

Progress in Post-Quantum Physics and Unified Field Theory

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Abstract

Progress in extending the de Broglie-Bohm-Vigier (AKA dBBV) quantum ontology to the experimental mind-matter problem is reported in Part I. Progress in extending Einstein's classical orthodox holonomic topology-conserving general relativity of 1915 to the unified field theory including topology-changing anholonomic torsion fields from the "hyperspace" of M-theory is reported in Part II. I also make a conjecture that the empirical duality in the Wesson compared to the Sirag data plots, noted by Gray in 1988, is actually showing the M-theory T-duality $R \leftrightarrow 1/2R, n \leftrightarrow m$ ¹ The Wesson "Regge trajectory" (Kaluza-Klein excitation $n \leftrightarrow$ winding number m) mass scale $\sim \sqrt{\alpha} M_p \rightarrow 10^{18} \text{ GeV} \sim l_p / \sqrt{\alpha} \sim 10^{-32} \text{ cm}$. The "dual" Blackett-Sirag magneto-gyro mass scale $\sim M_p / \sqrt{\alpha} \rightarrow 10^{20} \text{ GeV} \sim \sqrt{\alpha} l_p \sim 10^{-34} \text{ cm}$, where $\alpha = e^2 / \hbar c \approx 1/137$ and $M_p \equiv \sqrt{(\hbar c / G)} \rightarrow 10^{19} \text{ GeV} \sim l_p \equiv \sqrt{(\hbar G / c^3)} \sim 10^{-33} \text{ cm}$. What is clear is that we now have a new "telescope" directly into the quantum gravity scale showing strong anholonomic unified field effects beyond Einstein's 1915 theory. This is as important as the Hubble flow, the cosmic microwave background, missing mass, gravity waves, and the anomalous acceleration of the universe. A completely new conception of COSMOS is now emerging from the actual data.

Part I: Progress in Post-Quantum Physics

Orthodox quantum theory has many "degenerate"² informal interpretations that appear to have no crucial experimental tests to "lift the degeneracy". The experimental situation is now changing dramatically and quickly with my recognition of the real meaning of data lying around in journals unread for twenty years. All of the contemporary competing interpretations³, save dBBV, only have the quantum wave and not the particle in their models of quantum reality. The "particle" or "Bohm point" moving on the landscape formed by the quantum potential and other forces is "eschewed".⁴ This immediately causes confused thinking, e.g., in the recent articles claiming to divide the charge e of the electron into two equal pieces.⁵ This confusion comes from falsely assuming that the quantum wave "is the essence of an electron" carrying the charge because there is no particle at the micro level. The experimental result of increased current is easily understood intuitively in the dBBV interpretation in which the complete indivisible electron particle, of screened charge e , is completely localized in only one of the two bubbles that the physically real pilot wave divides into. One of the paired bubbles has a real but empty branch. The smaller bubbles move faster through the liquid helium explaining the observed increase of electric current without having to cut the electron in half. Therefore, this experiment seems to lift the degeneracy.⁶ Bohm's ontology works better for this experiment.

¹ 11.6 eq. (11.6.2) p. 477 "Intro to Superstrings and M-Theory", M. Kaku, Springer-Verlag, 1999.

² In the sense of atomic spectroscopy with "degenerate energy eigenfunctions" of the Hamiltonian operator.

³ E.g., Stapp's "ontological collapse", Penrose's "R" and "OR", "many worlds" in all of its variations such as David Deutsch's "multiverse", Gell-Mann/Hartle decohering histories, John Cramer's "transactional" with weak backward causation consistent with "signal locality" AKA "passion at a distance" (Abner Shimony).

⁴ "Bohmian Mechanics and Quantum Theory: An Appraisal" Ed. J.T. Cushing, A. Fine, S. Goldstein (Kluwer, 1996)

⁵ New Scientist magazine, 14 October 2000 "This sounds harmless enough, but the implications are staggering. If the bubble split, half of the electron's wave function would be trapped in each of the two daughter bubbles As the wave function is the essence of an electron, the electron would be split into two. The indivisible would have been divided. ... 'There were more bubbles, and being smaller they were more mobile,' says Maris. Although the total charge in the system remained the same, the smaller bubbles felt less drag in the helium, and thus moved faster. Consequently, the current went up,"

⁶ My solution here is reminiscent of King Solomon's when asked to divide the baby in half. The electron, like the baby, has been thrown out with the bathwater in all the alternative interpretations save dBBV.

In another recent development, Henry Stapp⁷ has proposed a model of ontological collapse⁸ of the quantum wave with infinite speed in the preferred cosmological rest frame of the Hubble flow⁹ in the standard cosmological model. This is quantum theory on a classical curved space-time geometry not full blown quantum gravity. Stapp's conjecture is similar to Bohm's and Hiley's in which the quantum potential Q acts instantaneously in this same preferred frame. There is no reason to suppose that classical Diff(4) local gauge symmetry¹⁰ of the 1915 general theory of relativity should be valid when quantum nonlocality is important. However, experiments by Gisin¹¹ et-al in Geneva seem to rule out this idea, although Stapp and I are in serious disagreement¹² on how to think about this problem. I am only giving my biased perspective here. Special relativity still works locally. According to the Einstein addition of velocities, an infinite speed in one frame is a finite superluminal speed $v = c^2/u$ ¹³, where u is the subluminal speed of the moving "G-frame" relative to the allegedly preferred global rest frame of the Hubble flow. For example, the rotating Earth's motion has a 24 hr periodic projection u , of its CM motion on to the flight line between the G-detectors, of amplitude ~ 300 to 600 km/sec.¹⁴ Therefore, *except for ~ 5 seconds every 43,200 seconds*, the G-frame qubit speed is less than the minimum $2/3 \times 10^7 c$ required dipping down to $v = (3 \times 10^5)^2 / (4 \times 10^2) \approx 2.5 \times 10^8$ km/s $\approx 10^3 c$ reaching a peak less than $2/3 \times 10^7 c$ for most of the data run. In contrast, Gisin cites "a lower bound for the speed of quantum information in this "G-frame" at $2/3 \times 10^7 c$ " for the parameters of the actual experiment¹⁵ in Geneva of EPR photon pair correlations over a distance 10.6 km. Therefore, G-frame detectors, each with speed u relative to the Hubble flow, separated by a distance 10.6 km requiring a qubit speed of at least $2/3 \times 10^7 c$ to travel between them in the 5 picosecond time uncertainty¹⁶ in the detections, should not show the actually observed EPR correlations most of the time. In fact, the EPR correlations are seen all of the time. This argument assumes that the qubit speed in the Hubble frame is infinite, so that objective collapse with a real qubit speed is a useful way to picture how the nonlocal EPR correlations are maintained. Therefore, Stapp's conjecture here is falsified by the actual experiment. Does this also shoot down the Bohm-Vigier conjecture that the quantum potential Q acts instantly in the preferred Hubble flow frame? Yes, the model that does survive is that of "backward causation"¹⁷ originating in the Wheeler-Feynman 1940 program for classical electrodynamics eliminating independent dynamical degrees of freedom for the electromagnetic field with "Everything is particles."¹⁸ However, it appears that $Q = (\hbar/2m)\nabla^2 R/R$ can be redefined¹⁹ in terms of backward

⁷ Discussion by e-mail among Stapp, Stan Klein and myself.

⁸ "speed of quantum information" (Gisin et-al, ref 11)

⁹ In which the cosmic microwave black body background radiation is isotropic to about one part in 10^5 .

¹⁰ Integrable holonomic general coordinate transformations that are global 1-1 conserving topology of the 4d spacetime manifold.

¹¹ Quant-ph/0007008 4 July 2000 "The Speed of Quantum Information and the Preferred Frame: Analysis of Experimental Data" V. Scarani, W. Tittel, H. Zbinden, N. Gisin

¹² There is no preferred frame in global special relativity, consequently whether or not nonlocal EPR correlations are observed cannot depend upon the common state of uniform motion of the two detectors relative to any other frame. However, global special relativity breaks down in general relativity where it can only be used locally. Therefore, this issue is an experimental one. Stapp inconsistently tries to maintain global special relativity and the preferred frame of the Hubble flow together in my opinion.

¹³ Same as de Broglie's relation of wave to particle speed at the beginning of the wave mechanics of matter.

¹⁴ "Introduction to Cosmology", J.V. Narlikar. p.301 (Cambridge, 1993)

¹⁵ Time resolution of 5 picoseconds in footnote [19] of ref 11.

¹⁶ Photon pulse temporal width

¹⁷ "Feynman zig zag" (O. Costa de Beauregard), "transactional interpretation" (J. Cramer), "history and destiny state vectors" (Y. Aharonov et-al), Hoyle-Narlikar "advanced response of the universe" in "Cosmology and Action at a Distance Electrodynamics" World Scientific, 1996.

"Time's Arrow and Archimedes Point", Huw Price, Oxford, 1996.

¹⁸ "Geons, Blackholes & Quantum Foam", Wheeler's autobiography with Ken Ford.

causation. Note that the term “ret” for “retarded” means “from the past”, or what Aharonov calls the “history” state vector. Similarly, the term “adv” for “advanced” means “from the future”, or what Aharonov calls the “destiny” state vector. Feynman already used this idea in his original paper on the path integral in nonrelativistic quantum theory.²⁰

$$\begin{aligned}\psi_{ret} &= R_{ret} e^{iS/\hbar} \\ \psi_{adv} &= R_{adv} e^{-iS/\hbar} \\ R &\equiv \sqrt{R_{ret} R_{adv}}\end{aligned}\tag{1.1}$$

Bohm showed that the pilot wave is a physical field of qubits in the configuration space of the piloted material. The ideas of quantum probability²¹ are not fundamental. God does not play dice with *post*-quantum reality. Therefore, unlike the orthodox statistical interpretations relying fundamentally on ensembles of identically prepared simple atomic systems such as particle beams in scattering experiments, Bohm’s ontology is ideally suited to explain unique complex highly entangled systems such as the living human brain. There was only one Shakespeare²² and to invoke shadow Shakespeares in a multiverse of parallel worlds is “excess metaphysical baggage”.²³ This is not to deny the possibility of “other worlds” close by in material hyperspace, less than a millimeter away, as in M-theory with “3D membranes” folded by anholonomic torsion fields.²⁴ One can even imagine traversable wormholes connecting these worlds to each other. Bohm and Hiley also emphasize that the quantum pilot field is “nonmechanical” and “organic” with no “preassigned interactions between the parts”. In this sense, the pilot field is not at all like a classical machine. The pilot field in configuration space for entangled subsystems is form-dependent and intensity-independent totally opposite to classical fields in ordinary space. It is intimate²⁵, immediate, and undiminished with increasing separation unlike the classical dynamical force fields of electromagnetism, gravity, and torsion confined to ordinary space. These are all desiderata for the “mental field” out of which our thoughts, feelings, and perceptions arise in consciousness. Indeed, the pilot field idea immediately explains how thought can move matter. What Bohm’s and Vigier’s “causal theory” cannot qualitatively explain in principle is how matter influences thought to create the inner conscious experience. This is because of an argument Bohm and Hiley give²⁶ that the standard statistical predictions of quantum theory for ensembles of identically prepared simple independent unentangled systems²⁷ require that there can be no direct reaction or “back-action” of matter on its pilot field. Such a compensating post-quantum reaction to quantum pilot action would result in “signal nonlocality” violating the Stapp-Eberhard no-go theorem. The latter forbids the use of quantum nonlocality as a direct communication channel for what Einstein called “spooky telepathic action at a distance” in violation of the retarded causality postulate of the classical theory of special relativity. The modern theory of quantum computing, cryptography and teleportation would fall apart if the signal-locality of orthodox quantum theory could be violated. Yet, this is precisely what the human mind does when it experiences and knows. The quantum potential Q characterized by action without reaction is “fragile”.²⁸ It is this “fragility” that maintains irreducible

¹⁹ There is no collapse in the Bohm ontology, hence no “qubit speed” for collapse. We have seen that the standard backward causation models without the particle cannot explain the apparent splitting of the charge on the electron as naturally as the Bohm ontology can.

²⁰ Rev. Mod. Phys. 20, 267, “Space-Time Approach to Non-Relativistic Quantum Mechanics” (1948)

²¹ Feynman’s phenomenological rules: add complex amplitudes before squaring for indistinguishable alternatives. Square amplitudes before adding for distinguishable alternatives.

²² Whether or not the real Shakespeare was really the brothers Francis and Tony Bacon at the Scriptorium in London with Ben Johnson (Sirag “Shakespeare’s doublet reversed in First Folio picture”) not the issue.

²³ Wheeler refuting “many worlds” he once endorsed.

²⁴ August 2000, Scientific American “The Universe’s Unseen Dimensions” p.62, N. Arkani-Hamed et-al.

²⁵ Literally attached to a material configuration like the private mind of an individual living brain.

²⁶ P.30 and Ch. 14 in “The Undivided Universe” (1993)

²⁷ We can call this the “actuary’s limit” of sub-quantal equilibrium of the nonlocal hidden variables, AKA “sub-quantal heat death” in Antony Valentini’s Ph.D. dissertation under Dennis Sciama at Cambridge.

²⁸ Bohm and Hiley’s term in “The Undivided Universe”.

uncontrollable local quantum randomness²⁹ even in nonlocally entangled systems. It is not possible to control a quantum probability at a distance in orthodox quantum theory. Yet, this is precisely what happens in the brain, indeed, in the entire living body beyond the neural transmission of electrical signals and the transport of chemical messenger molecules as important as they are. The pilot field of the Bohm-Vigier “causal theory”, with deterministic particle trajectories, is an “absolute physical object”³⁰. Therefore, this pilot wave is just like Newton’s absolute space and absolute time before special relativity and just like the *absolutely* flat space-time of special relativity before Einstein introduced the direct back-reaction of matter on spacetime geometry to bend it into gravity. The unified field theory goes further twisting the spacetime geometry and changing the topology of the 3D membranes to create and destroy traversable wormholes as one example.

Why does quantum theory work so well? I propose the following model. Imagine two barriers. One barrier is for the action of the quantum pilot field on the matter it is piloting of height \hbar per qubit³¹. The other barrier is for the reaction or “back-action” of the matter on its pilot field. When the quantum action is balanced in strength by this new post-quantum reaction, one forms a self-organizing feedback control loop between pilot field and its matter suppressing quantum randomness with “signal nonlocality”. Orthodox quantum theory is strongly violated in this situation. The Bohm-Vigier “causal theory” breaks down completely in this new regime. The particle paths are no longer deterministic, rather, they are self-determining. The entangled individual particle paths, inseparable in configuration space, exhibit strangely synchronized motions beyond the local contact forces from classical signal connections when viewed in ordinary space. This is the essence of the “self” in biological life. Indeed, the particle paths co-evolve with the changing shape of the landscape formed by the now *post*-quantum potential Q^* . Both the particle paths and the shape of the landscape they ride on in configuration space are tweaked by external perturbations from the non-self environment. There is a further mathematical generalization in that the co-evolutionary flow of the nonlocally entangled particle paths on the landscape of their common pilot field is no longer an integrable holonomic path-independent flow characterized by exact differentials. One now has a more complex dynamically changing self-determining topology of closed inexact differential nonintegrable anholonomic flows on the landscape. Indeed one must use the Pfaffian theory of nonintegrability of R. Kiehn³² <http://www22.pair.com/csdc/car/carhomep.htm> in which one has a nonstatistical topological irreversibility³³ constituting a self-organizing process of an open system far from thermodynamic equilibrium with memory and learning. I postulate the Ansatz that the height of the reaction barrier of matter back on its pilot qubit information field is

$$A_{backaction} = \frac{2\alpha mc^2}{N(N-1)H} \approx 2 \left(\frac{e^2}{\hbar c} \right) \frac{mc^2}{N^2 H} \quad (1.2)$$

where H is the Hubble cosmological parameter whose dependence on global cosmic time differs for different solutions of the Einstein field equations.³⁴ This Ansatz is interim since the Einstein field equations need to be changed to include the anholonomic unified field from the nonsymmetric connection for parallel transport of vectors around closed loops in the deformed spacetime manifold. These closed loops in the manifold project into broken loops with translational gaps in the flat tangent spacetime fiber erected at the common beginning and end of the closed loop in the manifold.³⁵ N is the number of coherently entangled

²⁹ The late Heinz Pagels, killed in a way he foresaw in a dream, discusses how quantum randomness prohibits the use of nonlocality as a direct communication channel in “The Cosmic Code”. This book closes with Pagels’ strange precognitive dream of his then future death.

³⁰ “On the Ether” Albert Einstein, 1924

³¹ A “qubit” is the basic unit of quantum information analogous to the Shannon “c-bit” of classical information associated with negative thermodynamic entropy. The qubit is a relative phase coherent two-state quantum system. The spin of a single electron forms a qubit. A single hydrophobically-caged electron inside the protein dimer molecules tiled around subneuronal microtubule (e.g. Stuart Hameroff’s papers) forms the qubit we are specifically interested in.

³² See Kiehn’s paper in these proceedings.

³³ Pfaffians of degree 3 and 4 in the Cartan theory of differential forms.

³⁴ When $N \sim 1$ the backaction barrier is much higher than the action barrier. So quantum theory works.

³⁵ “Spin and Torsion in Gravitation” pp. 10, 11 Figs. 1,2,3 V. de Sabbata & C. Sivaram, World Scientific (1994)

qubits forming a nonlocally connected network of qubits, each of rest mass m and electric charge e , of N nodes. We have post-quantum signal-nonlocality so that the local motion of a single node in the intelligent net is not random, but is synchronized with the simultaneous motion of the other nodes in the approximation of their common rest frame. Galilean relativity works fine here since the dimensionless velocity parameter for each node obeys $v/c \ll 1$. The height $A_{backaction}$ of the back-action barrier is normalized per qubit node. The N^2 in the denominator is the coherence complexity factor lowering the height of the reaction barrier³⁶. The fine structure constant α is the strength of the lowest order Feynman diagram connecting two electron nodes with the exchange of a virtual longitudinally polarized near field photon. One needs $\sim N(N-1)/2$ virtual photons in the same field oscillator mode to phase coherently connect all N nodes together to lowest order Feynman diagram expansion in the N node many-body problem. I make the second Ansatz that this quantum coherent non-radiating near field is the 40 Hz Crick brain field in the specific application of this model to the actual living human brain. Since the virtual photons are “off the mass shell”,³⁷ the equation $\omega = kc$ does not apply to them. The Crick near electric field³⁸ “enslaves”³⁹ the N electron qubit nodes into a coherently-phased interferometric array across the whole cortex forming the brain hologram of Bohm and Pribram. Impose the action-reaction principle, in this case the heights of the two barriers are equal forming a resonant two way feedback control loop in contrast to the one way action of orthodox quantum theory with uncontrollable randomness from a “fragile” integrable quantum potential field without memory. The nonintegrable post-quantum field, with both memory from the past and “presponse”⁴⁰ from the future, is robust stabilized by the action-reaction loop.

$$\begin{aligned}
 A_{action} &= A_{reaction} \\
 \hbar &= \frac{2\alpha mc^2}{N_c^2 H} \\
 N_c^2 &= \frac{2\alpha mc^2}{\hbar H} \approx 2 \left(\frac{1}{137} \right) \left(\frac{10^{-27} 10^{21} 4 \times 10^{17}}{10^{-27}} \right) \\
 &\approx 0.06 \times 10^{38} = 6 \times 10^{36} \\
 N_c &\approx 2.5 \times 10^{18}
 \end{aligned} \tag{1.3}$$

for the critical nonlocal entanglement complexity needed to obey the action-reaction principle. Stuart Hameroff <http://www.consciousness.arizona.edu/hameroff/> informed me that this is the correct order of magnitude⁴¹ for the total number of hydrophobically-caged electrons in the human brain. Furthermore, from the simple post-quantum model of Bohm and Hiley⁴² the duration of a single undivided moment of self-organization⁴³ is

$$\tau \approx \frac{1}{HN_c} = \frac{4 \times 10^{17}}{2.5 \times 10^{18}} \approx 0.16 \text{ sec} \tag{1.4}$$

³⁶ This coherent lowering of the barrier also applies to Schwinger’s theory of cold fusion.

³⁷ For photons, the mass shell Fourier transformed to spacetime is the classical light cone. Virtual photons are off the light cone either inside it or outside it. The superluminal virtual longitudinal photons outside the classical light cone dominate the static near field Coulomb force between pairs of charges. Far field radiation of real transverse polarization plays a small role here. The near electric and magnetic induction fields are what are biophysically most significant.

³⁸ “The Astonishing Hypothesis”, F. Crick, Scribner’s, 1994.

³⁹ “Principles of Brain Functioning”, 4.2.2, 4.2.3, 4.2.4 H. Haken, Springer-Verlag, 1996.

⁴⁰ AKA “presentiment” “The Conscious Universe”, Dean Radin, Harper Edge, 1997 replicated by Dick Bierman.

⁴¹ A billion billion electron qubits.

⁴² “The Undivided Universe” 14.3, 14.6, Bohm & Hiley op-cit

⁴³ I interpret this as Whitehead’s “occasion of experience” i.e. an undivided conscious moment in the intrinsically mental quantum information pilot field.

One must erase the configuration of a billion billion qubits every 0.16 seconds in order to form the Jamesian "stream of consciousness". The required power dissipation to accomplish this is

$$\frac{dE}{dt} = \frac{N_c kT}{\tau} = \frac{1.7 \times 10^{18} \times 1.4 \times 10^{-16} \times 3 \times 10^2}{1.6 \times 10^{-1}} \quad (1.5)$$

$$\approx 4.5 \times 10^5 \frac{\text{ergs}}{\text{sec}} = 4.5 \times 10^{-2} \text{Watts}$$

The resting adult human body metabolizes at about 100 Watts, so this is a small power consumption to generate consciousness in this model. What is unique about my model here⁴⁴ is that human consciousness has a cosmological origin⁴⁵ in a kind of mental version of Mach's Principle compatible with the Hoyle-Narlikar "future response of the universe"⁴⁶ with backward causation based upon a generalization of the Wheeler-Feynman conjecture.

Part II: Progress in Classical Unified Field Theory

This is the "particle" part of the dBBV ontological "wave-particle duality". As I show below in some detail, Vigier's idea that elementary particles have extended spatial structure in which the center of charge is displaced from the center of mass with a finite rest mass of the photon in a superconducting Dirac "aether" of correlated virtual electron-positron pairs is getting increasing experimental confirmation. Bo Lehnert⁴⁷ has shown several electromagnetic anomalies such as an effective electric charge density in the classical vacuum needed to explain observed data. I suspect that all of Bo Lehnert's observations can be adequately explained by Corum's anholonomic $\Omega_{\mu\nu}^\lambda$ field⁴⁸ equation

$$F_{\mu\nu} = \frac{\partial A_\mu}{\partial x^\nu} - \frac{\partial A_\nu}{\partial x^\mu} + 2\Omega_{\mu\nu}^\lambda A_\lambda \quad (2.1)$$

Where $F_{\mu\nu}$ is the Maxwell electromagnetic field tensor and A_μ is the electromagnetic 4-potential now a local classical observable. The equivalence principle used by Einstein in 1915 only applied to the nonuniform holonomic translational motion with nonrotating local noninertial frames. The use of a nonsymmetric connection comes from extending the equivalence principle to nonuniform anholonomic rotations of local noninertial frames.⁴⁹ Corum's equation is not U(1) gauge invariant. One can make it gauge invariant with a minimal coupling using Dirac's⁵⁰ string quantization of electric charge from the magnetic monopole.

$$\tilde{F}_{\mu\nu} = \frac{\partial A_\mu}{\partial x^\nu} - \frac{\partial A_\nu}{\partial x^\mu} - 2\Omega_{\mu\nu}^\lambda \left(\frac{g_n}{\sqrt{\hbar c}} P_\lambda - A_\lambda \right) \quad (2.2)$$

$$g_n = \frac{2\pi n \sqrt{\hbar c}}{e}, n = 1, 2, 3, \dots$$

Where P_λ is the mechanical 4-momentum and n is a topological winding number. This means that one must violate holonomic Diff(4) gauge symmetry when generating the anholonomic $\Omega_{\mu\nu}^\lambda$ field in order to

⁴⁴ Compared to Stapp's or Penrose's.

⁴⁵ The connection of the Hubble parameter to the mass of the spatially extended electron has also been noted by R. I. Gray op-cit who derives $H^{-1} = (4r/3)^2 (\alpha c/Gm)$, where $r = e^2/mc^2$

⁴⁶ "The Intelligent Universe", Fred Hoyle, Holt, Rinehart & Winston (1983).

⁴⁷ See contribution to this conference. Lehnert is at the Royal Institute of Technology in Stockholm.

⁴⁸ This third rank tensor field under holonomic Diff(4) gauge symmetry of 1915 general relativity is the antisymmetric part of the connection field for nonintegrable parallel transport of vectors along paths in the manifold. J.Math Physics, 18, 4, pp. 770-776, 1977 "Relativistic rotation and the anholonomic object" James F. Corum

⁴⁹ e.g. Gennady Shipov "A Theory of Physical Vacuum" Moscow, 1998 and Vladimir Poponin's paper in these proceedings.

⁵⁰ "Geometry, Particles and Fields" pp 18, 391, 491, Bjorn Felsager, Springer-Verlag, 1998.

preserve the internal U(1) gauge symmetry of the electromagnetic force. Kleinert’s theory (<http://www.physik.fu-berlin.de/~kleinert/>) of “super-tetrads” for the unified field beyond Einstein’s 1915 theory is required. Eq. (2.2) should also explain the [Blackett-Sirag Effect](#)⁵¹ for rotating neutral astronomical objects that show an anomalous magnetic moment (<http://stardrive.org/Jack/blackett1.pdf>). Sirag’s empirical data plot for the magneto-gyroscopic coefficient obeys

$$\frac{\mu_{astro}}{J_{astro}} = \beta \frac{\sqrt{G}}{2c} = 0.08689 \frac{\sqrt{G}}{c} \approx \sqrt{\frac{\alpha G}{c^2}} \quad (2.3)$$

The Kerr-Newman solution for a rotating charged black hole has a non-radiating solution with zero Hawking radiation when the Pythagorean theorem is obeyed in control parameter space⁵², i.e.,

$$\left(\frac{GM}{c^2}\right)^2 = \left(\frac{\left(\frac{l_p c^2 \langle \phi \rangle}{\sqrt{\hbar c}}\right)^2 M}{c^2}\right)^2 = \left(\frac{J}{Mc}\right)^2 + \left(\frac{\sqrt{G}Q}{c^2}\right)^2 \rightarrow l_p^2 \langle \phi \rangle^2 \left(g_n^2 + \frac{Q^2}{\hbar c}\right) \quad (2.4)$$

$$\frac{J_n}{Mc} = \frac{p_n M^2}{Mc} = \frac{Mc^2}{T_n} = l_p \langle \phi \rangle g_n = l_p \langle \phi \rangle \frac{2\pi n \sqrt{\hbar c}}{e} \Rightarrow \frac{1}{p_n} = \frac{T_n}{c^3} = \frac{M}{cl_p \langle \phi \rangle g_n} \quad (2.5)$$

$$\frac{\sqrt{G}}{c^2} = \frac{l_p \langle \phi \rangle}{\sqrt{\hbar c}} \Rightarrow G = \left(\frac{l_p c^2 \langle \phi \rangle}{\sqrt{\hbar c}}\right)^2 = \frac{l_p^2 c^3 \langle \phi \rangle^2}{\hbar} \quad (2.6)$$

T is the string tension [energy/length] and $\langle \phi \rangle$ is the dimensionless vacuum expectation of the dilaton field. Changing $\langle \phi \rangle$ changes the effective gravity parameter G and the string tension T_n . I conjecture that this right triangle constraint must be generalized to the general triangle constraint

$$\left(\frac{GM}{c^2}\right)^2 = \left(\frac{J}{Mc}\right)^2 + \left(\frac{\sqrt{G}Q}{c^2}\right)^2 - 2\left(\frac{J}{Mc}\right)\left(\frac{\sqrt{G}Q}{c^2}\right)\cos\theta \quad (2.7)$$

with torsion “hair”⁵³ in the cross-term for a unified field generalization of the orthodox black hole and wormhole solutions beyond Einstein’s symmetric 1915 general relativity. Model the bare electron as a non-radiating wormhole mouth with charge $\sqrt{\hbar c} \approx 11.7e = 11.7 \times 4.8 \times 10^{-10} = 5.6 \times 10^{-9} esu$ and bare mass $\sqrt{\hbar c/\alpha G} = 11.7 \times 2.18 \times 10^{-5} gm$. The magneto-gyroscopic coefficient is then

$$\frac{\mu}{J} = \frac{Q}{Mc} \approx \frac{\sqrt{\alpha G}}{c} \quad (2.8)$$

⁵¹ “Gravitational Magnetism” Nature, Vol. 278, 535, April, 1979.

“The gravi-magnetic hypothesis is that a rotating mass,” [electrically neutral] “measured in gravitational units ($M = G^{1/2} m$) has the same magnetic effect as that of an electrostatic charge, measured in esus moving at the same angular velocity at the same distance.” 4-1 “Unified Physics”, R. I. Gray, O.B.E., in-house report, 1988 from Naval Surface Warfare Center, Dahlgren, VA. This also implies EM radiation from accelerating neutral matter. Also p. 459 eq. (11.2.4) ref 1 on Schwinger’s classical “dyon”.

⁵² In the sense of Rene Thom’s “catastrophe theory” and V.I. Arnold’s “singularity theory”. Folds and other kinds of controllable catastrophes in the dynamic 3D membrane embedded in 10d hyperspace are expected.

⁵³ The black hole is not completely bald when we add torsion. Wheeler had $J \sim M^2$ in 1955 “Geon” paper.

$$m_{\text{Blackett}} = \frac{M_p^2}{m_{\text{Wesson}}} \approx \frac{Q}{\sqrt{\alpha G}} \rightarrow \sqrt{\frac{\hbar c}{\alpha G}} \approx \frac{M_p}{\sqrt{\alpha}} \approx 11.7 M_p \approx 10^{20} \text{ Gev} \quad (2.9)$$

Therefore the bare mass that fits the data in (2.3) is $M/\sqrt{\hbar c/G} = \sqrt{1/\alpha} = 11.7$. In other words, the magneto-gyroscopic measurements of astronomical objects act as a “telescope” directly into the quantum gravity era! This is consistent with Vigier’s notion of the spatially extended bare elementary particle in a superconducting virtual dressed electron-positron screening plasma in the quantum vacuum that is not dragged along with the rotating bare core due to zero superfluid viscosity. We have additional empirical astronomical data of P.S. Wesson⁵⁴

$$J = pM^2 \approx 8 \times 10^{-16} [gm^{-1}cm^2 \text{ sec}^{-1}] M^2 [gm^2] \quad (2.10)$$

that fits my 1973⁵⁵ association of Regge trajectories to tiny non-radiating rotating black holes with strong short-range gravity. The hadronic resonances of the strong quantum chromodynamic SU(3) color force have $p_{\text{hadron}} \approx 1 \text{ Gev}^{-2}$. In contrast (2.7) is ~ 36 powers of 10 flatter, i.e. $p_{\text{astro}} \approx 10^{-36} \text{ Gev}^{-2}$. Note that the new parameter p , not found in the 1915 Einstein general relativity, has the dimensions of vorticity flux per unit mass for the circulation of the aether flows. Therefore, this shows a strong presence of the anholonomic unified field at all scales of the universe from planets to pulsars to galaxies to clusters and superclusters. The Blackett-Sirag data together with the Wesson data rank in equal importance to the data on Hubble’s law for the cosmological redshift and the isotropic cosmic microwave blackbody background radiation. Wesson points out the strong dimensionless anholonomic unified field coupling strength parameter and conjectures from his data that

$$\gamma \equiv \frac{G}{pc} \approx \alpha = \frac{l_p^2 \langle \phi \rangle^2 T}{\hbar c} \approx \frac{1}{137} \quad (2.11)$$

This corresponds to the mass scale

$$m_{\text{Wesson}} / \sqrt{\hbar c/G} \equiv \sqrt{G/pc} = \sqrt{\gamma} \approx \sqrt{\alpha} = 0.085 \rightarrow 0.85 \times 10^{18} \text{ Gev} \quad (2.12)$$

closer to the GUT unification compared to the Sirag-Blackett mass scale of 11.7.⁵⁶ The Blackett-Sirag mass scale is roughly dual, in the sense of superstring M-theory, to the Wesson mass scale using the Planck mass as the standard. Therefore, I conclude that the empirical evidence from both Blackett-Sirag and Wesson are effective “telescopes” down to Wheeler’s “quantum foam” at the Planck scale confirming M-theory qualitatively. This shows that bare matter is made from non-radiating spatially-extended rotating charged wormholes whose gyromagnetic properties decouple from the zero viscosity superconducting virtual dressed electron-positron Dirac-Vigier quantum vacuum.⁵⁷

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⁵⁴ Phys. Rev. D, 23, 8, 1730, April 1981 “Clue to the Unification of Gravitation and Particle Physics”. P.S. Wesson.

⁵⁵ “The Eightfold Way as a Consequence of the General Theory of Relativity” Collective Phenomena, 1, 1974 (edited by H. Frohlich and F.W. Cummings), & “Speculations on Gravitation and Cosmology in Hadron Physics”, Collective Phenomena, pp 163-167 (1973); “Quantum Mechanics as a Consequence of General Relativity” IC/74/9 International Centre Theoretical Physics, Trieste, Italy; “Gravitation, Strong Interactions and the Creation of the Universe”, Nature-Physical Science (December 4, 1974) “The Primordial Proton”, Physics Today letter (May, 1974) 69 also Andrew Salthouse “Is Symmetry Breaking in SU(3) a Consequence of General Relativity”, UM HE 73-29 cites my work and fits nuclear data to it.

“Space-Time and Beyond” p. 168 (Dutton, 1975) also strong finite range gravity to scale 1 micron p. 129, 137.

⁵⁶ Not quite superstring dual $R \rightarrow 1/R$, but the data is not accurate enough yet.

⁵⁷ “Dirac’s Aether in Relativistic Quantum Mechanics”, J.P. Vigier, N.C. Petroni, Fdn. Physics, 13, 2, 29 (1983).