter would go to magnetic flux tubes as dark matter and the rest would annihilate with ordinary matter.

4.1 Is dark antimatter at dark magnetic flux tubes?

If $J(M^4)$ (or rather $J(CD)$) leads to charge separation, the obvious idea is that charge separation could be also behind matter antimatter asymmetry. I worked long time ago a model for large scale voids as extremals of Kähler action. The idea was that Kähler force due to the induced CP_2 Kähler form drives fermions to the boundaries of large voids and antifermions to a "big" cosmic strings going through the void. The same could take place in all scales. In particular, cosmic strings containing galaxies as pearls in string would contain dark matter in super-conducting or superf.....

A modification of model would be based on $J(M^4)$ having opposite couplings to fermions and antifermions. Quantum classical correspondence (QCC) demands that $U(1)$ charge corresponds to the difference of baryon and lepton numbers so its average density an vanish separately for matter and antimatter.

There is however a problem. Can one regard the dark antimatter at the cosmic string serve as a source of a radial M^4 U(1) force as Maxwellian intuition would suggests? Or is U(1) force purely geometric force? It seems natural to assign to a given flux carrying U(1) flux tube opposite U(1) charges - fermion numbers - at the ends of the flux tube. If flux tube connects particles with same fermion number the U(1) flux must vanish. To the average flux for the induced U(1) electric field corresponds to that for U(1) charged string in Maxwellian theory.

Antimatter could be a macroscopic quantum phase with $h_{eff}/h = n$ at flux tubes or even as Cooper pairs whose members are located at parallel flux tubes. For instance, long flux tubes which look like highly flattened squares could be considered. In this case the magnetic fluxes would be antiparallel and have identical magnitudes. Cooper pairs would have spin zero. They could however rotate inside around the magnetic field inside flux tube and also around the closed flux tube and therefore have net angular momentum.

The "big" cosmic string going through the voids center creates a transversal gravitational $1/\rho$ force proportional to string tension and the matter at the boundaries of void rotates with velocity that does not depend on ρ. At the level of many-sheeted space-time gravitational force is mediated by gravitational flux along the radial flux tubes orthogonal to the axis of "big" cosmic string. If

there is U(1) force associated with these flux tubes, it means $1/\rho$ repulsive force tending to reduce gravitational force. One can of course U(1) force appearing in the field equations for preferred extremals as generalization of corresponding force for point like particles relates to the accelerated expansion.

Scaled up analog for galactic rotation curves along various shapes for the boundary of void: surface obtained by rotating some plane curve around the cosmic string. One could imagine also a tesselation of hyperboloid of M^4_+ by cells having void as unit cell. Cosmic lattice.

$J(M^4)$ induces CP,P, and T violation in cosmic scales and the connection with matter antimatter asymmetry, the evidence for large scale parity violation suggested by CMB anomalies and large scale T violation possibly related to the emergence of preferred arrow of time suggests itself. For instance, the separation of matter and antimatter could involve CME;: matter and antimatter would be driven to different regions of many-sheeted space-time.

4.2 What could be the mechanism of matter antimatter separation?

Basic idea: matter antimatter asymmetry is local. The amounts of matter and antimatter are identical in long enough scales. CP violation caused by $J(CD)$ implies that antimatter is dark and resides inside long flux tubes and most matter is visible and outside them.

The decay of flux tube energy to elementary particles in the reconnections of flux tubes create antimatter and matter and part of antimatter goes to flux tubes. Outside the flux tubes annihilation takes place and leaves small fraction of matter. 10^{-9} is the fraction and characterizes CP breaking.

Also B-L separation is possible and here the analog of Podkletnov effect is suggestive. Baryon go to flux tubes as dark matter and leptons remain outside,

Simplest mechanism. Are cosmic strings two sheeted structures. Pairs of flux tubes just like elementary particle ! Splitting mechanism would produce particles! Could some particles go to flux tubes as dark antimatter and could some particles remain outside as matter. Annihilation would leave antimatter inside and matter outside. CP breaking!!

4.2.1 Could flux tube networks lead to matter antimatter separation

The idea about flux tube network would suggest network of U(1) flux tubes connecting nodes, which have non-vanishing $F = B + L$. Given flux tube could be of type $B - L$, $\overline{B} - \overline{L}$, $\overline{B} - B$ or $\overline{L} - L$. The annihilation of fermions and antifermions would delete links $\overline{B} - B$ and $\overline{L} - L$ and tend to annihilate matter and antimatter.

The reconnection of $\overline{B} - B$ and $L - \overline{L}$ bonds is not present in the ordinary kinetics and would transform matter-antimatter bonds $\overline{B} - B$ or $\overline{L} - L$ to $B - L$ and $\overline{B} - \overline{L}$ and vice versa and could reduce the number of bonds between antimatter and matter. Matter antimatter separation would take place if the process leads to disjoint networks having only $B - L$ bonds and $\overline{B} - \overline{L}$ bonds and vanishing total $B + L$ remain from the process. Due to CP breaking these networks could have different space-time realizations. It is also possible that antimatter is dark.

B-L separation is an analog of chiral separation in hadron physics is possible. Now however 4-chiralities would be replaced by H-chiralities.

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