Quantum Field Theory in Accelerating Local Reference Frames v.4

Jack Sarfatti[1]

Abstract

The Dirac "square root" tetrads of the metric tensor are spin 1 fields that are intrinsically renormalizable for quantum gravity models. Spin 2 gravitons are EPR entangled pairs of S-wave spin 1 tetrad quanta. As in superconductors there may be higher P & D wave relative orbital angular momenta as well as S-wave spin 0 and spin 1 micro-quantum corrections that do not show up in the long-range "classical" (macro-quantum coherent) limit. Both the c-number tetrads and the spin connections in our model are emergent from the eight gluon vacuum condensates of QCD that form in the inflationary phase transition. Their residual micro-quantum operator parts are the spin 1 quantum fields that are responsible for both the dark energy and the dark matter. Spread out dark energy with negative pressure comes from w = -1 random zero point virtual bosons of positive energy density that antigravitate because of the equivalence principle. Similarly, clumped dark matter comes from w = -1 random zero point negative energy density fermion-antifermion vacuum polarization loops of positive pressure that gravitate and is indistinguishable from w = 0 CDM for the distant observer. Therefore, the CERN LHC will not detect any exotic real particles that can explain $\Omega_{DM} \approx 0.23$ if this theory is correct. New conjectured expressions for important physical observables both at the micro and macro levels in rotating frames are presented. They need to be tested in the laboratory, for example, alleged anomalous gravity from rotating superconductors.[2]

The approximately Minkowski metric η_{IJ} covariantly unaccelerated Local Inertial Frame (LIF) indices are I,J,K,L. Their curvilinear metric $g_{\mu\nu}$ *locally coincident* accelerating Local Non-Inertial Frame (LNIF) indices are $\mu,\nu,...$ The internal symmetry electroweak-strong frame indices are $a,b,c,...$. The four tetrad[3] Cartan 1-forms[4] that form an LIF[5] basis are e^I. The locally coincident LNIF basis is the set e^μ. You can think of these local frames as rigid material cages with detectors in 3D with a clock attached. For example, the NASA Pioneer space probe shown below is a good example of a local frame in Einstein's General Relativity (GR).

---

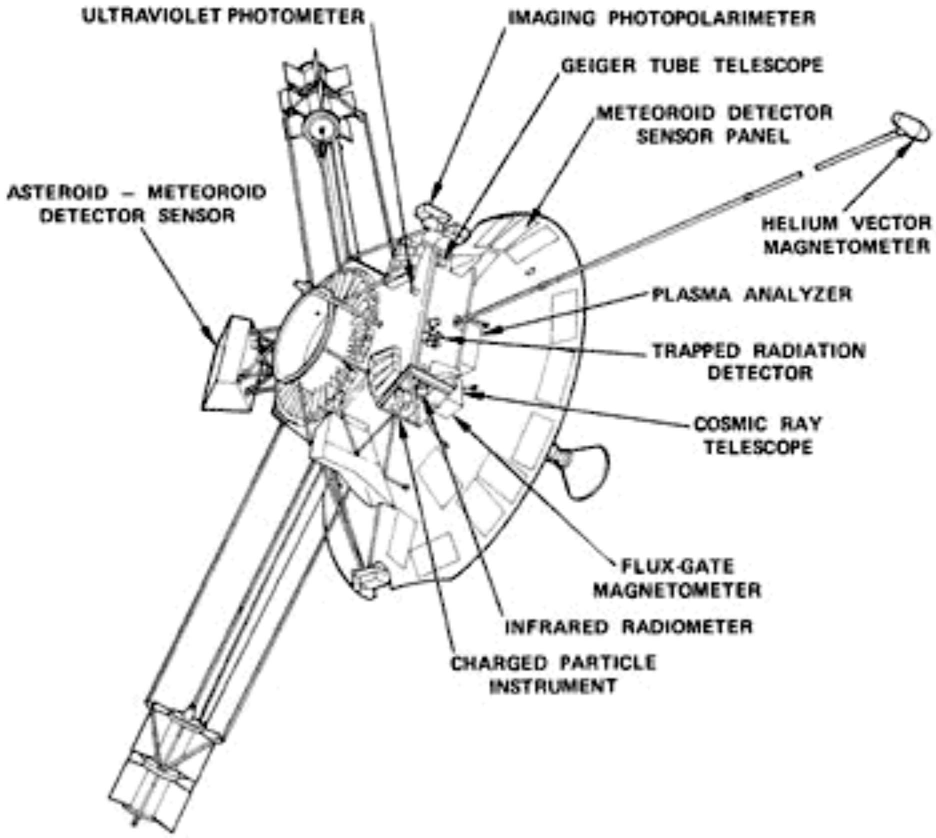
[1] ISEP, sarfatti@pacbell.net

[2] http://www.sciencedaily.com/releases/2006/03/060325232140.htm
http://www.scribd.com/doc/861751/Exploration-of-Anomalous-Gravity-Effects-by-Magnetized-High-Tc-Superconducting-Oxides
http://en.wikipedia.org/wiki/Gravitational_shielding

[3] http://en.wikipedia.org/wiki/Tetrad_(general_relativity)

[4] http://en.wikipedia.org/wiki/Differential_form

[5] http://en.wikipedia.org/wiki/Local_reference_frame



There are no g-forces on the LIF material structures (non-rotating by definition). There are g-forces on the LNIF material structures either from a non-gravity force or from conservation of angular momentum if the LNIF rotates about its center of mass (ignoring internal friction etc). The antisymmetric six spin connection[6] Cartan 1-forms are ω^{IJ} whose 24 coefficients are

$$\omega^{IJ}_{\mu} = e^{[I}_{\nu}\partial_{\mu}e^{\nu J]} + e^{[I}_{\nu}e^{\sigma J]}\Gamma^{\nu}_{\sigma\mu} = -\omega^{JI}_{\mu} \tag{1.1}$$

where $\Gamma^{\nu}_{\sigma\mu}$ is the affine connection[7] that encodes the effects of orbital rotation and spin as well as possible dynamically independent torsion fields in addition to curvature fields. I will always use Einstein's 1915 GR "curvature" and am not using the constraint of "teleparallelism" [8]as in the theory of Gennady Shipov.[9]

---

[6] http://en.wikipedia.org/wiki/Spin_connection
[7] http://en.wikipedia.org/wiki/Affine_connection
[8] http://en.wikipedia.org/wiki/Teleparallelism
http://en.wikipedia.org/wiki/Gauge_gravitation_theory
http://en.wikipedia.org/wiki/Einstein-Cartan_theory
[9] http://www.trinitas.ru/rus/doc/0231/008a/02310065.htm

The dynamical parts of the tetrads and spin connections are the compensating gauge potentials from localizing[10] the universal spacetime symmetry invariance groups of the global dynamical actions of all matter fields in the multiverse without exception. This is an expression of the strongest possible version of Einstein's equivalence principle forced by the invariant light cone structure in the classical limit.

The Dirac matrices[11] in the LNIF are

$$\gamma_\mu \overset{?}{=} e^I_\mu \gamma_I + \frac{1}{2}\omega^{IJ}_\mu [\gamma_I, \gamma_J] \tag{1.2}$$

The new term I am guessing at is the second term on the RHS involving the spin connection and the commutator of the Dirac matrices in Minkowski spacetime.

The *antisymmetric* electroweak-strong gauge force field tensors in the LIF are

$$F^a_{IJ} = \partial_I A^a_J - \partial_J A^a_I + g f^a_{bc} A^b_I A^c_J \tag{1.3}$$

There internal *multi-valued*[12] Goldstone phase "super-potential" Cartan 0-forms are $\widehat{\Theta}^a$

$$A^a_I = \partial_I \widehat{\Theta}^a \tag{1.4}$$

The multi-valued property, e.g. phase jumps by 2π going around a stringy vortex defect in a superfluid, or the 4π jump wrapping around a point hedgehog monopole defect, make the field tensors non-zero.

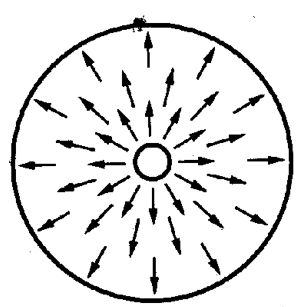


Fig. 1. Magnetization pointing outwards in the space between two spherical enclosing surfaces. This is known as a hedgehog. David Thouless Topological QM book

---

[10] http://en.wikipedia.org/wiki/Gauge_theory
[11] http://en.wikipedia.org/wiki/Gamma_matrices
[12] Hagen Kleinert http://users.physik.fu-berlin.de/~kleinert/kleinert/openarticle.php?id=366

These Goldstone *phase singularities* happen at *nodes* of the real Higgs field ground state order parameters where in effect

$$[\partial_I, \partial_J]\widehat{\Theta}^a \neq 0 \tag{1.5}$$

The Lie algebra of the internal electroweak-strong charges is

$$[Q_a, Q_b] = f_{ab}^c Q_c \tag{1.6}$$

The *antisymmetric* electroweak-strong field tensors in the LNIF are

$$F_{\mu\nu}^a \stackrel{?}{=} e_\mu^I e_\nu^J F_{IJ}^a + \frac{f_{bc}^a}{2}[\omega_\mu^{IJ}, \omega_\nu^{KL}] F_{IJ}^b F_{KL}^c \tag{1.7}$$

again note my *conjectured* rotational-torsion field 2nd term on the RHS of (1.6)

The gauge covariant partial derivative operator on matter fields in the LNIF is

$$D_\mu \stackrel{?}{=} e_\mu^I(\partial_I + iQ_a A_I^a) + \frac{1}{2}\omega_\mu^{IJ}\left([\partial_I, \partial_J] - [Q_a A_I^a, Q_{a'} A_J^{a'}]\right) \tag{1.8}$$

To get the Feynman propagators of leptons and quarks in the LNIF we need

$$\not{D} \stackrel{?}{=} \gamma^\mu D_\mu = g^{\mu\nu}\gamma_\nu D_\mu \tag{1.9}$$

The non-trivial parts B_μ^I of the 16 tetrad coefficient maps connecting locally coincident LIFs and LNIFs are the compensating gauge potentials from localizing the universal 4-parameter translation group T4.

$$e_\mu^I = \delta_\mu^I + \mathrm{B}_\mu^I \tag{1.10}$$

$$\left\|\delta_\mu^I\right\| = \begin{matrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{matrix} \tag{1.11}$$

$$e^I = e_\mu^I e^\mu \tag{1.12}$$

$$\omega^{IJ} = \omega_\mu^{IJ} e^\mu \tag{1.13}$$

My Ansatz that needs to be tested is

$$B^{I} = diagM^{IJ} \tag{1.14}$$

$$\omega^{IJ} = -\omega^{JI} = \frac{1}{2}M^{[I,J]} \tag{1.15}$$

$$M^{IJ} = d\Phi^{I} \wedge \Theta^{J} - \Phi^{I} \wedge d\Theta^{J} \tag{1.16}$$

I conjecture that the unification of gravity with the electroweak-strong forces is at the level of the Cartan 0-form Goldstone phases of our post-inflation macroquantum coherent vacuum whose residual false vacuum zero point fluctuations is the missing 96% of the stuff of the world. Dark energy ~ 73% is from virtual bosons with negative pressure. Dark matter ~ 23% is from virtual fermion-antifermion loops with positive pressure. The connection of the internal QCD SU3 forces with gravity is conjectured to be simply

$$\begin{gathered}\widehat{\Theta}^{a} = \sigma_{I}^{a}\Phi^{I} + \sigma_{J}^{a}\Theta^{J} \\ a = 1,2,\ldots 8 \\ I,J = 0,1,2,3\end{gathered} \tag{1.17}$$