My Original Ideas

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I make Popper falsifiable[i] original predictions in this book: Dark matter[ii] detectors will fail to register true signals because dark matter is caused by virtual particles inside the quantum vacuum not real particles outside the vacuum whizzing through space. Trying to find real dark matter particles is like Michelson and Morley in 1887 trying to detect the motion of Earth through the aether with their interferometer.[iii] A preponderance of virtual spin ½ fermion-antifermion pairs over virtual spin 1 boson pairs creates the net gravity attraction of dark matter that mimics cold dark matter real particles. Dark energy is the opposite.

I also claim to have essentially solved the mind-matter "hard problem."

"It is undeniable that some organisms are subjects of experience. But the question of how it is that these systems are subjects of experience is perplexing. Why is it that when our cognitive systems engage in visual and auditory information processing, we have visual or auditory experience: the quality of deep blue, the sensation of middle C? How can we explain why there is something it is like to entertain a mental image, or to experience an emotion? It is widely agreed that experience arises from a physical basis, but we have no good explanation of why and how it so arises. Why should physical processing give rise to a rich inner life at all? It seems objectively unreasonable that it should, and yet it does." David Chalmers[iv]

I used David Bohm's picture of quantum theory.[v] The non-relativistic limit is valid for biological physics. I postulate that Bohm's quantum information field called the quantum potential Q that pilots particles and electromagnetic fields is essentially "mental" or "thoughtlike" (Henry P. Stapp[vi]) with the particles and electromagnetic fields as "matter" in the common sense way of thinking. Orthodox quantum theory, that I will call "special quantum theory" in analogy with Einstein's "special theory of relativity," obeys the no entanglement signal theorem ("no communication theorem) in its several guises.[vii] This means that nonlocal quantum entanglement, now a powerful resource in applied physics of imaging, cryptography, teleportation, cannot be used as a stand-alone command-control-communication-channel C4. Yes, one can encode a complex message nonlocally in a spatially extended entangled quantum system, like the electron switches inside the protein dimers in the microtubules of our brains in the Stuart Hameroff model,[viii] for example, but we cannot decrypt the spread-out coded message without light-speed limited classical signal keys. I say that our consciousness violates this restriction and the theory that

explains it is, in analogy with Einstein's general theory of relativity of the gravitational field - "general quantum theory." Antony Valentini has published papers on "general" quantum theory where he introduces the idea of "signal nonlocality" in a more formal way than I did and Brian Josephson did independently before him. I claim that evidence for signal nonlocality is found in the independent "brain presponse" data of several experimental scientists, Ben Libet, Dean Radin, Dick Bierman, and most recently Cornell's Daryl Bem in his paper "Feeling the Future."

Technically, the special quantum theory taught in school is linear and unitary provided that "strong" measurements are not made in between the time evolution of the quantum system. General quantum theory is nonlinear and non-unitary. Both of these properties can arise in different ways. Spontaneous symmetry breaking of the ground state of complex systems is one way. General quantum systems, it seems, must be open systems pumped far from thermodynamic equilibrium like Ilya Prigogine's "dissipative structures." David Bohm with Basil Hiley showed that the no-communication theorem of special quantum theory comes from the violation of Einstein's philosophical "action-reaction principle" that forms the essence of his general theory of relativity of the gravitational field.[1] In special relativity, the four-dimensional spacetime continuum pilots the real force-free "geodesic" motion of particles and field configurations without any direct back-reaction of those piloted particles and fields on the spacetime-continuum. That is, the space-time continuum acts without being reacted upon directly! The quantum potential Q in orthodox special quantum theory is absolute exactly like the spacetime continuum in Einstein's 1905 special theory of relativity. In the case of the spacetime continuum Einstein found this to be repugnant to his intuition of how God should have created the universe. Indeed, Wolfgang Pauli quipped that Einstein should stop telling God what to do. Einstein did not know about the Bohm quantum potential Q until about 1952 when David Bohm became is student at Princeton. Bohm was a young professor at the time, but sat at Einstein's feet so to speak. Einstein by 1916 transformed the spacetime continuum from an absolute object into a relative object the geometrodynamical field in which the particles and non-gravity fields back-react directly producing curvature of the spacetime continuum.[2] Indeed, such curvature permits time travel to the past as well as global faster than light messaging through traversable "stargate" wormholes that is the other side of the quantum

[1] Newton's third law is a special case of Einstein's more general action-reaction principle. It follows from conservation of linear momentum in a closed system that has spatial translational invariance from Emmy Noether's theorem. One must be careful when there are retardation effects and when special relativity is important. I have shown, in an important special case, how to avoid the retardation problem using local gauge invariance and the canonical momentum of an electric charge in the electromagnetic field. My argument appears to be original not noticed before as far as I am aware.

[2] Oddly Bohm did not seriously apply this action-reaction insight to his quantum theory until near his death in the early 1990s. That's when the torch was passed to me as I read his short remark in 1994 about this in his last book "The Undivided Universe" with Basil Hiley. Most mainstream quantum mechanics did not understand Bohm's idea at all.

entanglement coin where "ER = EPR." Note, that locally, the message-signal travels slower than light inside the wormhole. It is faster than light only to observers outside the wormhole. So we have to borrow from John Archibald Wheeler "faster-than-light without faster-than-light." The no-communication theorem of special quantum theory corresponds to wormholes with event horizons that pinch off before a message or traveller can get through the warped space tunnel. Anti-gravitating amplified dark energy holds the wormhole open. General quantum theory violating the no-signal theorem of special quantum theory depends on the dark energy that is about 68% of all the stuff in the universe. Now there are the naysayers who discount all this. However, because of the UFO evidence, I take the position in this book of "Damn the photon torpedoes, full warp ahead." One other point, Einstein's equivalence principle allows artificial "non-tidal" gravity even in special relativity. We experience artificial gravity without curvature when we are at rest in accelerating reference frames called "non-inertial frames." Real gravity fields, in the sense of Newton's theory, correspond to hovering in a "stretch-squeeze" Weyl "tidal" curvature field. This is called the "static LNIF" observer in general relativity and it does not exist behind the event horizon of a black hole – at least prior to Stephen Hawking's recent change of heart on what lies behind the event horizon because of the so-called "firewall" paradox. However, even in such a real gravity field with curvature, we can eliminate its "non-tidal" artificial gravity component by freely falling weightless on a timelike geodesic that is inside our local light cone. The light cone is the essential object in both special and general relativity. Ordinary material objects are always inside their local light cones. The simple light cone is the spherical electromagnetic far field radiation wave from a point source. Retarded history light waves travel from now along the future light cone. Advanced destiny light waves travel from now backwards in time along the past light cone. We must specify the sign of the energies of these waves. This is called a boundary condition. Feynman uses the natural one where retarded waves carry positive energy and advanced waves carry negative energy. This choice generates the ordinary universally attractive gravity field. However, if we invert this boundary condition we get a universally repulsive anti-gravity field like the actually observed dark energy accelerating the expansion of 3D space in our observable universe.

Now, let's return to the hard problem of our immediate experience of the "Now" in our consciousness called "qualia" by the mind-matter philosophers. I say that "qualia" are generated in our minds as immediate experiences from the direct back-reactions of the charged particles and electromagnetic fields in our brain on a macroscopically coherent quantum potential Q mental pilot field. Our conscious experiences, qualia, are simply excited states out of the ground state of our Q-field. The Q-field emerges from spontaneous symmetry breaking of a dissipative structure in our brains. Topological computing also probably plays an essential role because it is robust against thermal environmental decoherence. This would be a off-equilibrium biological version of the fractional quantum Hall effect in 2D nano-quantum wells with the braid group of anyonic fractional quantum statistics replacing the spin-statistics connection of 3D quantum systems. Indeed, the wrapping of the protein dimers around the microtubules inside our nerve cells is, it

seems to my intuition, such a 2D nano-quantum well structure. Summarizing, the analogy of real tidal gravity curvature to conscious qualia is profound.

There are two kinds of Stephen Hawking black body radiation[ix] from black holes and our two past and future cosmological horizons that define the edges of our observable universe. Hawking's original prediction was from low energy horizon surface area modes of vibration. The new higher energy radiation is from the quantum uncertainty thickness of these horizons. In particular, the black hole horizons are heat engines doing work whose outer regions pump out beams of particles.

- Dark energy accelerating the expansion rate of the three-dimensional space of our universe, itself maybe a back-from-the-future hologram image, is redshifted advanced Wheeler-Feynman Hawking black body radiation with negative energy density. Retarded radiation from past obeys the Feynman propagator boundary condition that positive energy propagates forward in time, while negative energy propagates backward in time. I postulate here, the mirror image anti-Feynman boundary condition for back-from the future advanced radiation: that negative energy propagates forward in time, while positive energy propagates backwards in time. Therefore, even though $w = +1/3$ for real black body thermalized photons they generate universally repulsive anti-gravity. The cosmological expansion of space makes a blue shift for back-from-the-future advanced radiation, but it's a very small correction to the enormously larger gravity redshift from our future dark energy de Sitter cosmological event horizon that may well be the holographic Hawking Brain/Brane of God, whose software is his "Mind of God." Indeed, the Hawking radiation energy density is the actually observed hc/ALp^2 where A is the area-entropy of the observer-dependent future cosmic horizon. $A \sim 10^{124}$ quantum bits of information. In general quantum theory we have entanglement signal nonlocality, which makes the Brane of God conscious in my opinion – take it, or leave it.[x]
- One of the most important principles in modern theoretical physics is that of local gauge invariance used in conjunction with the idea of spontaneous symmetry breaking of the lowest energy state called the quantum vacuum for virtual particles and the quantum ground state for real particles. The "God Particle" of Peter Higgs found in the CERN LHC in Geneva, Switzerland, that gives rest masses to spin ½ fermion leptons and quarks as well as weak force spin 1 vector bosons is an example of the former. The persistent electric currents in quantized magnetized superconducting rings are an example of the latter. The equations of local gauge invariance that explain all the real forces of electromagnetism, weak and strong interactions are presented in text books as formal mathematical tricks without any immediate physical meaning. I have recently discovered their physical meaning. I have connected the pure mathematics of local gauge transformations to Einstein's "objects of

experience." The simplest case is that of electromagnetism from the internal symmetry U1 unitary Lie group of continuous phase transformations. The electromagnetic field potential A transforms to A + (hc/e)df. Of course, h is the Planck's quantum of action and c is the speed of light in vacuum. Everyone knows that f is the quantum phase of, for example, the electron test charge e's wave function y, whose rest mass m is induced by the Higgs vacuum superconductor field that presumably forms in the moment of inflation Alpha Point creation of our universe in the quantum phase transition from a false to the "true" vacuum. The total linear momentum of the charge coincident with the electromagnetic field A is the canonical momentum P

$$P = mV + (e/c)A$$

The gauge transformation keeps the canonical momentum P invariant. It does not change because from the Schrodinger quantum equation of motion

$$mV \rightarrow mV - hd\phi$$

$$(e/c)A \rightarrow (e/c)A + hd\phi$$

It suddenly dawned on me that $hd\phi$ is simply the linear momentum transfer Δp between the test charge and the electromagnetic field it is in local contact with. This is a near field electrical contact force caused by the exchange of a virtual photon whose momentum is simply $hd\phi$. Indeed, from Fourier analysis it is easily shown that the virtual photon has longitudinal polarization pointing in the same direction as its linear momentum. Let me remind the physicist reader that virtual particles do not obey Einstein's "mass shell" constraint between energy and momentum. That is, unlike the case for real particles excited out of the vacuum, the equation

$$E^2 = c^2P^2 + (mc^2)^2$$

Is violated for virtual particles. Since $\Delta p = hd\phi$ cancels out in an elementary exchange, $DP/ds = 0$ and $DE/ds = 0$ separately in such an exchange that takes time Δt. The local contact force per elementary exchange is

$$hd\phi/\Delta t \sim - (e/c)DA/ds \sim e(\text{electric field})$$

Where

$$\Delta E \, \Delta t < h.$$

The action-reaction principle in this case in the form of linear momentum conservation and Noether's theorem connecting conservation laws with

continuous symmetries of dynamical fields is trivially obeyed locally without any need for the astrological belief called Mach's Principle that inertial resistance to off-geodesic pushes by real forces in Newton's second law of particle mechanics comes from the far away stars as suggested by Dennis Sciama and promoted by James Woodward and others. Einstein may be forgiven for flirting with Mach's Principle in his struggle to create general relativity. He eventually rejected it as no more than a useful psychological crutch in his creative process. This same idea will work for the SU2 weak real force as well as the SU3 strong real force. Real forces push slower than light massive test particles off the timelike geodesics of the gravitational field in contrast to fictitious forces that are actually the non-tidal curvature-free part of the gravitational field itself! This is what the equivalence principle demands.

Amazingly enough, local gauge invariance also works for the proper off-geodesic accelerations of test particles in the gravitational field rather than the linear momenta of test particles being measured by those detectors. The key idea of gravity is that of the geodesic, which is longest proper time path connecting two events in Einstein's unified four-dimensional spacetime continuum. That is, all neighboring paths that have the same starting and ending events have smaller proper times. This is an example of the "Action Principle" that is a key organizing idea of all theoretical physics. Clocks moving on these paths, called "world lines" measure proper time. Proper time is the amount you age if you are on that world line journey. Indeed, this explains why your twin who is abducted by an evil extra-terrestrial is much younger than you when they return him as in Francis Ford Coppola's "4400" sci fi TV series for example. The proper acceleration of a test particle is DV/ds where V is the "four-velocity" of the test particle relative to some detector at the origin of a local frame of reference. In general, using my symbolic short hand without tensor indices to keep it as simple as possible, without being simpler than is possible (Einstein paraphrase):

$$DV/ds = dV/ds - \{LNIF\}(VV)$$

Where the symbol {LNIF} describes the detector at the origin of the local frame, in this case a "Local Non-Inertial-Frame." It's also called the "Christoffel symbol", the "Levi-Civita connection" and the "affine metric connection with zero torsion." Mathematically it describes, "parallel transport" of geometric objects in a tangent fiber bundle whose base space is Einstein's world spacetime continuum. Physically it encodes all the fictitious forces on the observed test object Eve caused by real forces on the detector at the origin of the local frame of reference, either Alice or Bob's. For example, {LNIF} could describe a rotating frame or a frame with translational proper off-geodesic acceleration, or both at once. Any object, is on an off-geodesic world line only if an external real (EM-weak-strong) force acts on it. This is Newton's second law of motion. Newton's first law of motion is simply

the "geodesic equation" that if no real forces act, the massive object moves along a timelike geodesic that is independent of the mass of the object. In this case, we assume that the mass of the object is not changing as it would in a rocket or jet ejecting mass in the exhaust.

We now consider a physical local frame transformation. Suppose Alice is measuring Eve's motion. Also imagine that Bob is momentarily coincident with Alice and they both measure Eve's motion with radars. Remember now, that Eve, Alice and Bob all with rest masses are each independently on arbitrary timelike world lines. Eve's world line need not be close to Alice's and Bob's since they measure Eve's motion with light signals. However, Alice and Bob must be physically near each other and must make their measurements of Eve almost simultaneously in order to test Einstein's general relativity field equations. The local frame transformation between coincident Alice and Bob is X. The Christoffel symbol then transforms as

$$\{LNIF\}_A \rightarrow \{LNIF\}_B = XX^{-1}X^{-1}\{LNIF\}_A + X^{-1}X^{-1}dX$$

$$V_A \rightarrow V_B = XV_A$$

$$\{LNIF\}(VV)_A \rightarrow XX^{-1}X^{-1}\{LNIF\}XX(VV)_A + X^{-1}X^{-1}XX(VV)_A dX$$

$$= X\{LNIF\}(VV)_A + (VV)_A\, dX$$

$$dV_A/ds \rightarrow dV_B/ds = XdV_A/ds - (VV)_A\, dX$$

Just as the exchanged virtual photon momentum transfer $hd\phi\Delta t$ cancels out in the local electrical U1 contact gauge force for coincident fermion charge and spin 1 boson field, so does the gravity gauge transformation term $(VV)_A dX$ cancel out leaving the first rank tensor transformation

$$DV_A/ds \rightarrow DV_B/ds = XdV_A/ds$$

What is the physical meaning of the gravity gauge term $dX(VV)_A$? Obviously, it is the proper acceleration difference between coincident Alice and Bob. Einstein's equivalence principle tells us that a frame with proper acceleration is the same as a frame at rest in a non-tidal Newtonian gravity field. Because of the Unruh effect, it corresponds to the momentum of a macro-quantum coherent Glauber state of near field virtual spin 2 gravitons with momentum $(h/c^2)dX(VV)_A$

I was much enthralled with John Archibald Wheeler's geometrodynamics back in the late 1960s when I was a very young assistant professor of physics at San Diego State with Fred Alan Wolf who was an associate professor. Wheeler modeled the electron as a tiny wormhole with closed lines of quantized electric flux lines threading it. The quantization of electric charge

was then trivially explained from the single-valuedness on the wormhole's quantum wave function around a closed loop exactly like the quantization of magnetic flux vortices in Type II superconductors and the magnetic flux through superconducting rings carrying persistent currents. The electric flux entering one of the two wormhole mouths of the Einstein-Rosen bridge would be a tiny Kerr-Newman black hole pure vacuum black hole with negative electric charge from Gauss's theorem. The flux leaving the other mouth in possibly a different parallel universe would have positive electric charge and would be a white hole. What we didn't know back then, but what we know now some forty plus years later is that the white hole mouth is unstable while the black hole mouth is stable. Therefore, we have a trivial explanation for the C-charge violation, why we do not see anti-matter in the universe. One major problem, if we want to explain the rest of the lepton and the quarks this way, is that Newton's gravity G is too small. I should add, that quarks were not totally accepted back then. Geoffrey Chew's analytic S-Matrix was also a competitor. Gerard t' Hooft had not yet showed the renormalizability of Yang-Mills gauge theories and the role of spontaneous symmetry breaking of the vacuum giving a "superconducting" order parameter for the SU2 weak force. This order parameter was described by Glauber macro-quantum coherent states of virtual massive Higgs and virtual massless Goldstone quanta forming a spin 0 cosmic field that gives rest masses to the weak spin 1 boson of the radioactive weak force as well as rest mass to the spin ½ leptons and quarks. Abdus Salam had introduced the idea of f-gravity with a strong force massive graviton. This gave a strong short-range gravity on the scale of a Fermi that was forty powers of ten stronger than Newton's gravity at short scales. I immediately realized that Salam's idea naturally explained why the slopes of all the Regge trajectories for hadronic resonances were parallel to each other in the plot of their spins against the square of their masses seen in the peaks in the resonance scattering cross sections. The hadrons were little black holes. Their Hawking radiation would explain their decay times. Salam was excited by my discovery and he invited me to his Institute for Theoretical Physics in Trieste, Italy 1973-4. My old idea has recently been rediscovered in 2013. I also got the idea that EPR quantum entanglement was the other face of the same coin describing the wormhole ER. That is, the two mouths of the wormhole connected by a stringy tunnel described, for example, an entangled electron-positron pair. Lenny Susskind and I knew each other at Cornell in 1963-5 and he rediscovered this idea not long ago. We now know that all the no-go theorems of quantum information theory, which prohibit faster-then-light messaging, correspond to the pinch off of the wormholes with event horizon mouths when signals try to get through them. However, we also now know that the anti-gravitating dark energy permits traversable "stargate" wormholes whose mouths are not event horizons. Therefore, signals can get through them not only faster-than-light, but also even back-from-the-future in time.

[i] The concern with falsifiability gained attention by way of philosopher of science Karl Popper's scientific epistemology "falsificationism". Popper stresses the problem of demarcation—distinguishing the scientific from the unscientific—and makes *falsifiability* the demarcation criterion, such that what is unfalsifiable is classified as unscientific, and the practice of declaring an unfalsifiable theory to be scientifically true is pseudoscience. This is often epitomized in Wolfgang Pauli famously saying, of an argument that fails to be scientific because it cannot be falsified by experiment, "it is not only not right, it is not even wrong!" http://en.wikipedia.org/wiki/Falsifiability

[ii] **Dark matter** is a type of matter hypothesized in astronomy and cosmology to account for a large part of the mass that appears to be missing from the universe. Dark matter cannot be seen directly with telescopes; evidently it neither emits nor absorbs light or other electromagnetic radiation at any significant level. It is otherwise hypothesized to simply be matter that is not reactant to light.[1] Instead, the existence and properties of dark matter are inferred from its gravitational effects on visible matter, radiation, and the large-scale structure of the universe. According to the Planck mission team, and based on the standard model of cosmology, the total mass–energy of the known universe contains 4.9% ordinary matter, 26.8% dark matter and 68.3% dark energy. http://en.wikipedia.org/wiki/Dark_matter

[iii] http://en.wikipedia.org/wiki/Michelson–Morley_experiment

[iv] http://en.wikipedia.org/wiki/Hard_problem_of_consciousness

[v] http://www.tcm.phy.cam.ac.uk/~mdt26/pilot_waves.html

[vi] http://en.wikipedia.org/wiki/Henry_Stapp

[vii] http://en.wikipedia.org/wiki/No-communication_theorem

[viii] http://en.wikipedia.org/wiki/Stuart_Hameroff

[ix] http://en.wikipedia.org/wiki/Hawking_radiation

[x] We conjecture that Vasiliev's theory of higher spin gravity in four-dimensional de Sitter space (dS4) is holographically dual to a three-dimensional conformal field theory (CFT3) living on the spacelike boundary of dS4 at future timelike infinity. ...The AdS/CFT correspondence provides a non-perturbative holographic definition of anti-de Sitter (AdS) quantum gravity in terms of a CFT living on the timelike conformal boundary of AdS. Our own universe is unlikely to have an anti-de Sitter boundary, but may well have a de Sitter (dS) boundary in the far future. This dS boundary shares a number of mathematical properties with the AdS boundary. Hence it is natural to try to define dS quantum gravity in terms of a CFT living on the future conformal boundary of dS [1, 2, 3, 4, 5, 6]. One key difference is that in AdS/CFT, the radial direction emerges holographically from the CFT, while in dS/CFT time itself must be holographically emergent. It is challenging to reconcile this with our usual quantum notions of unitary time evolution. … A second key difference is that we have had no useful microscopically complete examples of the dS/CFT correspondence. This has stymied progress in the subject and at times rendered the discussions somewhat formal.[1] It is the purpose of this paper to begin to fill this gap. … Specifically, we conjecture that Vasiliev's higher spin gravity [7, 8] in dS4 is holographically dual to the three-dimensional conformal field theory (CFT3) with anticommuting scalars and Sp(N) symmetry studied by LeClair and collaborators in [9, 10, 11, 12]. This is a de Sitter analogue of the conjectured Giombi-Klebanov-Polyakov-Yin (GKPY) duality relating the O(N) CFT3 to Vasiliev gravity in AdS4, whose remarkable properties have received much recent attention [13, 14, 15, 16, 17, 18, 19]. The Sp(N) CFT3 dual to de Sitter space has anticommuting scalar fields **and is therefore non-unitary**. This peculiarity does not rule out the duality because in dS/CFT, the CFT is Euclidean and never continued to Lorentzian signature. On the other hand,

the good properties of ordinary time evolution in the bulk must be encoded somehow in the CFT. Indeed the Sp(N) CFT3 turns out to have a “pseudo-unitary” structure [11] which may be relevant.” Dionysios Anninosa, Thomas Hartmanb and Andrew Stromingerc http://arxiv.org/abs/arXiv:1108.5735