



The Sommerfeld Institute
of Advanced Physics

**Hyperspace, star gates, time travel to the past and
propellantless propulsion of alleged flying saucers.**

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Note added Aug 6, 2001.

Star Trek Q's Psychokinetic Warping of Space-Time?

$$G_{\mu\nu} + L_p^* |\psi|^2 g_{\mu\nu} = \left(\frac{G^*}{c^4} \right) T_{\mu\nu}$$

$G_{\mu\nu}$ = Einstein's curvature tensor

$L_p^* = \sqrt{\hbar G^* / c^3}$ = hyperspace amplified quantum gravity Planck scale now a local field

$g_{\mu\nu}$ = Einstein's metric tensor field

$T_{\mu\nu}$ = stress-energy tensor of all sources of the gravity field

ψ = local order parameter of cohered virtual zero point quantum vacuum fluctuations of the unified electroweak-strong-gravity forces plus lepto-quark sources plus any real Bose-Einstein condensates.¹

The topodynamic principle that the boundary of a boundary vanishes² leads to the Bianchi identity that implies³

$$G_{\mu;\nu}^{\nu} = 0$$

Therefore, we get the vacuum propeller equation for the flight of flying saucers

¹ This is my generalization of a term introduced by Giovanni Modanese for the vacuum propeller explanation of UFO flight.

² John Archibald Wheeler's "A Journey into Gravity and Spacetime", Scientific American Press, 1990.

³ ; denotes the curved spacetime or symmetric Levi-Civita "covariant" derivative. Torsion and anholonomic constraints are hidden in the * notation.

$$g_{\mu}^{\nu} \left(L_p * |\psi|^2 \right)_{;\nu} - \left[\left(\frac{G^*}{c^4} \right) T_{\mu}^{\nu} \right]_{;\nu} = 0$$

The mental current is

$$J_{\mu} = g_{\mu}^{\nu} \left(L_p * |\psi|^2 \right)_{;\nu}$$

The post-quantum current continuity equation violation is

$$J_{\mu}{}^{;\mu} = \left[\left(\frac{G^*}{c^4} \right) T_{\mu}^{\nu} \right]_{;\nu}{}^{;\mu} \neq 0$$

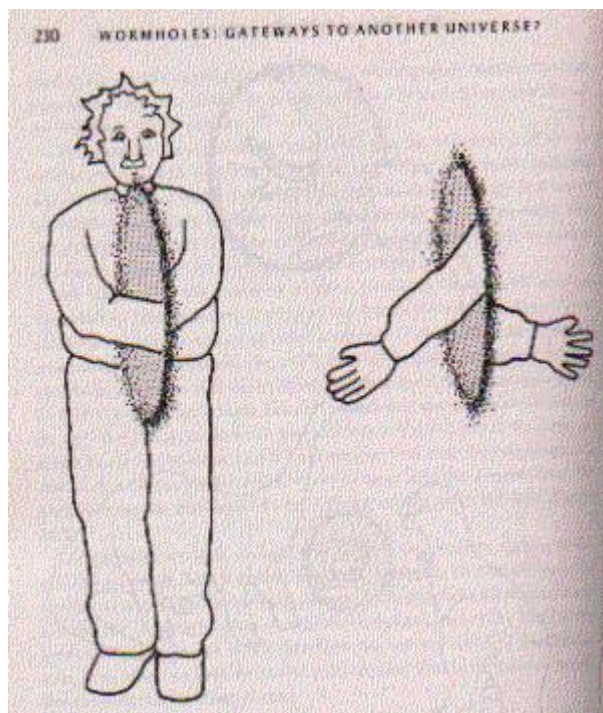
is the direct back-action of the material sources of the on the mental pilot field partially telling matter how to move.

Quantum theory uses a locally incoherent nonlocal wave function for entangled systems with signal locality. In contrast, post-quantum theory uses a locally coherent macroscopic wavefunction, or “hologram”, with signal nonlocality.

I. Key ideas in Matt Visser's book⁴ "Lorentzian Wormholes".

<http://www.physics.wustl.edu/~visser/general.html>

Definition: A "star gate" is a traversable Lorentzian wormhole with no space-time singularities, no lethal horizons, small g-forces and small tidal forces, congenial to humans and alleged alien extra-terrestrials, in the "throat" or passageway.



Michio Kaku's "Hyperspace" Fig 10.4 p. 230⁵

⁴ American Institute of Physics, QC173.6.V57 1995

⁵ *The Curious Case of the One-Armed Man*

"It occurred to some of these Livermore personnel that Geller's feats, if they were genuine, represented a potentially serious security threat. ... When they checked the audio tape ... they found a distinctive, metallic sounding voice ... things like this had happened before The Livermore group quickly found themselves involved in more strangeness than they could handle ... suddenly there in the middle of the room would be a weird, hovering, almost comically stereotypical image of a flying saucer. It was always about eight inches across, in a gray, fuzzy monochrome, as if it were some kind of hologram ... The thematic connection with Geller was obvious, when one remembered that Geller claimed to be controlled by a giant computerized flying saucer named "Spectra" ... They all had top security clearances ... Then there was the very strange

<http://stardrive.org/Jack/contact.pdf>

<http://stardrive.org/cartoon/spectra.html>

On another case of the metallic voice of Spectra.

The star gate can be used for fast essentially subjectively instantaneous travel to distant parts of our visible material universe at the same cosmic epoch. It can also be used for essentially subjectively instantaneous travel to the past and future of the starting point and to parallel material universes “next door”⁶ across thin separations in the extra-unseen dimensions of material hyperspace⁷ that probably has 10 space-like dimensions.

business of the metallic voice ... Among the few intelligible words it pronounced were two or three which Kennett [Kit Green of CIA] recognized as the code name of a very closely held government project ... Russo [Ron Hawke?] complained about a telephone call from the strange metallic voice. The voice demanded that the Livermore group cease its research activities with Geller ... one of the last such apparitions ... suddenly there was this ... arm ... hovering holographically in the middle of the room. The arm was clothed as if it belonged to a man wearing a plain gray suit. There was no bloody stump where it should have connected with a shoulder. It merely faded into clear space Within a few days Puthoff and Targ arrived in Washington ... [Kit Green] met them ... ‘And so the goddamn arm—’ said [Kit Green], winding up his story [to Puthoff & Targ] ‘What do you think of that? And as [Kit Green] pronounced the word ‘that’, there was a sharp heavy pounding on the door ... Standing in the doorway was a man He ... said in an oddly stilted voice, ‘Oh! I guess ... I must ... be .. in ... the wrong ... room.’ .. he walked out, slowly, stiffly, giving all of them time to see that one sleeve of his gray suit, pinned to his side was empty.” Pp.164-169, “Remote Viewers: The Secret History of America’s Psychic Spies”, Jim Schnabel, Dell (1997) ISBN:0-440-22306-7 For my association with Geller, Puthoff & Targ during same time period see Martin Gardner’s “Magic and Paraphysics”, “MIT Technology Review”, 1976, reprinted in “Science, Good, Bad and Bogus”. This is all forensic evidence so to speak. It cannot be ignored. Note the apparently disembodied arm on one side of the Star Gate in Kaku’s picture above. Coincidence? See also “The Star Gate Conspiracy” by Picknett & Prince for more true weirdness in the field of Consciousness/UFO/PSI research

⁶ “The universe next door” coined by Robert Anton Wilson, author of “The Cosmic Trigger” in which youthful ideas from the 1970’s of Saul-Paul Sirag and myself are extensively discussed.

⁷ “Hyperspace”, Michio Kaku, QC21.2.KS 1994, ISBN 0-385-47705-8, Oxford University Press

“The Universe’s Unseen Dimensions” Scientific American, August 2000, p.62

Star Gate Engineering



11/19/00

- Topology change in unified field theory permits advanced civilization to engineer traversable wormholes using the Cartan nonsymmetric connection field from hyperspace.

Artist's imagined Star Gate in Times Square from Jan 2000 Scientific American

“The existence of macroscopic Lorentzian wormholes (say, sizes of the order a few metres) is not inconsistent with the rest of known physics... there is certainly no positive experimental evidence, as of the time of this writing (1994) that might conclusively prove or disprove the existence of Lorentzian wormholes of any type.” Visser, xix

I disagree with Visser's empirical position here. I say that the good UFO evidence provides a strong plausibility argument for the existence of environmentally benign Lorentzian wormholes on a scale of a few meters. On the other hand, Visser makes some excellent fundamental conceptual distinctions.

“The word ‘paradox’ has ... been ... abused ... There are at least two different essentially opposite meanings:

- A logical inconsistency in an apparently plausible argument.
- An apparent inconsistency in a perfectly correct argument.

Many of the more noisy arguments about ‘paradoxical’ aspects of relativity and time travel boil down to the various disputants using these differing definitions without realizing it. (P.203) ... There are no inconsistencies in special relativity. ... the classical logical paradoxes associated with time travel ... fall into two broad classes

- Consistency paradoxes⁸

⁸ “take a time machine back to ... five minutes ago. ... permanently discourage your younger self from any future experimental research into time travel ... Who killed you? Your future self? But you are now dead, so there is no future self able to come back and kill you. Therefore, you cannot be dead. Therefore, in five minutes you *can* hop into the

□ Bootstrap paradoxes⁹

... traversable wormholes, if they exist, seem to lead, almost inevitably, to time machine formation ... Possible responses to the problem of time travel ... include

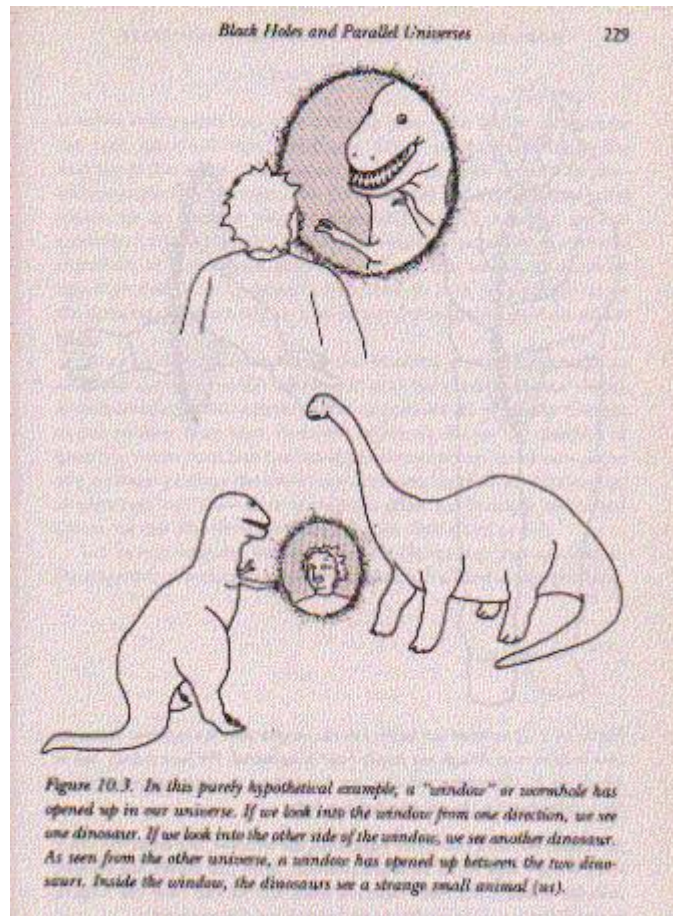
- The violent and radical rewriting of physics from the ground up.¹⁰
- The invoking of consistency constraints.
- The denial of the possibility of time travel.
- The denial of the possibility of traversable wormholes.

... a time machine is any object or system that permits one to travel into the past. Paradoxes arise because once back in the past one should, *a priori*, be able to influence one's own future¹¹ (P.204) (which is also one's own past) by either leaving a message or by influencing oneself by some more physical means ... (205)

time machine and come back to kill your past self...Consistency paradoxes arise whenever there is a possibility of changing one's own history." (P. 213, Visser)
⁹ information (or objects, or even people?) ... created from nothing ... Suppose I travel back in time ... and give my younger self a ... copy of this book ... Who wrote the book? ... there are no logical inconsistencies ... the purported effects are certainly weird." (P. 213, Visser). Indeed this may be how our entire universe is created from nothing.

¹⁰ This is what I am doing in this document.

¹¹ See Jean Cocteau's last film "The Last Testament of Orphee" and related films like "La Jetee", "Twelve Monkeys".

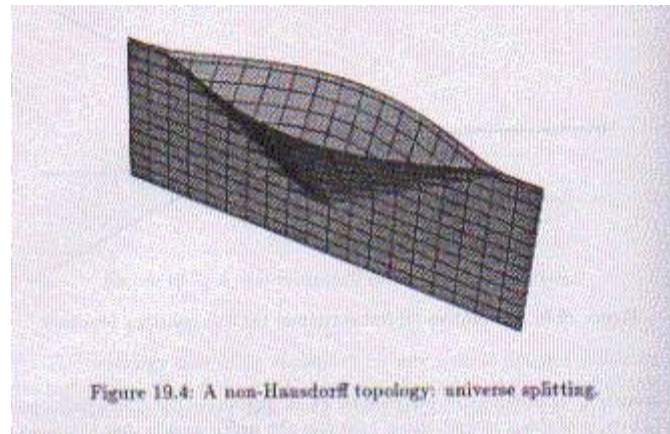


Star Gate Time Machine, Kaku's "Hyperspace", p. 229

Conjecture: Super Cosmos¹² requires a non-Hausdorff topology in the material manifold of hyperspace's Quantum G^* geometrodynamics with Abdus Salam's G^* variable strong short-range low energy quantum gravity. Example: Penrose's quantum gravity "OR"¹³ requires a non-Hausdorff topology in 3-geometry and, consequently, in 4-dim space-time manifold.

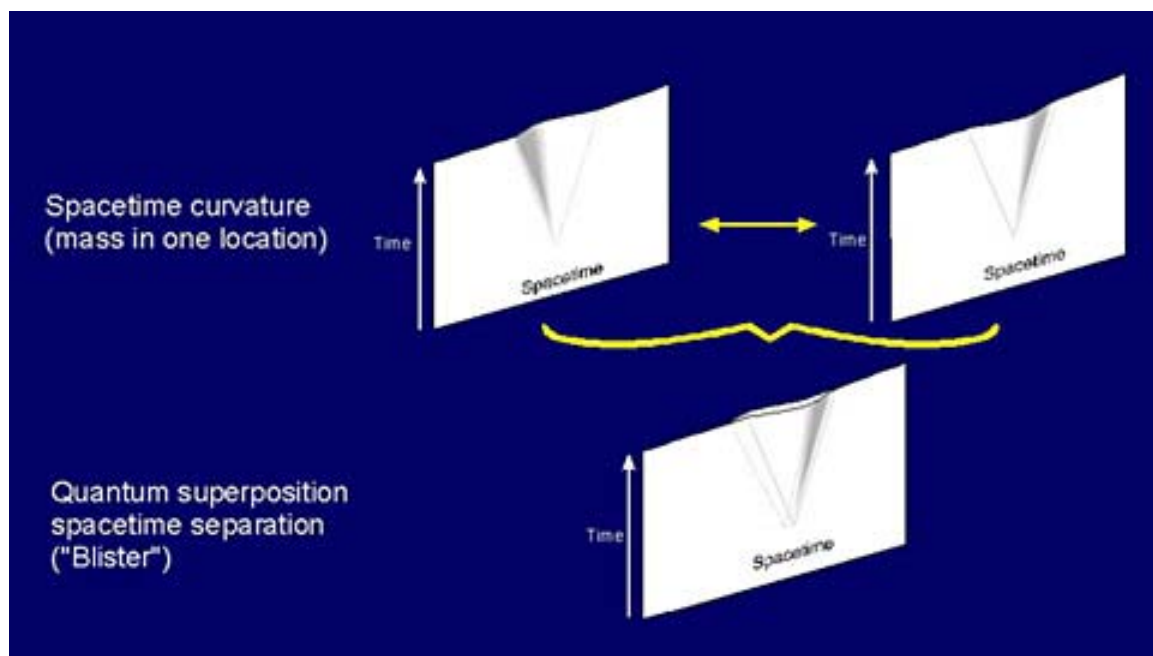
¹² "Super Cosmos" only has meaning in the context of Bohm's realism. It is Deutsch's thought-like "multiverse" landscape together with Kaku's rock-like "hyperspace" as the system point rolling over the landscape. Hyperspace contains many rock-like universes inside it as shown in Kaku's picture below. Carl Sagan's "Cosmos" was only one of the rock-like universes floating in hyperspace – the one we are stuck inside of like Abbott's "Flatlanders".

¹³ "Shadows of the Mind", Oxford University



Splitting space-time manifold in non-Hausdorff topology (Visser, Fig. 19.4 p. 254)

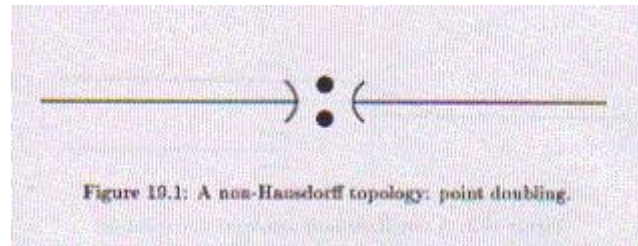
Compare the above picture to Stuart Hameroff's picture¹⁴ in
<http://www.consciousness.arizona.edu/hameroff/hardfina.html>



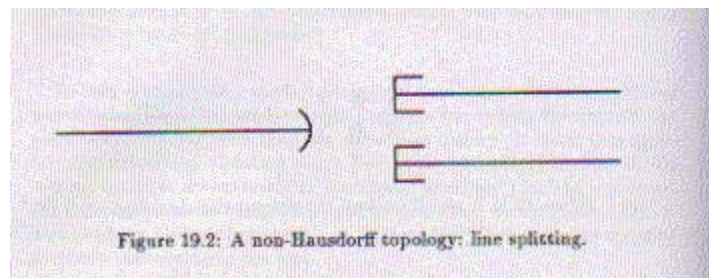
A topology is Hausdorff if and only if for any two points P and P' there exist non overlapping open sets $\{P\}$ and $\{P'\}$ containing P and P' respectively. An open set is like

¹⁴ Note a major difference in Hameroff's model of consciousness and mine is that his requires the entire heavy protein dimer molecule as the basic qubit. In contrast, I use only the single electron quantum dot inside that molecule's hydrophobic cage as the basic qubit. Furthermore my theory asserts that our moment of subjective consciousness ~ 1 sec is determined by the large scale cosmological structure of the universe that we sense in the local Hubble flow of the expansion of space. No other model of consciousness generation has that feature which also implies infinite consciousness rate at the Big Bang for the "Mind of God" in Hawking's sense.

the open interval $0 < x < 1$ without the end points at 0 and 1. Examples of non-Hausdorff topologies:



Point doubling (Visser, Fig. 19.1, p. 251)



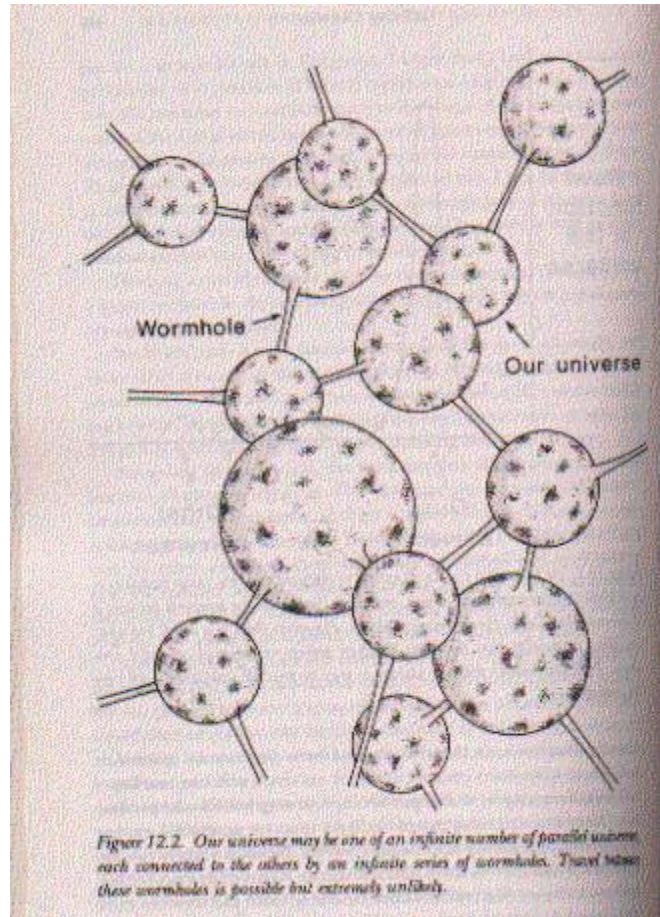
Line splitting creating and merging alternative timelines.¹⁵
(Visser, Fig. 19.2, p. 252)

“What does it mean physically for space-time to be non-Hausdorff? While coordinate patches remain four-dimensional in such a space-time, the manifold itself can be arbitrarily complicated. Local physics remains tied to nicely behaved four-dimensional coordinate patches. Thus, one can, for instance, impose the Einstein field equations in the usual manner. Every now and then, however, a ‘temporal anomaly’ induces a ‘non-Hausdorff wave front’, which duplicates the whole universe. ... This structure is now sufficiently rich to be able to offer a ‘multiple history’ resolution of the consistency paradoxes.

This is *one* possible resolution of the consistency paradoxes; there are others. Suppose a time traveler goes back into the past. He/she/it leaves behind a perfectly acceptable universe ... The moment x that he/she/it steps out of the time machine into the past, one might suppose a ‘temporal anomaly’ occurs. A new history (a new timeline) is initiated. This new history can diverge from the old history only in the causal future of x . This is exactly the sort of situation that the mathematical formalism of non-Hausdorff manifolds is capable of describing. ... the traveler can change history all he/she/it likes – the alterations are merely alterations to a new history, the old history proceeding completely unaffected. ... Both the old and new history shares a common asymptotic region ... both

¹⁵ Michael Crichton's scifi. Novel “Timeline” bears an uncanny resemblance to me and Rashi des Troyes (AKA Solomon ha Zarfati, 1040-1105). We see more of the high strangeness, or Jungian synchronicity, as in the “Curious Case of the One-Armed Man” and the metallic “Spectra” voice allegedly from a flying saucer that CIA and Teller's LLL personnel, as well as myself, were contacted by in 1973 and 1953 respectively. This is real fact not fiction.

histories share the same space-like infinity. Thus, both histories have the same ADM mass ... While we can use non-Hausdorff space-times to analyze time travel there is nothing to tell us that we *must* do it this way ... one can have non-Hausdorff manifolds without having time travel ... universes splitting for other nefarious reasons ... and one can have time travel without invoking non-Hausdorff manifolds (e.g. via the Novikov consistency conjecture) ... one could question the naïve notion that the 'present' has a unique fixed 'past history' ... merely by adding a time-reversed 'branching event' ... one obtains a 'merging event' where two universes merge into one. Not only is predictability more than somewhat dubious ... but one appears to have lost retrodictability as well. ...



Michio Kaku's rock-like "Hyperspace" Fig 12.2 p. 256

such a cognitive framework would render the universe unsafe for historians¹⁶ ... These notions are still firmly classical ... without directly invoking quantum effects ... One does invoke semi classical quantum effects. The best way to build a time machine seems to be via a traversable wormhole. To hold the traversable wormhole open one has to violate the ANEC."¹⁷ (Visser, 19.1.2 pp 250 - 255)

¹⁶ E.g. Esalen's Michael Murphy's "novel", based on true events, "An End to Ordinary History".

¹⁷ ANEC = "Averaged Null Energy Condition". More on that below.

3Dim Fold in 10DimHyperspace



- Dynamical topology change in unified field theory forbidden in 1915 general relativity
- Post-quantum signal nonlocality forbidden in quantum theory.

11/19/00

Picture of anholonomic torsion folded 3dim "brane" August 2000 Scientific American

Topology change, classical and quantum.ⁱ

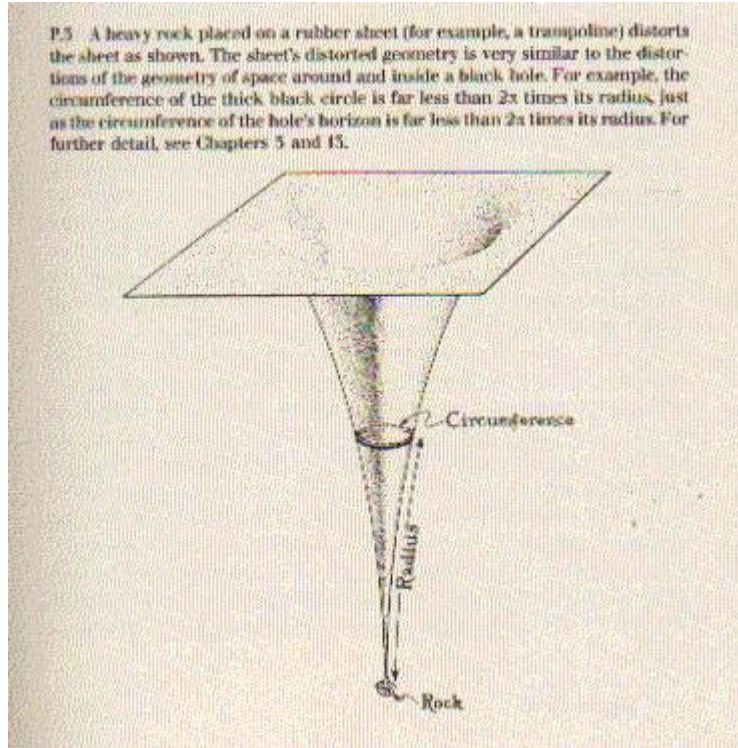
Wheeler introduced the "quantum foam" where the geometrodynamics zero point quantum vacuum fluctuations are large. This should not be confused with the electromagnetic zero point quantum vacuum fluctuations that take place on a classical fixed flat space-time used by Haisch, Rueda and Puthoff trying to explain the origin of inertia, e.g., the "m" in $\mathbf{F} = m\mathbf{a}$.¹⁸

The "geon" wormhole is a metastable quasi soliton of gravity and electromagnetic fields. It cannot explain spatially extended elementary particles¹⁹ A point particle, of course, still

¹⁸ **Boldface for 3-vectors.**

¹⁹ The fact that the electron, and the quarks inside the nucleon, look like point particles is explained by positive elliptical space curvature in which the shortening of the radial meter sticks means that the surface area scattering cross section is smaller than the Euclidean $4\pi r^2$ flat value. For example, the electron looks at least as small as 10^{-16} cm even though its Compton wavelength is 10^{-11} cm. That is, the radius looks bigger compared to the circumference of a circle because the tangential meter sticks do not shrink whilst the radial meter sticks do shrink. Since the radial meter sticks shrink relative to the ones around the circumference, you need more of them than you do in Euclidean geometry. Note, this is opposite to the situation for a rotating disk where one gets negative hyperbolic curvature because of Lorentz contraction of the meter sticks around the circumference and the equivalence principle. Therefore, rotation and static gravity work oppositely to each other. The Abdus Salam $G^* \gg G$ at short range with softer string tension T^* to lower vibrational frequencies makes the G^* eon which *can* be used for elementary particle modeling. Is the proton stable for a similar reason, i.e. gravitational redshift time dilation? The low energy nuclear force, with binding energies

has a finite scattering cross section. What we have here is a “point particle without a point particle” in the spirit of Wheeler’s “mass without mass” and “charge without charge”. What it means operationally to say that the electron is a point particle and that the quarks inside nucleons is large angle scattering.²⁰ The order of magnitude of the effective area or scattering cross section σ_{ee} of two point electrons colliding with each other is not zero but $\sim \alpha^2 (\hbar/mc)^2 = (e^2/mc^2)^2 \sim 10^{-25} \text{ cm}^2$.²¹ In deep inelastic scattering of electrons off nucleons, the evidence for three real point-like quarks inside is in a fractal self-similarity of the *form factors*²² called “Bjorken scaling”.



Kip Thorne's "Black Holes and Time Warps" p. 31

This is why the spatially extended electron looks like a point particle in scattering data.²³

~ 10 Mev, can be pictured as electric charge independent spin 0, spin 1, spin 2 meson exchange coming from the fifth Kaluza-Klein dimension. This is implicit in Paul Wesson's book "Space-Time, Matter".

²⁰ Geiger-Marsden wide angle scattering of alpha particles off thin gold foil 1908 explained by Rutherford is the basic idea here taken to high energy physics with form factors in momentum transfer space.

²¹ This does not mean directly that the electron is extended over distance 10^{-13} cm.

²² Form factors are QED perturbation theoretic departures from simple electron-photon vertex γ_μ .

²³ The "rock" in Kip's picture is the rock-like spatially extended "electron" that is one of Bohm's not so "hidden variables". The "Radius" is the Compton wavelength $\hbar/mc \sim 10^{-11}$ cm, the distance around the "Circumference" (\sim effective size in 2dim Flatland) seen by the external probe is much smaller, at least as small as 10^{-16} cm. This is because $G^* \gg$

<http://kestrel.nmt.edu/raymond/ph13xbook/node187.html>
<http://kestrel.nmt.edu/raymond/ph13xbook/node192.html>
<http://kestrel.nmt.edu/raymond/ph13xbook/node191.html>
<http://www.purdue.edu/UNS/html4ever/970110.Koltick.electron.html>
http://modelingnts.la.asu.edu/html/Impl_QM.html
<http://www.phys.washington.edu/~dehmelt/all2000.html>

Meaning of "point particle" in scattering data.

because the geometrodynamical coupling G/c^4 of geometry to stress energy density is too weak. In other words, the tension T in the quantum gravity vibrating string is too stiff. Note that

$$\frac{G}{c^4} = \frac{1}{T} \quad (1.1)$$

The stiffer, the more taut the superstring, like the violin string, the higher the fundamental frequency and, therefore, the *weaker* the geometrodynamical coupling coefficient between the warping of space-time and the stress-energy density needed to locally make the space-time warp. This is counter-intuitive. Star Gate metric engineering needs a softer less taut superstring, which means a much stronger geometrodynamical coupling. That's the physical meaning of eq. (1.1).

Wheeler got "mass without mass" and "charge without charge" from vacuum curvature and trapped electric flux lines in the wormhole mouth.

G at these micro scales. The electron is a G*eon. This insight solves a major puzzle and answers one of Nick Herbert's objections to Bohm's mystical realism refuting Bohr's mystical idealism. Realism includes both materialism and idealism, that is, both rock-like and thought-like things interwoven equally as material and mental threads in the fabric of physical reality. This instantly solves David Chalmers's "hard problem" (e.g. December, 1995 Scientific American), which is much ado about nothing, a tempest in a teapot, and artifact from Bohr's incomplete mental epistemology without ontology. The mental qubit pilot field provides the landscape on which the material system point rides. The only issue then, for the understanding of consciousness as a physical phenomenon, is whether the play between mind and matter is one-way or two-way? Orthodox quantum theory has it one-way with mind *directly* moving matter but not vice versa. Post-quantum theory has it two-way where matter also *directly* grips mind inducing consciousness in mind. This solution is parallel to Einstein's moving from special relativity to general relativity. In special relativity space-time grips matter one way. In general relativity matter also grips space-time *back* causing it to curve. The general idea of back-action, of the two-way relation between a pilot field landscape and a system point is common to both general relativity and post-quantum theory, i.e., to both gravity and subjective inner consciousness. Our consciousness is cosmologically dependent on the large scale structure of the material visible universe.

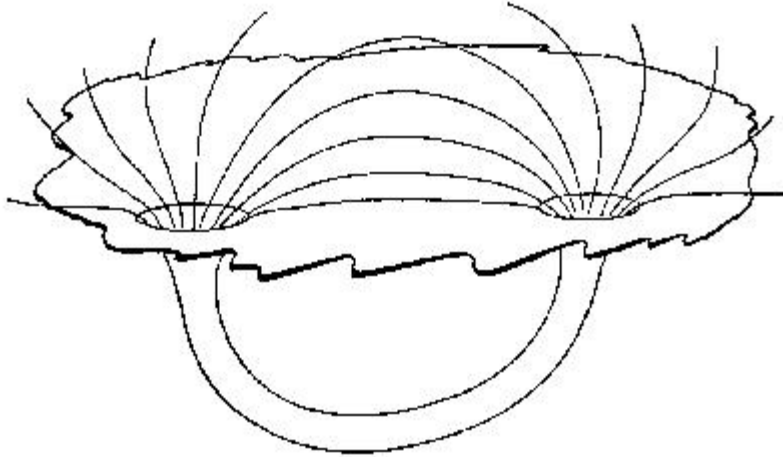


Figure 6.1: Wheeler's schematic picture of a wormhole: "Schematic representation of lines of force in a doubly-connected space. In the upper continuum the lines of force behave much as if the tunnel mouths were seats of equal and opposite charges."

From Visser p.54

The masses M and times need not be the same for the two wormhole mouths.²⁴ Therefore, topology change can generate electron-proton pairs violating charge conjugation invariance as well as electron-positron pairs. Thus, it is easy to understand why the universe has more matter than antimatter once one sees that with the extra dimensions of hyperspace

$$\frac{G^*}{c^4} = \frac{1}{T^*} \gg \frac{G}{c^4} = \frac{1}{T} \quad (1.2)$$

$$T^* \ll T \quad (1.3)$$

²⁴ "the two mouths of the wormhole can in general have different masses". Visser 11.2. p. 103 The traversable wormhole has a time "redshift function" and a space "shape function" for each mouth. The different masses mean different shape functions at each mouth or Star Gate portal. The time travel effect means there are different redshift functions at each mouth. If the redshift functions are identical then the intra-universe travel between different parts of the same universe will be virtually instantaneous externally, i.e. not only the ubiquitous internal relatively short proper time it takes to free float through the wormhole tunnel across hyperspace without any ill effect from g and tidal forces, but one will wind up at same cosmic epoch in the Hubble flow, i.e., same absolute temperature of the cosmic black body radiation background.



Jack Sarfatti in 1971 as Asst. Professor of Physics, San Diego State University

What “quantum gravity” means is that the geometrodynamical field has quantum fluctuations.²⁵ There are two kinds²⁶, “far field” and “near field”, the former is

$$\Delta g_{far} \sim \frac{L_p}{L} \quad (1.4)$$

$$L_p \equiv \left(\frac{\hbar G}{c^3} \right)^{\frac{1}{2}} \sim 10^{-35} \text{ meters} \quad (1.5)$$

Equation (1.4) for the “far field” fluctuation at renormalization group “fractal” scale L comes from first order perturbation quantum theory of weak field gravity²⁷ in a flat space-time background. The stress-energy density is approximated as a fixed classical external field. The “near field” expression comes from a different “test particle” picture.²⁸ The test particle is confined to space scale L

$$\Delta p L \sim \hbar \quad (1.6)$$

For a real particle on its special relativistic mass shell at high energy

²⁵ It is not as Hameroff presents it as simply Heisenberg's time-energy uncertainty applied to the Newtonian gravity self-energy of a mass m since that happens in a classical geometrodynamical field in the weak field slow speed approximation on a scale much larger than the Planck scale. Penrose's idea that Hameroff cites here can only make sense with $G^* \gg G$ at the scale of m's Compton wavelength.

²⁶ Online discussion Jack Sarfatti, Tony Smith and Nick Herbert ~ 3 years ago.

²⁷ P.56 Visser

²⁸ 6.3, p.61, Visser

$$\Delta E \sim \sqrt{m_o^2 c^4 + (\Delta p c)^2} \sim c \Delta p \quad (1.7)$$

The classical Newtonian potential is, therefore, of order

$$V \sim \frac{G \left(\frac{\Delta E}{c^2} \right)}{L} \sim c^2 \left(\frac{\hbar G}{c^3 L^2} \right) \sim c^2 \left(\frac{L_p}{L} \right)^2 \quad (1.8)$$

In the weak field limit of Einstein's GR

$$\Delta g_{near} \sim \frac{V}{c^2} \sim \left(\frac{L_p}{L} \right)^2 \quad (1.9)$$

What happens when either of these two kinds of near and far quantum vacuum zero point fluctuations in the geometrodynamical field g are large of order unity. Does the topology change or not? Note that the geometrodynamical field is dimensionless with no physical units, i.e. a pure number like the fine structure constant $1/137 \sim 0.0073$ coupling of the exchange of a virtual photon between two electrons.²⁹ If the topology changes, then we immediately violate naïve retarded causality of past causes and future effects and must have time travel to the past. Remember Bell's quantum theorem that the statistical predictions of orthodox quantum theory are incompatible with both counterfactual definiteness and retarded causality. You can have a many-worlds interpretation of quantum theory with retarded causality³⁰ because there is no longer any counter-factual definiteness. That is, there is no longer a unique historical reality. Of course, there is nothing that demands that a many-worlds quantum "mental"³¹ multiverse³² obey retarded causality, only that it can, but need not. That is, you must violate at least one of the two conditions of counter-factual definiteness and/or retarded causality that all causes must be in the time-like or light-like past of their effects. You can also violate both and still be consistent with the statistical structure of quantum theory that forbids any kind of

²⁹ Or the same electron in a self-energy Feynman diagram for perturbation theory. The square root of the fine structure constant 0.0854 is the vertex coupling of two point electron world lines and one photon world line.

³⁰ As in Murray Gell-Mann's "The Quark and the Jaguar".

³¹ Deutsch, like Stapp, Penrose et-al follow Bohr that there is no mental-material duality in quantum reality. That is, the quantum wave function is a complete description of physical reality at the quantum level with no additional material hidden variable as Bohm requires in his 1952 theory. I am not talking about the much later "implicate order" program which is not yet a "theory" the way the 1952 theory is. "Hyperspace" in the sense of superstring M-theory introduces an additional material "hyper verse" as the not-so "hidden variable". You can think of this distinction in terms of complexity theory of neural nets and ecology in which there is both a "landscape" and a "system point", or "hidden variable" rolling on the landscape or "wave function" of "qubits".

³² As in David Deutsch's "The Fabric of Reality".

nonlocal communication because of local quantum randomness³³ in entangled quantum states of many-particle systems.

Bell's theorem says following three conditions are mutually incompatible:

1. Counterfactual definiteness
2. Chronology protection = retarded causality = locality = no rock-like time travel to past = no precognitive remote viewing = no real time faster than light communication
3. Statistical predictions of orthodox quantum theory, i.e. sub quantum heat death of Valentini, <http://xxx.lanl.gov/abs/quant-ph/0106098> "equilibrium of hidden variables" of Bohm & Hiley

- Does the topology of 3-dim space change as a function of time in a given way of slicing³⁴ 4-dim space-time into 3-dim space-like surfaces?
- Do different 4-dim space-time topologies interfere quantum mechanically in the Hawking-Feynman path integral quantization of Einstein's general theory of relativity?³⁵
- Classically, retarded causality and positive stress-energy density forbid a change in the topology of 3-dim space.³⁶ Geroch³⁷ proved that spatial topology change in space-time, in closed universes and some open ones, requires retarded causality violation in the sense of closed time-like curves i.e. time travel to the past. Tipler³⁸ then showed that Einstein's Lorentzian signature classical field equation with this kind of spatial topology change requires "exotic" negative stress-energy density somewhere-when. You cannot have retarded causality, positive stress-energy density, Einstein's field equation in hyperbolic space-time, and spatial topology change all obeyed simultaneously.
- Topology change of 3-dim space and time travel to the past are closely linked together, e.g. <http://arxiv.org/abs/gr-qc/9406053>
- Wheeler's intuitive idea of "geometrodynamics" included the idea that tiny elementary particles like electrons and nucleons were kinks or knots in space itself. These "geons" have "mass without mass", "charge without charge" and

³³ Heinz Pagels' "The Cosmic Code".

³⁴ A "foliation"

³⁵ Bryce DeWitt thought such a thing was "meaningless" because he was stuck in retarded causality with no time travel to the past as we seem to see as a fact in the UFO phenomenon.

³⁶ P. 63 Visser

³⁷ Geroch, J. Math. Phys., 8, 782 (1967); Ph.D. dissertation under John A. Wheeler, Princeton, 1968.

³⁸ Tipler's Ph.D. dissertation under Wheeler's student Misner at University of Maryland, 1976. Ann. Phys. 108, 1 (1977)

even half-integral fermionic “spin without spin”³⁹ The creation and annihilation of particles known in relativistic quantum field theory of point particles could then be understood in terms of spatially extended particles as geons in the Bohm ontological quantum theory of 1952 extending de Broglie's ideas with both pilot waves and real particles. This did not work simply because G/c^4 was too small. However, Abdus Salam showed⁴⁰ how to solve this problem because this quantity gets large at the tiny distances where the elementary particles are as in eq. (1.2) above.

The Geroch-Hawking-Tipler et-al classical topology-causality theorems⁴¹ say the following conditions are incompatible:

1'. Positive energy density, e.g. ANEC et-al

2'. Retarded causality = locality = no closed time-like curves CTC = chronology protection i.e. same as 2 above in Bell's theorem.

3'. Einstein's geometrodynamical field equation

$$G_{\mu\nu} = (G/c^4)T_{\mu\nu}$$

for the local bending of space-time, i.e. $G_{\mu\nu}$ by the stress-energy density tensor field $T_{\mu\nu}$ of Bohm's *not so hidden* variables (system points in the landscape complexity theory picture), i.e. rock-like G^* eon solitons, i.e. knotted *vacuum* wormholes with varying topological complexity prior to the thought-like qubit pilot field landscape.

4'. Topology change of the 3-dim geometrodynamical field configurations in a given Hamiltonian canonical ADM foliation or slicing of 4-dim space-time into space-like surfaces with given lapse and shift fields

The above is for classical topology change. What about quantum topology change? The ADM canonical quantization of Einstein's classical geometrodynamics slices 4-dim space-time into a foliation of 3-dim space-like surfaces. Any two point on such a space-like surface lie outside each other's light cones. Therefore, barring closed time-like and light-like world lines in this point test particle approximation, there cannot be any classical causal hyperbolic influence connecting them. There is also the issue of elliptical gauge constraints here. One must “gauge fix” and then attempt to quantize the “physical

³⁹ Friedman & Sorkin, Phys. Rev. Lett. 44, 1100 (1980)

⁴⁰ In the early 1970's, i.e. “f-gravity”, when, as a professor at San Diego State, I showed how to understand the Regge trajectories $J \sim E^2$ of the hadronic resonances as rotating G^* eons in the Kerr metric. Salam invited me to his institute in 1973-4 to continue this line of inquiry.

⁴¹ Is there a connection of non-Hausdorff topology of line-doubling alternative timelines in the many rock-like universes of hyperspace to branch point singularities in Riemann surfaces making functions of a complex variable single-valued – Penrose's twisters?

degrees of freedom" in analogy to Feynman's quantum electrodynamics where the physical degrees of freedom might be the transverse polarized far field real photons able to propagate energy in vacuum to infinity in contrast to longitudinal-scalar polarized virtual photons forming evanescent near fields that are stuck to essentially finite regions around their charged sources. Our brain EM/EEG fields associated with mental processing are these near fields of zillions and zillions of these virtual photons in coherent states, not the far field radiation of real photons. Induction fields in electrical transformers and electrical motors and generators are near fields as well. Real photons have a tight connection $f = kc$ between frequency f and wave number (reciprocal wavelength) k . Virtual photons do not. We say virtual quanta are "off mass shell", or in this case off the classical light cone both inside and outside. If outside, we have a virtual space-like particle. This distinction comes from the propagator correlation functions of special relativistic quantum field perturbation theory of Feynman diagrams where the real quanta are poles of the propagator in the complex energy plane. The virtual quanta are the non-pole stuff contributing to the propagator. Of course, Quantum G*eometry is essentially non-perturbative like Askhtekar's "loop" approach independent of fixed background metric and Penrose's "nonlinear graviton".⁴² Assuming retarded causality and global foliation by space-like surfaces, as in classical theory:

⁴² "The Geometric Universe", Oxford (1998)

"Under Hodge I was steered toward differential geometry and topology. From Hodge's book I learnt about harmonic forms and their origin in Maxwell's equations, while from the ... French school(... Cartan...) I learnt about sheaf cohomology ... years later I became acquainted with spin and the Dirac operator... Roger's work centered on ... classical algebraic geometry... the theory of invariants ... diagrammatic ideas have come to the fore ... in the frontier between topology and physics (e.g. knots and Chern-Simons...) ... the Klein representation of lines in 3-space by points of a quadric in 5-space ... He was using complex contour integrals to represent solutions of ... differential equations. Roger ... pointed out that, as with the usual residue calculus, the precise integrands were not the thing. The singularities really determined the story... the twistor programme ... Its first success ... in which the sheaf cohomology groups ... corresponded precisely to the solutions of zero rest mass field equations... this as a complexification of the Radon transform ... resurrected for application to tomography... but the Penrose version is both richer and more beautiful ... The second success ... solve the self-dual Yang-Mills equations ... instantons ... Donaldson's remarkable work on 4-manifolds ... Finally, the twistor programme led to a deep understanding of the self-dual Einstein equations in which the Riemannian geometry gets encoded entirely into the holomorphic geometry of a complex 3-manifold."-- M. Atiyah

SU(3) strong force as G*eometry in hyperspace?

"In higher dimensions hyper-Kahler manifolds are the natural generalization of self-dual Einstein manifolds and the twistor theory applies Hyper-Kahler geometry arises naturally in super-symmetric field theories ... integrable systems of differential equations, and their soliton solutions ... inverse scattering method and ... Riemann surface theory ... how to produce a ... 'quantum gravity' There are several rival

“Theorem 12 Canonical quantization of the gravitational field is incompatible with topology change.” P. 68, Visser.

For example, as a corollary, the topology of the 3-dim space-like surfaces cannot change in their time evolution if you have chronology protection forbidding teleological purposeful future causes of past effects in globally self-consistent Novikov loops of time travel to the past in a Hausdorff topology without branching universes.

There is also the Feynman path functional integral quantization of classical field theory. This is an integral over all possible geometrodynamical field configurations. Do we include configurations of different topological classes? Hawking must “Wick rotate” from hyperbolic Lorentzian topological signature with light cones to elliptical Euclidean Riemannian signature without light cones. In the flat space-time special relativity quantum field perturbation theory this is no problem. In curved space-time it is a big problem. The imprint of hyperbolic causal light cone structure is in the OS positivity elliptical structure.⁴³ This is lost starting in curved space-time along with the $\pm i\epsilon$ pole shifts of the Feynman quantum perturbation theory propagator contour⁴⁴ in the complex

philosophies ... The orthodox one is string theory and associated quantum field theory, and here the prophet is Edward Witten. We then have the twistor approach led by Roger Penrose. There is also a newer approach based on non-commutative geometry pioneered by Alan Connes A synthesis ... integrable systems, solitons, duality, holomorphic geometry and supersymmetry...” -- M Atiyah, Master of Trinity College, Cambridge, pp 3-7

“the celebrated Penrose transform (... 1976...)... construct, by deforming twistor space, the general self-dual solution of Einstein's equation, or ... *the nonlinear graviton*'. In general relativity, the space-time metric plays a dual role. On the one hand, it represents the gravitational potential and is thus a dynamical variable. On the other hand, it determines space-time geometry. Field theoretic approaches to quantum gravity – including the current formulation of string theory – split this role. Typically, one introduces a flat, kinematic metric and regards the difference between the physical metric and this flat background as a perturbation which is then subjected to quantization... Roger ... emphasized that the dual role of the metric should be taken seriously and not compromised just because the standard machinery of quantum field theory is inapplicable if we do not have a background space-time at our disposal ... on the non-linear graviton, Roger illustrated why ... non-perturbative effects should be important. In the perturbative treatment, one begins with Minkowski space and describes the gravitational interaction through spin-2 quanta ... the ‘linear gravitons’ ... what are the atoms of geometry? ... Is there a discrete underlying structure? “ A. Ashtekar, Ch 11

⁴³ p. 69, Visser

⁴⁴ Boundary condition in which retarded quantum bit waves propagate to future with positive energy and advanced quantum bit waves propagate to past with negative energies and opposite charges. This propagation is in configuration space for entangled particles. If there is ODLRO the configuration space collapses to lower dimensions with

energy plane cleanly separating positive from negative frequency field modes. This is needed for conventional quantization of classical fields in flat space-time. It cannot be done in curved space-time. The ambiguity is great "one is led to at least ten different candidate models for what it means to quantize gravity via functional integrals."

Quantum tunneling is a dynamical process and does not assist topology change, which is a kinematical process independent of the Einstein field equation. What matters for topology change in the geometrodynamical field is time travel to the past.⁴⁵ Violation of Hawking's chronology protection conjecture forbidding time travel to the past and topology change in space allowing spatially extended elementary particles as quantum G*eons in knot configurations⁴⁶, with wormhole handles⁴⁷, are linked together. You can't have one without the other. Topology change and time travel to the past go hand in hand like love and marriage and a horse and carriage.⁴⁸ Topology change is essentially a choice of physical model at the classical not the quantum level. It is in the Bohm hidden variable or "system point" not in the pilot qubit wave or "landscape".

The issue of horizons.

Horizons are classical one-way membranes permitting light-like and time-like world lines for real and virtual quanta to enter but not to leave. This property may be relevant to the "arrow of time" enigma and black hole thermodynamics since one cannot formally time reverse the motion of a world line through a one-way membrane and return to the initial point.⁴⁹ There is no restriction on space-like world lines for real and virtual quanta. Real quanta of ordinary matter lie on light-like and time-like matter. This may not be so for "exotic" matter needed to keep Star Gates open and stable. Only virtual quanta of ordinary matter can follow space-like world lines outside the classical light cone. All of this is limited to the point test particle approximation with infinite self-energy and needs to be reconsidered in hyperspace string theory with finite self-energy. Horizons also stop time. That is, the observer outside the horizon sees an infinite gravitational redshift going completely dark in far field radiation signals emitted by the test particle that locally

macroscopic occupation in bosonic degrees of freedom for fully symmetric nonclassical permutation symmetry.

⁴⁵ "Topology change in classical general relativity is not merely an energetically forbidden process" perhaps circumvented by the negative energy Bohm quantum potential causing tunneling, but is "rather (assuming suitable causality ... and an everywhere Lorentzian metric) ... a kinematically forbidden process. Dynamical information (such as the Einstein field equation) is not needed to arrive at this conclusion,": p. 71 Visser.

⁴⁶ "Gauge Fields, Knots and Gravity", Baez & Munian, World (1994)

⁴⁷ Internal SU(2) weak and SU(3) strong quantum numbers as topological in origin for these spatially extended structures that look point like in high energy scattering from radial shrinking of meter sticks in the strong Salam G* field at short distances.

⁴⁸ Alluding to a song.

⁴⁹ As one can do, for example in Newtonian classical mechanics and in Maxwell classical EM field theory.

passes through the horizon. The local observer, if on a free float weightless geodesic⁵⁰ into a black hole with rocket engines off need not feel anything strange in the way of tidal forces if a large enough collapsed mass is behind the horizon. Not so for a hovering observer not on a geodesic with rocket engines blasting radially inward into the black hole preventing free float. This nongeodesic hovering observer feels weight and would feel an infinite life destroying tidal force if attempting to hover too close outside the horizon still far from the classical singularity inside it.⁵¹

There are different kinds of horizons

- Event or absolute⁵²
- Apparent
- Cauchy
- Particle
- Putative

Light-like and time-like things trapped behind event or absolute horizons are classically trapped for all eternity and can never escape. Most will be crushed out of existence in a singularity where their world lines simply end. Absolute horizons can only be defined in

⁵⁰ “geodesic” is a “straight line” in a curved space. For example, lines of longitude through North and South poles on a 2-dim sphere of positive elliptical curvature. There are no parallel geodesics through point parallel to a given geodesic in a space region of positive elliptical curvature. There is one and only one for a flat Euclidean space, and there are an infinite number for a space region of negative hyperbolic curvature such as is generated by a rotating disk via the Einstein equivalence principle. The radially oriented meter sticks contract in a spherically symmetric space region of positive elliptical curvature, the tangentially oriented meter sticks do not contract. It is the opposite for a spherically symmetric space region of negative hyperbolic curvature. Note that time-like and light-like geodesics in hyperbolic Lorentzian space-time of signature -+++ (or ---+) are extremally maximal not minimal in the sense of the calculus of variations. This corresponds to the nongeodesic twin being younger than his geodesic brother. Time moves more quickly between two common points of coincidence for the geodesic twin than for the nongeodesic one. They are never more than infinitesimally separated from each other in this construction that is more generally the “classical action principle”. The geodesic is the shortest extremum in the Riemannian elliptical case of signature ++++.

⁵¹ “If your capsule spirals in much farther, your body will give way; you will be torn apart! There is no hope of reaching the horizon’s vicinity.” PP.34-35 “Black Holes & Time Warps”, Kip Thorne, Norton, (1994).

⁵² The free float timelike geodesic observer-participator goes through the event horizon in a short proper time without feeling any g-force weight or tidal force stretching his head from his feet like on the Medieval Torture Rack. In contrast, the hovering spiraling non-geodesic observer with rockets firing, in slowly spiraling in circular orbit, will feel both g forces and tidal forces and cannot even get to the horizon without being ripped apart as Kip Thorne showed p. 35 “There is no hope of reaching the horizon’s vicinity.” The observer far from the event horizon never sees any object get really near it because of the infinite gravity redshift at the horizon “stopping time”.

asymptotically flat space-time geometries. Apparent horizons can be defined locally in terms of trapped surfaces. Cauchy horizons show a breakdown of determinism. The initial data algorithm breaks down on a Cauchy horizon. Given a space-like surface S with initial data for a partial differential equation, e.g., particle positions and velocities, or field configurations and their time rates of changes. Forget the Heisenberg quantum uncertainty principle, which also destroys the initial data algorithm for a different reason. One is able to compute a unique solution into the future for a finite 4-dim region $D(S)$ containing the space-like surface S . $D(S)$ is the domain of dependence. The boundary $B(D(S))$ of this 4-dim domain of dependence $D(S)$ is the Cauchy horizon $C(S)$ of S . That is,

$$C(S) = B(D(S)) \quad (1.10)$$

The particle horizon is observer-dependent. It means an observer either never gets to see or be influenced by any light-like and time-like signals from some regions of 4-dim space-time.

The ADM 3 + 1 split⁵³ or slicing or foliation of 4-dim space-time into 3-dim space-like surfaces goes as follows.

$$g_{\mu\nu}(t, \vec{x}) \equiv \begin{array}{cc} -(N^2 - g^{ij} \beta_i \beta_j) & \beta_j \\ \beta_i & g_{ij} \end{array} \quad (1.11)$$

Greek indices range 0,1,2,3. Latin indices range 1,2,3. 0 is "time coordinate axis" for a given local frame of reference in a coordinate patch in differential geometry. $N(t, \vec{x})$ is the "lapse function" and the 3-vector $\vec{\beta}(t, \vec{x})$ is the "shift function".

⁵³ 2.3.1 p.15 Visser

Why Puthoff's theory cannot work.⁵⁴

Note that Hal Puthoff's PV model⁵⁵ in <http://stardrive.org/Jack/puthoff1.pdf> is a very limited form of this. Puthoff requires isotropic coordinates

$$\frac{c^2}{K} = N^2 \tag{1.12}$$

$$\vec{\beta} = 0 \tag{1.13}$$

$$g_{ij} = \begin{matrix} & 0 & 0 \\ 0 & K & 0 \\ 0 & 0 & K \end{matrix} \tag{1.14}$$

This is clearly much too limited to explain all of the physics in Einstein's geometrodynamics such as electrically neutral "gravimagnetic" frame-drag from rotating masses that is amplified at small distances by Salam G* gravity. There are other things wrong with Puthoff's PV theory. Isotropic coordinates miss the coordinate patches containing the singularity. That's why Hal gets a *false* "graying" of the black hole by using an incomplete atlas, i.e. wrong differential geometry. He has not covered the whole manifold. Furthermore, Hal says that the quantum vacuum locally changes by a factor K such that the local speed of light in vacuum *in the free float LIF* is shifted from c to c/K. He also requires that Newton's constant G stays fixed under this distortion. Hal then says that the region K < 1 is "exotic" and is what we want for metric engineering. This means that the geometrodynamics coupling coefficient G/c⁴ between space-time geometry G_{μν} and stress-energy density T_{μν} in Einstein's 1915 field equation

$$G_{\mu\nu} = \left(\frac{G}{c^4}\right) T_{\mu\nu} \tag{1.15}$$

is K⁴G/c⁴ which is smaller than G/c⁴. We do not want that because it means a much weaker bending of space-time geometry G_{μν} for the same stress-energy density level T_{μν}. We obviously want just the opposite. That is, we want more bending or warping of space-time for the same power load on our warp drive generators onboard the unconventional flying object making a self-generated time-like geodesic with small tidal forces beyond

⁵⁴ New developments added Aug 6, 2001. Hal claims he is not doing a scaling transformation. In that case he should eliminate Tables I and II altogether. Hal also claims to be using the Yilmaz local stress-energy tensor tuv of the free gravity field in addition to Tuv(matter). Wheeler and Misner, however, argue that tuv = 0 because the equivalence principle demands that gravity stress-energy is nonlocal. Why? Because gravity is eliminated locally in the LIF and a tensor zero in the LIF must be zero in any LNIF such as one at rest relative to the source mass.

⁵⁵ Motivated by an intuitive remark of A. Sakharov who was Stalin's "Teller and Wheeler" developing nuclear weapons for the Soviet Union. Sakharov became a dissident toward the end.

the “test particle approximation”. However there is an even more serious problem with Hal’s K-transformation rules in that they violate “covariance” or “form invariance” of Einstein’s field equation (1.15). That is, the two sides of (1.15) do not have the same power of K on each side using Hal’s inconsistent rules. $G_{\mu\nu}$ transforms as $(\text{length})^{-2}$. $T_{\mu\nu}$ transforms as $(\text{energy})(\text{length})^{-3}$. Therefore, according to Hal’s rules

$$G_{\mu\nu} \rightarrow G_{\mu\nu}' = KG_{\mu\nu} \quad (1.16)$$

$$T_{\mu\nu} \rightarrow T_{\mu\nu}' = K^{-1/2}K^{3/2}T_{\mu\nu} = KT_{\mu\nu} \quad (1.17)$$

However, by Hal’s rules

$$KG_{\mu\nu} = K^4 \left(\frac{G}{c^4} \right) KT_{\mu\nu} = K^5 \left(\frac{G}{c^4} \right) T_{\mu\nu} \quad (1.18)$$

$$G_{\mu\nu} = K^4 \left(\frac{G}{c^4} \right) T_{\mu\nu} \quad (1.19)$$

Therefore, Hal’s rules are manifestly not covariant in violation of a basic meta-principle in the general theory of relativity. Indeed, I suspect that his K-transform may be a special case of a holonomic⁵⁶ general coordinate transformation, though I have not confirmed that as yet. In contrast, a consistent dimensional analysis does give

$$G \rightarrow G' = GK^{-4} \quad (1.20)$$

So that Einstein’s field equation is covariant when the correct rule is applied. However, now the geometrodynamics coupling is K-invariant so that changing K will not have any effect in metric engineering. These considerations lead me to reject the PV model, *as currently formulated*, as a viable theory of metric engineering of Star Gates and propellantless propulsion. Therefore, Eric Davis’s MUFON paper of July 2001 on this topic is incorrect at the end for suggesting that the Puthoff PV theory is a viable explanation for the UFO facts.

⁵⁶ “Holonomic” means “integrable”, path independent, state function like the potential of a conservative force field in Newtonian mechanics, the ability to have coordinate surfaces in a local chart in differential geometry. The set of overlapping charts forms an open set topology covering the warped manifold even prior to connection and metric Klein Erlangen (1872) group layers of geometric structure like the layers of an onion or artichoke. Einstein assumed it implicitly in 1915 not realizing the mathematical generalization to the anholonomic path dependent situation. Hagen Kleinert’s work in the Free University of Berlin explains this distinction in detail. It is not the same as the path dependence associated with local curvature in parallel transporting a vector around an infinitesimal closed loop in space-time.

What is basically wrong, in the long run, with the whole Haisch-Rueda-Puthoff “steam-roller” programme for the origin of inertia and gravity from stochastic zero point semi-classical electromagnetism⁵⁷ is their *essential* reliance on flat space-time and perturbation theory. This is not to say that one may not glean some useful insights in what they are doing. Roger Penrose spelled out the point I am trying to make here when he wrote:

“... if we remove life from Einstein’s beautiful theory by steam-rolling it first to flatness and linearity, then we shall learn nothing from attempting to wave the magic wand of quantum theory over the resulting corpse. ... If one such ‘graviton is added to the to the vacuum (Minkowski space) state the space remains flat. The null cones do not shift. If a second such ‘graviton’ is added, and a third and a fourth, the state still remains flat, with null cones still locked to their original Minkowski position. With such a perturbative viewpoint, it is only after an infinite number of gravitons have been added that the space can become curved. The situation can be compared to a power series expansion. For example, with any finite number of terms, the function

$$\frac{1}{z} + \frac{1}{z^2} + \dots + \frac{1}{z^n}$$

has a pole stuck at $z = 0$. But the sum to infinity

$$\frac{1}{z} + \frac{1}{z^2} + \dots + \frac{1}{z^n} + \dots$$

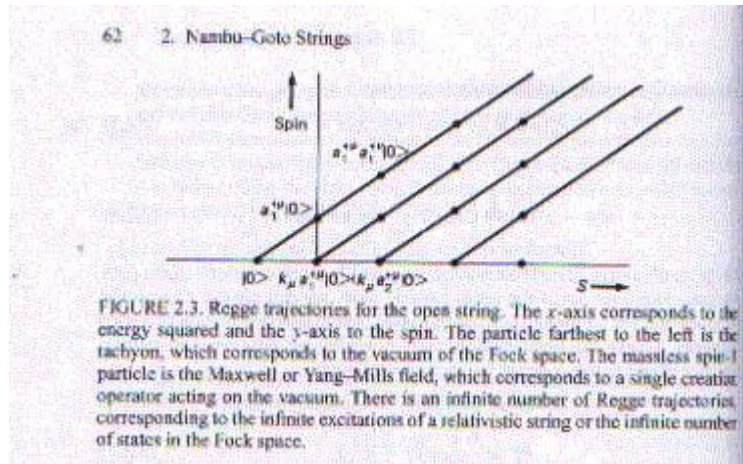
has its pole shifted to $z = 1$.”⁵⁸

⁵⁷ In the sense of Trevor Marshall’s idea.

⁵⁸ This applies to Feynman’s “Lectures on Gravitation” as well – too limited. See also Ashtekar’s remarks in footnote 36. As emphasized by P.W. Anderson, we find the same kind of mathematical situation in the theory of superconductivity which cannot be derived from the normal metal by perturbation theory. Spontaneous broken continuous symmetry in the vacuum, ODLRO, Higgs, et-al is always essentially non-perturbative. The shift in the pole from $z = 0$ to $z = 1$ in Penrose’s example, is exactly a toy model for ODLRO at some level of the hierarchy of reduced quantum density matrices for the thought-like landscape of a complex many-particle system. The shift in the pole away from zero is the long range phase coherent complex order parameter i.e. the giant “macroscopic” quantum wave function leading, for example, to the Josephson effects. This was a background topic of my Ph.D. dissertation parts of which were published with Cummings and Herald in “Physica” and, later developments, by H. Frohlich in “Collective Phenomena”. These same ideas apply to coherent mental post-quantum states in the material human and extra-terrestrial alien brain including the solid state brains of “Spectra” class “conscious robots” that are allegedly integrated into the nano-structure of the fuselages of the metallic flying saucers through the Star Gate Time Machines that pop into and out of our air space apparently rendering our air defense impotent and obsolete if reports from CAUS, COMETA, NIDS et-al are to be believed.

Strings and G*eons

Regge Trajectories⁵⁹ form the key experimental “open string” data of modern superstring M-theory.



Regge Trajectories of Hadronic Resonances

From Kaku's "Introduction to Superstrings and M-theory", p. 62 (1999 2nd ed)

I qualitatively explained this data⁶⁰ back in 1973 as rotating G*eons using Abdus Salam's "f-gravity". Salam⁶¹ read my paper on this in H. Frohlich's "Collective Phenomena" and invited me to his Institute in Trieste, Italy (1973-74) to continue working on the idea. Essentially from the Kerr metric in G* gravity, for an extreme black hole on the edge of a

⁵⁹ The classical action is important for the Feynman path integral quantization of field theory. The classical action for a point particle, with necessarily infinite self-energy of gravitation and electromagnetism, if charged, is proportional to the invariant proper time of the world line connecting an initial and a final event in space-time. For a set of *entangled* point particles we have to move to *configuration space* in the absence of ODLRO, which lowers the effective dimension of the configuration space sub-sector via macroscopic occupation of lower level quantum states or "Bose-Einstein condensation". Ordinary space is too small to negotiate quantum nonlocality. The classical action for a string is the area swept out by the string. There is only one constant the string tension T of eq. (1.1), or more generally T^* when $G^* \gg G$. All the interactions are determined topologically. This is very unlike point particle field theory. A single topological diagram in string theory is an infinite sum of Feynman diagrams of point particles on world lines. In this sense string theory is already at least intrinsically partially "nonperturbative" though not the way Ashtekar means it apparently.

⁶⁰ Note this symbolic representation has the parallel lines equally spaced in their intercepts of the E^2 horizontal axis. From Bekenstein we know that E^2 is a measure of black hole entropy and Shannon information with 1 c-bit per Planck area. The equal spacing then suggests a 1 c-bit increment between adjacent lines. Also note the leading vacuum Pomeron trajectory at the far left which is a tachyon at spin $J = 0$.

⁶¹ Nobel Prize with Weinberg on electro-weak unification, with Higgs mechanism for origin of mass, in the standard model based on the parity-violating neutral weak current they predicted then observed at CERN.

naked singularity with zero surface gravity at the outer horizon of the ergosphere, consequently zero Hawking temperature and zero Hawking radiative evaporation

$$\alpha^* = \frac{J\hbar}{mc} = \frac{G^* m}{c^2} = M^* \quad (1.21)$$

The universality of the Regge slope⁶² is then seen to be a consequence of Einstein's equivalence principle in which gravity is explained by locally eliminating it in a free float "LIF" with time-like geodesic coordinates.⁶³ J is quantized at integer and half-integers.

As I recall

$$\Delta J = 2 \quad (1.22)$$

$$J = \frac{G^* m^2}{\hbar c} = \frac{G^* E^2}{\hbar c^5} = \alpha' E^2 \sim \left(\frac{E}{1\text{Gev}} \right)^2 \quad (1.23)$$

my basic result in 1973. The actual plots may be of the form

$$\begin{aligned} J_{n,i} &= \alpha' (E_{n,i}^2 - nE_0^2) \\ n &= -1, 0, 1, 2, \dots \end{aligned} \quad (1.24)$$

Where $\alpha' E_0^2$ is 1 Bekenstein-Shannon c-bit corresponding, perhaps, to adding a Salam G^* Planck area to the vacuum G^* eon knot wormhole topological class for each Regge trajectory. See (1.48) below for a computation of E_0 .

In string theory⁶⁴

$$J \leq (2\pi\hbar c T)^{-1} E^2 + a_0 \quad (1.25)$$

The parameter a_0 is from *the zero point quantum fluctuation energy of the string* replacement of the point particle. This string is 1-dimensional compared to the point particle approximation which is zero-dimensional. Note that $a_0 = +1$ for an open string. Gauge force bosons of spin 1 are open strings. Also $a_0 = +2$ for closed strings which are the "linear gravitons" of spin 2. So all of this is perturbation theory deviating only a small amount from flat Minkowski space-time. In this sense, perturbative string theory is no better than the Haisch-Rueda-Puthoff models.

⁶² i.e., the parallel lines in the Regge plot above.

⁶³ "A Journey into Gravity and Space-time", John A. Wheeler, Sci. Am. Press, 1990

⁶⁴ G. Veneziano, Ch 15 "The Geometric Universe"

One nice thing about strings, however, is that there is no infinite self-energy.⁶⁵ Indeed, one gets the Planck length L_p of quantum gravity from the string. Go back to eq. (1.1). Therefore,

$$L_p^2 = \frac{G\hbar}{c^3} = \frac{\hbar c}{T} \quad (1.26)$$

The Planck area is of course worth 1 c-bit of Shannon-Bekenstein information or one quantum of entropy if there is a black hole absolute event horizon in the problem. This black hole entropy is negative for the *repulsive exotic* anti-G* root we recall. This connects to Kaluza-Klein hyperspace theory and dualities as we shall see in the next installment.

Kaluza-Klein Hyperspace Physics

In 1920's they suggested a fourth dimension of space (5-dim space-time) that was compactified into the topology of a flat Euclidean circle of radius R rather than a line. Therefore, any quantum wave is periodic in the extra space dimension like an electron in a perfect 1-dim crystal without defects.

$$x^5 \rightarrow x^5 + L_p \alpha(x^\mu) \quad (1.27)$$

This induces a *local gauge* or *quantum phase* transformation in the thought-like quantum pilot wave *compactified momentum* eigen-fields of an isolated point particle (pre-string theory)

$$\tilde{\psi}_{p_5}(x^\mu) \rightarrow \tilde{\psi}_{p_5}(x^\mu)' = e^{iL_p \alpha(x)} \tilde{\psi}_{p_5}(x^\mu) \quad (1.28)$$

Where the total thought-like pilot wave qubit field is

$$\psi(x^A) = \sum_{p_5} e^{ip_5 x^5} \tilde{\psi}_{p_5}(x^\mu) \quad (1.29)$$

$$x^A = (x^\mu, x^5) \quad (1.30)$$

⁶⁵ This is the key to *propellantless propulsion* beyond the test particle approximation of general relativity. We need to generate controllable directed time-like geodesics for the center of mass of the unconventional flying object. This is in apparent violation of the notion that internal forces cannot accelerate the center of mass. However, this is only "an apparent inconsistency in a perfectly correct argument" one we take the universe's unseen dimensions of hyperspace into account. There is more between Heaven and Earth than is dreamt of in Flatland philosophy from the Isle of Laputa. ☺

Therefore, the effective charge infinitesimally generating this *local internal symmetry* gauge transformation is quantized from the periodic compactification of the extra space dimension in hyperspace to

$$q_n^* = \frac{\sqrt{G^*} e_n}{c^2 L_p^*} = \frac{L_p^* p_5}{\hbar} = n \frac{L_p^*}{R} \quad (1.31)$$

When $n = 1$, for the charge e of the electron, and the renormalized mass m^*

$$\frac{\sqrt{G^*} e}{c^2 L_p^*} = \frac{L_p^*}{R} \quad (1.32)$$

$$e = \frac{L_p^{*2} c^2}{R} = \frac{\sqrt{G^*} \hbar}{cR} = \sqrt{G^*} m^* \quad (1.33)$$

This is the form of the empirical Blackett-Sirag relation where

$$m^* = \frac{\hbar}{cR} \quad (1.34)$$

Note that I have gone directly to Salam G^* eometrodynamics.

$$\alpha = \frac{e^2}{\hbar c} = \frac{G^* m^{*2}}{\hbar c} = \frac{G^* \hbar}{c^3 R^2} = \left(\frac{L_p^*}{R} \right)^2 \sim \frac{1}{137} \quad (1.35)$$

$$\frac{L_p^*}{R} = \sqrt{\alpha} \approx 0.0854 \quad (1.36)$$

For the electron we have $R \sim 10^{-11}$ cm. The Compton length is essentially the size of the compactification of the extra space dimension. It's Salam G^* field's Planck length or string length is $\sim 8.5\%$ smaller. There is no reason to assume that the scale R of the extra Kaluza-Klein⁶⁶ space-dimensions of hyperspace do not form effective local inhomogeneous scalar fields in ordinary space where the elementary particles are simply G^* eon nonlinear non-perturbative "solitons" with mutable kinky knotted extended space-

⁶⁶ "the KK idea was widely generalized, e.g. to generate larger (non-Abelian) gauge groups from even higher dimensional spaces endowed with suitable isometries KK theory leads to a unified *classical* theory but is based, in an essential way, on quantum mechanics: the quantization of momentum gives the quantization of electric charge! When we go from the semiclassical approximation to ... quantum field theory ... the problem of ultraviolet infinities" [i.e., infinite self-energy of the point particle]" immediately shows up. How do we handle that?" That's where string theory saves the day. Quote from G. Veneziano, Ch. 15, "The Geometric Universe".

like topologies of the physical vacuum that are the rock-like Bohm points or not so hidden variables. The picture is simple and direct once we dispense with all the Bohrian⁶⁷ mysticism clouding the minds of the best physicists for the past 75 years. Furthermore,

$$g_{\mu 5} \approx A_\mu \quad (1.37)$$

That is, the mixed metric tensor components between ordinary space-time and the extra hyperspace dimension, in this simplest toy model, is Maxwell's electromagnetic 4-potential. That is, hyperspace geometrodynamics based on the generalized Einstein principle of equivalence of explaining *all forces* by locally eliminating them in hyperspace takes the rug out from under the Sakharov inspired Haisch-Rueda-Puthoff program to try to derive geometrodynamics from 4-dim flat space-time stochastic electro-dynamics. This precisely the wrong way to go, the opposite is the case.

The $U(1)_{em}SU(2)_{weak}SU(3)_{strong}$ internal gauge symmetry standard model of fundamental sub-nuclear forces as exchange of virtual off-mass shell spin 1 bosons and sources as lepto-quark spin $\frac{1}{2}$ fermions, the latter as point particles of infinite self-energy from the ultraviolet catastrophe, is renormalizable⁶⁸ in Feynman diagram perturbation theory against a flat space-time. Gravity is not perturbatively renormalizable in this same way. When we go to hyperspace, not even the gauge fields are renormalizable in this point particle approximation.

The key equation is (1.1) above connecting G*-strings to G*eons. The key parameter is then

$$r = R / L_p^* \approx g_{55} \quad (1.38)$$

L_p^* is also called λ_s in the standard literature. Note that r is a scalar field in ordinary 4-dim space-time. Identifying r with g_{55} is in the simplest case of the original toy KK model. We see from eq. (1.36) that in those knotted soliton regions of the physical vacuum 3-geometry corresponding to electrons, muons, tauons that

$$r \rightarrow \frac{1}{\sqrt{\alpha}} \approx \sqrt{137} \approx 11.7 \quad (1.39)$$

in the source region of the knotted G*-string/G*eon. For quarks there will be factors of 1/3 and 2/3. Note also that $1/r \sim$ far field metric zero point quantum gravity vacuum fluctuation in the source region from eq. (1.4)

⁶⁷ "Quantum Dialogue", Mara Beller

⁶⁸ According to Feynman, who got a Nobel Prize for it with Schwinger and Tomonaga, "renormalization is a scandalous shell game" (private conversation 1968) for which he was reluctant to accept the prize. It allows physicists to sweep the infinities under the rug, though in QED it gives incredibly accurate numerical agreement with experiments. Feynman, however, always felt like Faust making a pact with Mephistopheles about it.

The “T-duality” of superstring “M-theory” is that physics is invariant on the hyperbola

$$r \rightarrow r' = \frac{1}{r} \quad (1.40)$$

for the “moduli space” of superstring compactifications that is the interval $r = [0,1]$ or, equivalently

$$r' = [\infty, 1] \quad (1.41)$$

In superstring T-duality “the roles of momentum and winding get interchanged. The energy connected to a winding⁶⁹ is an integer multiple of R even classically, since the winding of a (closed) string around a circle is a topological concept, while the momentum on a circle is an integer multiple of h/R only in the quantum theory.⁷⁰ ... gauge and gravity couplings get unified at the scale h/R .” – Veneziano, “The Geometric Universe”

Therefore, if $R \rightarrow L_p^*$, so that $r = 1$, the dimensionless grand unified coupling strength of gravity with the electro-weak-strong interactions is

$$\alpha_{GUT} = \left(\frac{L_p}{L_p^*} \right)^2 \quad (1.42)$$

Where $L_p = 1.616 \times 10^{-33} \text{ cm}$ is the Newtonian quantum gravity Planck scale.

S-duality of M-theory is from ODLRO spontaneous broken continuous conformal symmetry of the quantum geometrodynamics vacuum whose quantum is the “dilaton” and whose *real* “macroscopic long range order parameter *field*, or vacuum expectation value (AKA “VEV”), is

$$\langle \phi \rangle = \langle 0 | \hat{\phi} | 0 \rangle \quad (1.43)$$

$$\alpha_{GUT} = \left(\frac{L_p}{L_p^*} \right)^2 = \exp[-\langle \phi \rangle] = \frac{G}{G^*} \quad (1.44)$$

Note that α_{GUT} is a local scalar field in 4-dim space-time here not a constant. There is no long-range coherent complex phase, as in a “superfluid”, until we add its supersymmetric

⁶⁹ Of the string around the circle of radius R of the extra unseen Kaluza-Klein dimension.

⁷⁰ Louis de Broglie’s discovery from Planck’s law $E = hf$ applied to Einstein’s special relativity.

pseudoscalar partner, the “axion” to the scalar “dilaton”. The VEV $\langle \phi \rangle$ appears in classical action of the string multiplying the Euler characteristic counting the wormhole handles of the multi-sheeted Riemann surface swept out by the string.⁷¹ This also heuristically suggests to me, as a half-baked idea, the non-Hausdorff topology for 4-dim space-time. The quantum phase coherent dilaton + axion complex order parameter symmetry group is $SL(2, Z)$ with the S-duality invariance connecting perturbative weak coupling theory to non-perturbative strong coupling theory

$$\alpha \rightarrow \alpha' = \frac{1}{\alpha} \quad (1.45)$$

$$\alpha \equiv \left(\frac{L_p}{L_p^*} \right)^2 \quad (1.46)$$

The Regge-Wesson and Blackett-Sirag Effects

We have seen that the Blackett-Sirag relation drops out of hyperspace naturally. The extreme Kerr-Newman vacuum solution for a rotating electrically charged nonradiating black hole G^* eon with zero surface gravity at the outer horizon obeys the Pythagorean theorem⁷² for a right triangle of Euclid's geometry

$$\left(\frac{G^* m}{c^2} \right)^2 = \left(\frac{J \hbar}{mc} \right)^2 + G^* \left(\frac{e}{c^2} \right)^2 \quad (1.47)$$

The limit $J = 0$ gives the Blackett-Sirag equation⁷³ that rotating astronomical bodies seem to have a gravitationally induced effective net circulating electric charge

$$G^* m^2 = e^2 \quad (1.48)$$

The opposite limit $e = 0$ gives our simple Regge type relation. Paul Wesson has shown that rotating astronomical objects seem to obey it as well. Down to micro scale for the electron as a G^* eon. Take

$$e^2 = \frac{\hbar c}{137} \quad (1.49)$$

Substitute (1.49) into (1.47)

⁷¹ Ed Witten (1984) cited by Veneziano.

⁷² “About binomial theorem I am teeming with a lot o' news. With many cheerful facts about the square of the hypotenuse.” Major General Stanley, “Pirates of Penzance”, G&S

⁷³ Note that Haisch and Rueda say that you need charge e to get mass m . Problem is neutrino mass m since $e = 0$ for neutrino. But neutrino has self-energy vacuum polarization where it spends part of its Feynman history as several charged particles.

$$\left(\frac{G^* m}{c^2}\right)^2 = \left(\frac{J\hbar}{mc}\right)^2 + \left(\frac{G^*}{c^4}\right)\left(\frac{\hbar c}{137}\right) \quad (1.50)$$

$$(G^* m)^2 = \left(\frac{J\hbar c}{m}\right)^2 + G^* \left(\frac{\hbar c}{137}\right) \quad (1.51)$$

$$G^{*2} = \left(\frac{J\hbar c}{m^2}\right)^2 + G^* \left(\frac{\hbar c}{137m^2}\right) \quad (1.52)$$

$$G^{*2} - G^* \left(\frac{\hbar c}{137m^2}\right) - \left(\frac{J\hbar c}{m^2}\right)^2 = 0 \quad (1.53)$$

$$2G^*_{\pm} = \left(\frac{\hbar c}{137m^2}\right)_{\pm} \sqrt{\left[\left(\frac{\hbar c}{137m^2}\right)^2 + 4\left(\frac{J\hbar c}{m^2}\right)^2\right]} \quad (1.54)$$

Take $J = 1/2$ for the electron. Therefore,

$$2G^*_{\pm} = \left(\frac{\hbar c}{137m^2}\right)_{\pm} \sqrt{\left[\left(\frac{\hbar c}{137m^2}\right)^2 + \left(\frac{\hbar c}{m^2}\right)^2\right]} \quad (1.55)$$

$$2G^*_{\pm} = \left(\frac{\hbar c}{137m^2}\right)_{\pm} \left(\frac{\hbar c}{m^2}\right) \sqrt{\left[\left(\frac{1}{137}\right)^2 + 1\right]} \quad (1.56)$$

$$2G^*_{\pm} \approx \left(\frac{\hbar c}{137m^2}\right)_{\pm} \left(\frac{\hbar c}{m^2}\right) \left[1 + \frac{1}{2}\left(\frac{1}{137}\right)^2\right] \quad (1.57)$$

$$2G^*_{\pm} \approx \left(\frac{\hbar c}{137m^2}\right)_{\pm} \left(\frac{\hbar c}{m^2}\right) = \left(\frac{\hbar c}{m^2}\right) \left(\frac{1}{137} \pm 1\right) \quad (1.58)$$

So the negative root is *exotic* repulsive short-range *low energy* Salam anti-G*gravity needed to keep Lorentzian traversable Star Gate Time Travel Machines open and stable. The positive root is attractive. This is a *nonperturbative* hyperspace effect, from the unseen Kaluza-Klein extra space dimensions, without assuming the Haisch-Rueda-Puthoff flat background metric for spin 2 graviton propagators. Remember when Dirac got his negative energy solutions.

$$G^*_{\pm} \approx \pm \left(\frac{\hbar c}{2m^2}\right) \quad (1.59)$$

The corresponding Planck areas are

$$L_{p\pm}^{*2} = \pm \frac{\hbar G^*}{c^3} = \pm \left(\frac{\hbar}{2mc} \right)^2 \quad (1.60)$$

Exotic repulsive G*ravity has an imaginary Planck area and a negative entropy. That's interesting. Also we see that the effective Planck scale in hyperspace G*ravity is

$$|L_{p}^*| \approx \frac{1}{\sqrt{2}} \left(\frac{\hbar}{mc} \right) \quad (1.61)$$

More exactly

$$G^*_{+} \approx \left(\frac{1}{2} \right) \left(\frac{\hbar c}{m^2} \right) \left(\frac{138}{137} \right) \approx 0.50365 \left(\frac{\hbar c}{m^2} \right) \quad (1.62)$$

$$G^*_{-} \approx \left(\frac{1}{2} \right) \left(\frac{\hbar c}{m^2} \right) \left(\frac{1}{137} - 1 \right) \approx - \left(\frac{1}{2} \right) \left(\frac{\hbar c}{m^2} \right) \left(\frac{136}{137} \right) \approx -0.49635 \left(\frac{\hbar c}{m^2} \right) \quad (1.63)$$

$$2(G^*_{+} + G^*_{-}) \approx \left(\frac{1}{137} \right) \left(\frac{\hbar c}{m^2} \right) \approx \left(\frac{e^2}{\hbar c} \right) \left(\frac{\hbar c}{m^2} \right) = \frac{e^2}{m^2} \quad (1.64)$$

This is a generalized Blackett-Sirag type relation.⁷⁴ Go back to eq. (1.50)

$$G^{*2} = J^2 \left(\frac{\hbar c}{m^2} \right)^2 + \frac{G^*}{137} \left(\frac{\hbar c}{m^2} \right) \quad (1.65)$$

$$J^2 \left(\frac{\hbar c}{m^2} \right)^2 + \frac{G^*}{137} \left(\frac{\hbar c}{m^2} \right) - G^{*2} = 0 \quad (1.66)$$

$$\frac{\hbar c}{m_{\pm}^2} = \left(\frac{1}{2J^2} \right) \left[-\frac{G^*}{137} \pm \sqrt{\left(\frac{G^*}{137} \right)^2 + 4J^2 G^{*2}} \right] \quad (1.67)$$

That is mass doublets⁷⁵ for a given G* when $J \neq 0$. The case $J = 0$ is important for the Regge Plot abscissa intercepts.

⁷⁴ Sum of the eigen-roots is the invariant trace of the characteristic matrix of the polynomial. See also Galois group theory on limits to solvability of equations.

⁷⁵ With faster than light real tachyons in this toy model. Since topology change demands retarded causality violation in this radical rewrite of physics, that is OK.

$$0 = \alpha'(E_{n,i}^2 - nE_0^2) \quad (1.68)$$

$$n = -1, 0, 1, 2, \dots$$

$$G^{*2} = \frac{G^* \left(\frac{\hbar c^5}{E_0^2} \right)}{137} \quad (1.69)$$

$$E_0 = \sqrt{\frac{1}{137} \left(\frac{\hbar c^5}{G^*} \right)} = \sqrt{\frac{e^2}{\hbar c} \left(\frac{\hbar c^5}{G^*} \right)} = \sqrt{\left(\frac{e^2 c^4}{G^*} \right)} \quad (1.70)$$

Time Travel To The Past

Igor Novikov, a top Russian physicist, has a good pop book "The River of Time".⁷⁶
 Some sample excerpts from Ch 14 "Against the flow":

"it is possible to imagine that using specially designed machinery, a human being could get into a special 'tunnel' in which he moves backwards with respect to time in the external space, and emerges in the past when passing through the other mouth of this tunnel... the traveler through time does not get younger at all. However... he can find himself ... in the time of his youth or even in an epoch before he was born! ... This journey like diverting a small fraction of a powerful river, pumping this rivulet through a pipe along the bank in a direction opposite to the river flow, and then returning this water to the main flow far upstream ... the river of time. .. worlds with 'time loops' .. where one can sneak into one's own past? ... how such a 'tunnel' with two mouths can be converted into a Time Machine ... begin by creating huge gravitational fields ... to stabilize the tunnel by filling the tunnel with a matter resembling the vacuum-like state ... The antigravitation of this matter prevents the collapse of the tunnel ... the mouths that the wormhole connects .. can be pulled away from each other without changing the length of the 'wormhole' between them Mouths A and B seen from the outside look very much like black holes. The important difference is that it is possible both to enter and to emerge from them. Seen from the inside, they are connected by a tunnel and differ greatly from black holes ... the gravitational effect on living beings during passage ... will not be too great ... this device can serve as a Space Machine (not as yet a Time Machine) ... having entered mouth A ... and having passed through a short tunnel, emerges at mouth B among the faraway stars. The journey may not take much time at all. Reaching the stars will not require a very long and demanding flight through interstellar space ... redesign the system of mouths ... into a Time Machine ... Two identical clocks are placed in mouths A and B. Owing to the gravitational field near a mouth, both clocks are slowed down relative to clocks far from the mouths ... this slowdown is identical for both, in view of the symmetry ... Now we place ... at a neutron star ... mouth B at the surface while A runs farther out ... Now the clocks run differently: the B clock ... is slower than the A clock ... the relative slowdown is proportional to the distance between the clocks

⁷⁶ See Kaku's picture on p. 4 above of the Time Machine described by Novikov.

... look through the tunnel ... from clock A to clock B ... compare the readings ... We are looking through a short (several meters long) 'wormhole' that connects spatially very distant places. What do we see? ... the slowdown of clock B with respect to clock A is proportional to the distance between them. However, the distance separating them across the wormhole is negligibly small! The clocks thus sit practically side by side. Hence the slowdown of clock B relative to clock A from the standpoint of an observer .. in the wormhole is also infinitesimal. ... When we look at them from the outside, clock B ticks more slowly than clock A ... both are true ... if we look at the clocks through the wormhole (from either of its ends), we always find them showing identical time but if we are in outer space, clock B is always behind A. Now we tow the two mouths of the wormhole ... away from the neutron star... and 'park' them in an empty spot ... we can now move the mouths close to one another in outer space ... Now, far from the external gravitational field, the clocks are again running at the same rate, but the reading of clock B is behind that of clock A ... Let the observer at mouth B glance through the wormhole at clock A ... he observes the past of both clock A and of the surrounding worlds! The observer can walk through the passage and find himself in this past ... This is how this Time Machine works. ... this machine only allows the time traveler to visit the past in which the Time Machine has already existed."

Therefore, time travel to the past is only an apparent inconsistency in a perfectly correct argument from Einstein's theory of general relativity. The task of building a Time Machine becomes much easier than even Novikov realizes once we understand that T^* , the Salam G^* -string tension, is a local variable field in Einstein's field equation, and that the UFO phenomenon shows that advanced civilization is able to manipulate T^* to make practical Time Machines cheaply without too much energy density and at low electromagnetic frequencies. Exactly how they do it? I don't yet know. But knowing that they are doing it, is a big step forward in the right direction.

<http://www.ufoskeptic.org/>

<http://www.nidsci.org/>

<http://brumac.8k.com/>

Reliable info on UFOs.

Kip Thorne, in response to Carl Sagan (<http://stardrive.org/Jack/contact.pdf>), came up with the following *toy model* static⁷⁷ spherically symmetric traversable wormhole Star Gate geometrodynamics field solution⁷⁸ with two asymptotically flat space-time regions similar to the Einstein-Rosen bridge, but *without* the problem that you will die if you jump into an Einstein-Rosen bridge which has a deadly singularity behind its event

⁷⁷ "static metric" has global *Killing* time-like vector field that is orthogonal to foliation into spacelike 3-dim hypersurfaces with rock-like Bohm point ${}^3g = g_{ij}$ configurations in the ADM 3+1 split. A Killing vector field ξ in curved spacetime has vanishing *Lie derivative* of the metric tensor (i.e. isometry) $L_\xi g = 0$. This corresponds to $\xi_{(\mu;\nu)} = 0$ (Killing's equation) where ";" denotes the covariant derivative for the symmetric Levi-Civita connection field.

⁷⁸ I follow Matt Visser's 11.2 here.

horizon.⁷⁹ The Einstein-Rosen bridge is not a Star Gate. Beware the foolish Star Ship Captain who does not know the difference.

$$ds^2 = -e^{2\phi(t)} dt^2 + dt^2 + r(t)^2 [d\theta^2 + \sin^2 \theta d\varphi^2] \quad (1.71)$$

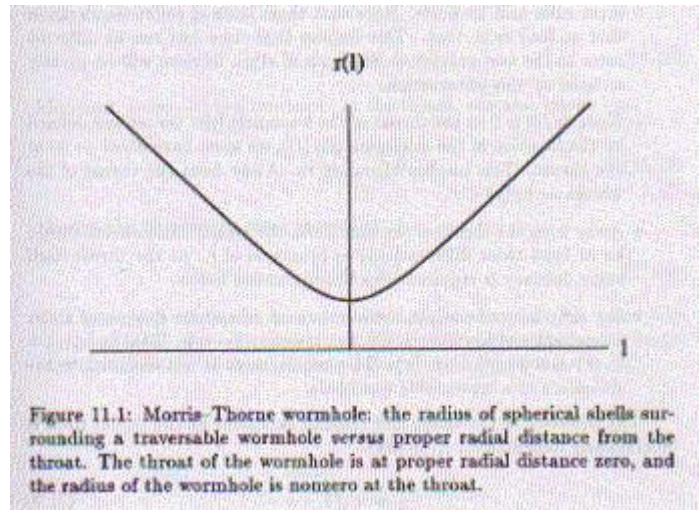
Where t is the *proper radial distance* and $-\infty < t < \infty$. A single coordinate patch works here. The condition for an absolute event horizon hiding a deadly singularity is⁸⁰

$$N^2 - g^{ij} \beta_i \beta_j = e^{2\phi(t)} = 0 \quad (1.72)$$

Therefore, eq. (1.72) cannot be true for eq. (1.71). Thorne's idea was to impose whatever nice geometry we want, then calculate the bending $G_{\mu\nu}$, plug it into Einstein's local field equation, and compute the required stress-energy density tensor field $T_{\mu\nu}$ needed to do the job for the given coupling strength coefficient G/c^4 . The radius of the spherically symmetric Star Gate mouth is

$$r_0 = \min\{r(t)\} \quad (1.73)$$

Where r is the Schwarzschild coordinate. Look at the picture below.



If you model the electron as a Salam G*eon traversable wormhole, the effective size of the particle⁸¹ goes as the square of the *proper* radial distance t not the Schwarzschild

⁷⁹ This also points up another error in Puthoff's PV theory which relies on "isotropic coordinates" that miss the coordinate patches containing the singularities, e.g. 5.1 of Visser.

⁸⁰ Look back at eq. (1.11) of the ADM 3+1 split. Here, of course, the shift function β_i vanishes, there is only the lapse function N .

radial coordinate r . Therefore, the electron looks like a point particle to the asymptotic observer when the scattering probe reaches the mouth where

$$r_0 = \frac{\hbar}{mc} \quad (1.74)$$

As a matter of computational simplicity transform from the radial proper coordinates to the Schwarzschild coordinates

$$ds^2 = -e^{2\phi_{\pm}(r)} dt^2 + \frac{dr^2}{1 - \frac{b_{\pm}(r)}{r}} + r^2 [d\theta^2 + \sin^2 \theta d\varphi^2] \quad (1.75)$$

Note the \pm subscripts on the Star Gate *redshift function* $\phi_{\pm}(r)$ and the Star Gate *shape function* $b_{\pm}(r)$. This denotes the two overlapping coordinate patch “charts” that make an “atlas” covering the total manifold. We originally covered the whole manifold with one patch using ι instead of r . Note that

$$\iota(r) = \pm \int_{r_0}^r \frac{dr'}{\sqrt{1 - \frac{b_{\pm}(r')}{r'}}} \quad (1.76)$$

The asymptotic mass at each mouth of the traversable wormhole need not be the same. This allows, for example, creation of an electron-proton pair violating all sorts of conservation laws. Electric charge is still conserved here. We have for the asymptotic shape functions beyond each mouth

$$\frac{2Gm_{\pm}}{c^2} \equiv b_{\pm} \equiv \lim_{r \rightarrow \infty} b_{\pm}(r) \quad (1.77)$$

$$b_{+} \neq b_{-} \quad (1.78)$$

For violation of matter-antimatter symmetry all we need is different space shape functions. Similarly for the asymptotic time redshift functions beyond each mouth, to get a time machine, all we need is

$$\phi_{+} \neq \phi_{-} \quad (1.79)$$

$$\phi_{\pm} = \lim_{r \rightarrow \infty} \phi_{\pm}(r) \quad (1.80)$$

⁸¹ As shown in the momentum transfer space dependent form factors giving *wide angle scattering* similar to the 1908 Geiger-Marsden experiment that showed that the nucleus was *small* compared to the whole atom.

“This implies that time can run at different rates in the two universes.”⁸²

Note, however, the shape function and its slope continuity conditions at the throat minimum

$$' \equiv \partial_r \quad (1.81)$$

$$r_0 = b_+(r_0) = b_-(r_0) \quad (1.82)$$

$$b'_+(r_0) = b'_-(r_0) \quad (1.83)$$

And key to understanding Novikov's above intuitive remark about time machines, i.e.

“When we look at them from the outside, clock B ticks more slowly than clock A ... both are true ... if we look at the clocks through the wormhole (from either of its ends), we always find them showing identical time”

is that the radial slopes of the redshift function at the mouth minimum r_0 match as well.⁸³

Thus,

$$\phi'_+(r_0) = \phi'_-(r_0) \quad (1.84)$$

The nonvanishing bending components of this static spherically symmetric Star Gate are⁸⁴

$$\begin{aligned} G_{\hat{t}\hat{t}} &= \frac{b'}{r^2} \\ G_{\hat{r}\hat{r}} &= -\frac{b}{r^3} + 2 \left\{ 1 - \frac{b}{r} \right\} \frac{\phi'}{r} \\ G_{\hat{\theta}\hat{\theta}} = G_{\hat{\phi}\hat{\phi}} &= \left\{ 1 - \frac{b}{r} \right\} \left[\phi'' + \phi' \left(\phi' + \frac{1}{r} \right) \right] - \frac{1}{2r^2} [b'r - b] \left(\phi' + \frac{1}{r} \right) \end{aligned} \quad (1.85)$$

Therefore, the throat minimum itself, using the above continuity conditions for the shape and redshift functions

⁸² P.104 Visser. More precisely, replace “universe” by “coordinate chart” or “patch”. The overlapping charts make the atlas that covers the whole manifold. Puthoff's theory seems to miss this idea?

⁸³ P.106, Visser.

⁸⁴ P.107 Visser (11.26)-(11.28)

$$\begin{aligned}
 G_{\hat{t}\hat{t}}|_{r_0} &= \frac{b'(r_0)}{r_0^2} \\
 G_{\hat{r}\hat{r}}|_{r_0} &= -\frac{1}{r_0^2} \\
 G_{\hat{\theta}\hat{\theta}}|_{r_0} &= G_{\hat{\phi}\hat{\phi}}|_{r_0} = \frac{1}{2r_0} [1 - b'(r_0)] \left(\phi'(r_0) + \frac{1}{r_0} \right)
 \end{aligned} \tag{1.86}$$

Note carefully that the dimensions of the bending components of the Einstein tensor $G_{\mu\nu}$ on the LHS of Einstein's classical Geometrodynamical local nonlinear partial differential field equation are $[\text{length}]^{-2}$. The nonvanishing stress-energy tensor components in this static spherically symmetric solution⁸⁵ are

$$T_{\hat{t}\hat{t}} = \rho c^2 \tag{1.87}$$

for the energy density.

$$T_{\hat{r}\hat{r}} = -\tau \tag{1.88}$$

for the radial pressure.⁸⁶

$$T_{\hat{\theta}\hat{\theta}} = T_{\hat{\phi}\hat{\phi}} = p \tag{1.89}$$

for the transverse pressure.⁸⁷ Einstein's field equation, we recall is⁸⁸

$$G_{\mu\nu} = \frac{G^*}{c^4} T_{\mu\nu} = \frac{1}{T^*} T_{\mu\nu} \tag{1.90}$$

⁸⁵ Note, the *traversable wormhole* solution, unlike the *exact* Schwarzschild and Kerr-Newman black hole solutions, is *not* a vacuum solution!

⁸⁶ I.e. *diagonal* radial component of internal stress force per unit area along normal unit vector in the radial direction.

⁸⁷ I.e. diagonal components of internal stress force per unit area along corresponding parallel normal unit vectors. There are no off-diagonal stress components in this static spherically symmetric toy model, which is not characteristic of thin flat panel Star Gates like in the Kaku pictures above at the beginning of this review article.

⁸⁸ I use the * operator to denote the Salam generalization, since we are only now interested in the throat or Star Gate "tunnel" passage way to Jacques Vallee's "Magnonia", Through The Looking Glass to The Universe Next Door.

Therefore, at the throat minimum

$$\begin{aligned}
 G_{\hat{t}\hat{t}}|_{r_0} &= \frac{b'(r_0)}{r_0^2} = \frac{G^*}{c^2} \rho \\
 G_{\hat{r}\hat{r}}|_{r_0} &= -\frac{1}{r_0^2} = -\frac{G^*}{c^4} \tau \\
 G_{\hat{\theta}\hat{\theta}}|_{r_0} &= G_{\hat{\phi}\hat{\phi}}|_{r_0} = \frac{1}{2r_0} [1 - b'(r_0)] \left(\phi'(r_0) + \frac{1}{r_0} \right) = \frac{G^*}{c^4} p
 \end{aligned} \tag{1.91}$$

Clearly, if $G^* \gg G$ we get more bending for the same stress-energy density. That is the name of this new ball game, which you will not find in any of the work funded by the NASA BPP project or at any of the meetings on exotic propulsion and/or UFOs.

Note that the size of the wormhole mouth, or spherical bubble “orb” to enter, scales as

$$r_o = \sqrt{\frac{c^4}{G^* \tau}} = \frac{1}{L_p^*} \sqrt{\frac{c\hbar}{\tau}} \tag{1.92}$$

The maximum conceivable stress-energy density supportable by any atomic material we can deal with is $\sim 1\text{ev}/(10^{-8})^3 \text{cm}^3$ compared to the Newtonian G Planck value $10^{28} \text{ev}/(10^{-33})^3 \text{cm}^3$. The strength of atomic matter is, therefore, 103 powers of ten too weak! This is why the theory of Puthoff, and the attempts of Davis's high power laser pulses et al, to explain UFOs without hyperspace amplified $G^* \gg G$ is hopelessly futile in principle. The same applies to the Penrose-Hameroff attempt to explain human consciousness with G rather than G^* . Therefore,

$$r_0 \approx \frac{10^{-15}}{L_p^*} \text{cm} \tag{1.93}$$

For the Newtonian G this is $10^{18} \text{cm} \sim 1$ light year. In order to explain observed UFO Star Gate “orbs” with $r_0 \approx 10^2 \text{cm}$, we need $L_p^* \approx 10^{-17} \text{cm}$. This is in the same ballpark as current superstring M-theory estimates according to August 2000 Scientific American's “The Universe's Unseen Dimensions”.

Toward a Refutation of Hawking's Chronology Protection Conjecture

Hawking suggests that while there may be traversable wormhole Star Gates, they cannot be used for time travel to the past.⁸⁹

“the observed fact that we are not hip-deep in tourists from the future can be interpreted as experimental evidence in support of some form of the notion of chronology protection.”

I dispute the above allegation's claim to be factual, i.e. UFO evidence is plausible evidence of time travel to the past. I take this as a pragmatic working anti-conjecture to Hawking's. First, we have to deal with the ideas of the “chronology horizon”, the “causality horizon”, the “polarized hypersurface” and the “fountains of space-time”. A causal world line is not space-like. A chronological world line is time-like. The null geodesic of a classical light ray, without wave diffraction, is causal though not chronological. Machinery with rest mass is on chronological world lines. The term “causal” below is understood as *classical* “retarded causation”, i.e. all causes are on or inside the past light cone of their point effect.⁹⁰ All communication signals are emitted on or inside the future light cone of the point emitter. This is also the “locality” of Bell's theorem, which is violated in orthodox quantum theory in all interpretations with the possible exception of one variation on the “many worlds” interpretation that violates “counter factual definiteness”.

“Space-times containing time machines will typically be causally well behaved up to a certain point – the causality horizon. Past the causality horizon all manner of evils lurk ... the boundary of the causal-violating region delimits the ‘active core’ of the time machine, the diseases associated with time travel propagate to the entire future of this region and destroy predictability to the entire future of the causality-violating region.” P. 209 Visser

⁸⁹ 19.3, Visser.

⁹⁰ The Penrose-Hawking black hole absolute horizon space-time singularity theorems require both this retarded causality structure and positive stress-energy density. Curiously, Pauli's 1941 spin-statistics connection in flat space-time of spinor fermions and scalar, vector and tensor bosons. In other words, that all spin $\frac{1}{2}$ particles are fermions obeying Pauli exclusion principle that no more than one particle in the same single-particle state, on the one hand, and all spin 0, spin 1, spin 2 particles are bosons able to macroscopically condense in large numbers into the same single-particle quantum state (AKA first order “ODLRO” with long-range quantum phase coherence in ordinary 3-dim space that is robust against decoherence), on the other hand, requires the same set of assumptions as do the Penrose-Hawking singularity theorems. This is a clue about “supersymmetry” where fermions and bosons transmute into each other. It is also a clue about *exotic matter* in which the spin-statistics connection may reverse with spinor bosons and scalar, vector and tensor fermions.

This is no big deal since classical chaos also destroys classical predictability even without the Heisenberg uncertainty principle. An important distinction⁹¹ is:

“(1) A causality horizon is not, in general, also an event horizon. (2) A causality horizon is a special case of a Cauchy horizon. All causality horizons are Cauchy horizons; most Cauchy horizons are not causality horizons. (3) The chronology horizon need not be equal to the causality horizon and may not accurately reflect all the predictability problems in the space-time. (4) In most model time machines ... the causality and chronology horizons coincide. ... A point x lies on a polarized hypersurface if and only if there exists a self-intersecting null geodesic that connects the point to itself. ... The polarized hypersurfaces all lie within the causality-violating region ... If the space-time contains only a single traversable wormhole, then self-intersecting curves ... causal or non causal ... can be characterized by a single winding number N ... this is just the total number of times the curve traverses the wormhole. The fundamental group (first homotopy group) is

$$\pi_1(M) = Z \tag{1.94}$$

... N th polarized hypersurface ... if and only if ... self-intersecting null geodesic ... traverses the wormhole N times ... Under certain ... assumptions the chronology horizon is the $N \rightarrow \infty$ limit of the N 'th polarized hypersurfaces ... for n traversable wormholes ..

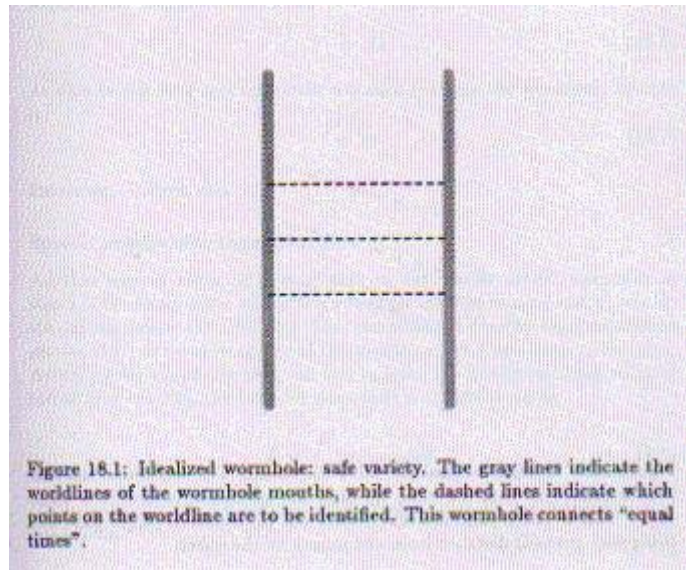
$$\pi_1(M) = \underbrace{Z \oplus Z \oplus \dots \oplus Z}_n \tag{1.95}$$

... A chronology horizon is ... past compactly generated if and only if all inextendible null curves on the chronology horizon tend, in the limit ... to negative infinite affine parameter, to a denumerable number of smooth closed null geodesics ... called the fountains of space-time ... The manifolds are .. time-orientable ... Future fountains are of interest if one wishes to look at the destruction, rather than the creation of a time machine” Quotes all from Visser 17.1 pp.204-212.

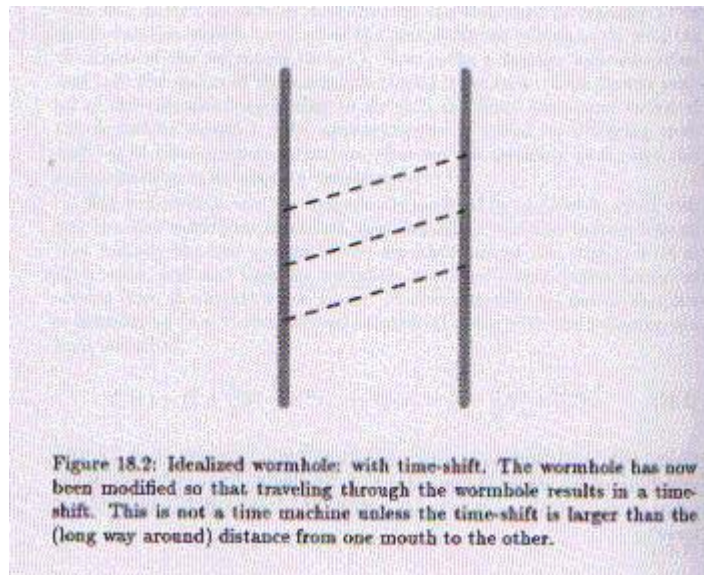
⁹¹ Missed by Larry Crowell in an e-mail thread on this topic. Larry incorrectly argued that chronology horizons are always also black hole singularity event horizons.

To transform the Star Gate into a Time Machine:

1. Find a Star Gate or manufacture one.



2. Use strong short range low energy Salam G*eometrydynamics from hyperspace to induce the "time-shift" $\Delta\tau$. This is analogous to switching on a G* "battery" potential difference like in the Josephson effect in superfluid helium where gravity acts like the electrical voltage in the Josephson effect in a superconductor.⁹²



$$\Delta\tau = \int_{-}^{+} \left[\sqrt{g_{00-}(x_-)} - \sqrt{g_{00+}(x_+)} \right] dt = \int_{-}^{+} \left[e^{\phi_+} - e^{\phi_-} \right] dt \quad (1.96)$$

⁹² PW Anderson, "Basic Notions of Condensed Matter Physics" (Benjamin, 1984)

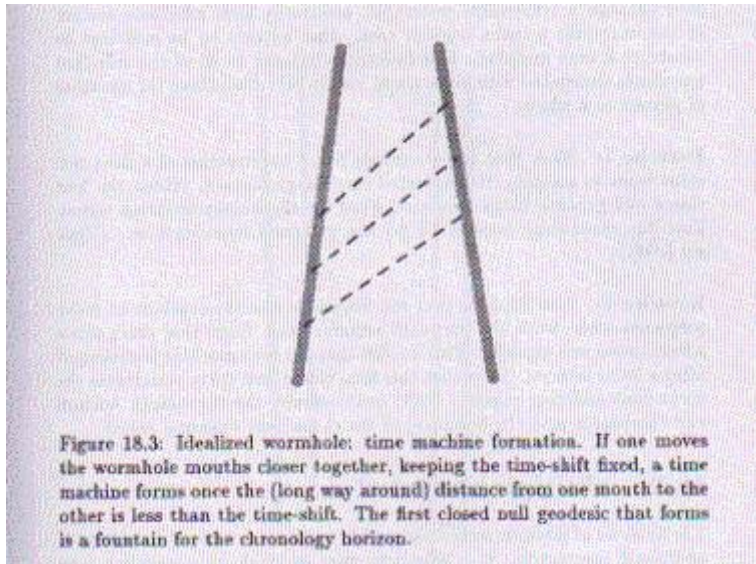
$$g_{00\pm}(r) = -e^{2\phi_{\pm}(r)} \quad (1.97)$$

For example, one obvious static spherically symmetric toy model is

$$\begin{aligned} \phi_{\pm}(r) &= \frac{2G_{\pm}^* m}{c^2 r} = \frac{2G_{\pm}^* \hbar m c}{\hbar c^3 r} \\ &= \frac{2L_{p\pm}^{*2} m c}{\hbar r} = 2 \left(\frac{L_{p\pm}^*}{r} \right) \left(\frac{L_{p\pm}^*}{\lambda_c} \right) \end{aligned} \quad (1.98)$$

It may be possible to do the integral exactly in terms of modified Bessel functions. We do not want to go to weak field approximation when $G^* \gg G$. Note that this is not the same as what Hal did because the metric form is not "isotropic" the way he uses the terms.

3. Bring the two mouths (portals, doorways) of the traversable wormhole Star Gate close together.



You get time travel to the past with a chronology horizon when the invariant proper time it takes to move along a timelike path from one mouth to the other is shorter than the time shift $\Delta\tau$ kept fixed when moving the mouths closer together after switching off the G^* potential difference. The first closed null geodesic that forms is the source fountain of the chronology horizon. This will not be the source of a dangerous blue shift as Hawking feared in his Kip Fest talk at Cal Tech (2000) because the effective Planck scale high frequency cut off c/L_p^* in the exotic skeleton supporting the Star Gate tunnel can be made much lower than $\sim 10^{44}$ Hz. In other words, the time travelers, using

G*eometroynamics, need not be fried by a super ultraviolet burst of radiation when passing through the hyperspace tunnel from future to present or from present to past.

Hawking's work may turn out to be simply an artifact of the ultra-weakness of Newtonian G/c^4 . Until my recent insight, no one in the field has even considered the impact of Salam's G^* on the problem of time travel. For example,

“It appears that any attempt to transform a single isolated wormhole into a time machine results in large vacuum polarization effects. These vacuum polarization effects seem sufficient to disrupt the internal structure of the wormhole long before the onset of Planck scale physics, and before the onset of time travel.” P. 263, Visser

One can see that this idea depends on the Newtonian G quantum gravity Planck scale being so tiny at 10^{-33} cm corresponding to a huge quantum gravity energy gap of 10^{28} electron volts. Salam's $G^* \gg G$ offers hitherto unforeseen alternatives. For example the length scale of the self-intersecting geodesic for vacuum polarization disruption of the time machine is⁹³

$$s^*|_{disrupt} \approx \Delta_{\gamma'}^{1/8} \sqrt{\pi L_p^* r_0} \quad (1.99)$$

We can take the “van Vleck determinant”

$$\Delta_{\gamma'} \approx 1 \quad (1.100)$$

Here is where the *finite self-energy of string theory* beyond the point particle quantum field theory saves the day. Unlike Hawking's point-particle model where

$$s_{\gamma}(x, x) \rightarrow 0 \quad (1.101)$$

for the scale of the self-intersecting time-like geodesic (CTC) in the quantum vacuum expectation value of the stress-energy density, i.e.⁹⁴

$$\langle 0|T_{\mu\nu}(x)|0\rangle \approx \hbar \sum_{\gamma} \frac{\sqrt{\Delta_{\gamma'}(x, x)}}{\pi^2 s_{\gamma'}(x, x)^4} t_{\mu\nu}(x; \gamma) \quad (1.102)$$

in first order perturbation theory on flat space-time background approximation

$$T_0 \equiv \sqrt{\langle 0|T_{\mu\nu}(x)|0\rangle \langle 0|T^{\mu\nu}(x)|0\rangle} \approx \hbar c \frac{\sqrt{\Delta_{\gamma'}}}{\pi^2 s_{\gamma'}(x, x)^4} \quad (1.103)$$

⁹³ eq. (19.7), p. 264, Visser

⁹⁴ eq. (19.3), p. 264, Visser

is estimate of back-reaction stress-energy density of virtual electron-positron pair zero point vacuum fluctuations on the space-time geometry. This needs to be compared to the exotic stress-energy density needed to keep the Star Gate open at the mouth, which is

$$T \approx \frac{\hbar c}{L_p^{*2} r_0^2} \quad (1.104)$$

The obvious parameter we want kept small is

$$\eta \equiv \frac{T_0}{T} = \frac{\frac{\sqrt{\Delta_{\gamma'}}}{\pi^2 s_{\gamma'}(x, x)^4}}{\frac{1}{L_p^{*2} r_0^2}} \approx \frac{\sqrt{\Delta_{\gamma'}} L_p^{*2} r_0^2}{\pi^2 s_{\gamma'}(x, x)^4} \rightarrow \frac{\sqrt{\Delta_{\gamma'}}}{\pi^2} \left(\frac{r_0}{L_p^*} \right)^2 < 1 \quad (1.105)$$

Can we have $r_0/L_p^* < 1$? Maybe, since the exotic region will be confined to a small part of the passage way like a doorframe. Furthermore, can we trust this first order perturbation theory result? It could turn out that a non-perturbative background metric independent calculation would give a quenching of the vacuum polarization. I mean something like

$$\eta \equiv \frac{T_0}{T} = \exp \left\{ - \left[\frac{\sqrt{\Delta_{\gamma'}}}{\pi^2} \left(\frac{r_0}{L_p^*} \right)^2 \right] \right\} \ll 1 \quad (1.106)$$

$$\frac{r_0}{L_p^*} \gg 1$$

ⁱ Paul Zielinski [PZ] wrote to Jack Sarfatti [JS] on June 27, 2001:

Post-Quantum Dialogue 1

[PZ]

It does appear that the entire quantum gravity project has hit a brick wall on their methods.

[JS]

That 10^{19} GeV quantum gravity energy gap is the problem. Even Penrose stumbles there and Hameroff, not a physicist, makes physicists wince over it as if it could be directly relevant to human consciousness! $G^* \gg G$ at short distance resolutions is another ball game altogether. This idea of Salam's was forgotten but resurfaced recently in new form in Aug 2000 Sci. Am p.62. Not clear yet what Ashtekar's nonperturbative loop gravity and this holographic area operator stuff will lead to. Note my Mickey Mouse model tension T^* obeys

$$G^*/c^4 = 1/T^*$$

which is big deal today in M-theory. I basically had it in 1973.

[PZ]

Sounds like it's all up for grabs. I'll check that Sci Am article.

[snip]

[JS]

What do you mean exactly by "Copernican system"? Basic idea that Earth is not the center of the universe is sustained in Newton and GR?

[PZ]

The Copernican theory held that the sun is motionless at the center of the universe, and the earth moves *relative to it*. Since this was the "center", the motion of the earth was *absolute*.

[JS]

Oh yes, in that strict literal sense of course you are correct.

[PZ]

Logically, that means *Galileo was wrong*. Copernicus' treatise was put on the Papal index *precisely* because Copernicus' theory was being touted as *literally true* by Galileo. Galileo was not as sophisticated as Bellarmine on epistemological issues. He was an upstart vulgar-Platonist. Hence his misguided arrogance.

[JS]

I was thinking more of modern "Copernican principle" that we are not special - isotropic homogeneous cosmology et-al.

[PZ]

Yes, but even in the Copernican-Darwinist framework we are a *very unlikely accident*. So *at least in that sense* we are still "special".

[JS]

Yes, indeed. We are not special in the material realm but we are special in the mental realm of complexity and consciousness. My own conjecture, since at least 1973 as Saul-Paul Sirag has documentation and audio tape for, is that time travel to the past is essential in the creation of the universe. That Greg Benford wrote "Timescape" is no accident we were students together at UCSD in the mid 60's. The universe is created by intelligent design from the future via time travel to the past violating Hawking's "chronology protection conjecture". Elementary particle transmutations, e.g.

$n \rightarrow p + e + \text{anti-neutrino}$

$2 \text{ photons} \rightarrow \text{electron-positron pair}$

Etc. are topology changes in the rock-like geometrodynamical field configurations with closed time-like curves (CTC's) violating chronology projection on the micro scale incessantly! It's all one big bootstrap globally consistent time loop with alternate time lines. The Novikov global self-consistency condition, and non-Hausdorff topology of alternative timelines from temporal anomalies induced by time travel to the past changing history, are not incompatible - one can have both just as one can have many-worlds violation of counterfactual definiteness, both rock-like and thought-like, together with retarded causality violations. It's the end of ordinary history.

Bell's theorem says following three conditions are mutually incompatible:

1. Counterfactual definiteness
2. Chronology protection = retarded causality = locality = no rock-like time travel to past = no precognitive remote viewing = no real time faster than light communication
3. Statistical predictions of orthodox quantum theory i.e. sub quantum heat death of Valentini, "equilibrium of hidden variables" of Bohm & Hiley

Note post-Bohmian quantum theory, my covering theory of quantum theory (called "Sarfatti Mechanics" by Nick Herbert, I prefer Sarfatti Non Mechanics), violates all three! It completely consistently leapfrogs over Bell's theorem.

This is physics from the future the "violent and radical rewriting of physics from the ground up" (Visser's "Lorentzian Wormholes"). This is the real Italian "Futurism" not what Marinetti did with my distant relative Margherita ~ 100 years ago.

The Geroch-Hawking-Tipler et-al classical topology-causality theorems say the following conditions are incompatible:

1'. Positive energy density, e.g. ANEC et-al

2'. Retarded causality = locality = no closed time-like curves CTC = chronology protection i.e. same as 2 above in Bell's theorem.

3' Einstein's geometrodynamical field equation

$$G_{uv} = (G/c^4)T_{uv}$$

for the local bending of space-time i.e. G_{uv} by the stress-energy density tensor field T_{uv} of Bohm not so hidden variables (system points), i.e., rock-like G*eon solitons i.e. knotted wormholes with varying topological complexity prior to the thought-like qubit pilot field landscape.

4' Topology change of the 3-dim geometrodynamical field configurations in a given Hamiltonian canonical ADM foliation or slicing of 4-dim space-time into space-like surfaces with given lapse and shift fields

[PZ]

Dumb luck. We won the Cosmic Lottery.:-)

[JS]

No, God does not play dice with the universe. It's not luck. There are no coincidences at this level. God is not a Mindless Idiot. Reality is more than a tale told by an idiot of sound and fury signifying nothing. Bye Bye to Existential Despair.

[PZ]

In Newton's theory, the sun moves around the center of mass of the solar system. It is just the heaviest body. However, in Newton's theory the dynamical laws assume a very simple form in one particular frame of reference.

[JS]

Yes, the inertial frame with no inertial forces like centrifugal and Coriolis from the absolute acceleration of the frame itself. Gravity is an inertial force without force, that's part of Einstein's principle of equivalence. He understood that when he read a report of a painter falling from a high ladder who said that from 10 dim hyperspace to ordinary 3-dim space, these hyperspace inertial forces look like non-inertial gauge forces in the freely floating LIFs (Local Inertial Frames). This is the alchemy of the unified field of

Einstein's Vision in which the "wood", or "lead, in the stress-energy density T_{uv} is replaced by the "marble", or "gold", of hyperspace-time geometry.

[PZ]

In GR the form of the dynamical laws does not depend on the frame of reference, and there is no longer a "force of gravity" per se. So the form of the "force of gravity", and the distinction between "fictitious" and gravitational forces, can no longer be appealed to in marking a preferred frame.

[JS]

Yes.

[PZ]

Of course, that doesn't in itself *prove* that there isn't one. It would just have to have a different justification.

[JS]

Yes. This issue of preferred frame confused Nick Herbert. Covariance of the field equations means no preferred frame at that level.

[PZ]

As far as *those equations* are concerned, yes.

[JS]

That does not apply to the vacuum or ground state solutions in situations of spontaneous broken symmetries as in a ferromagnet, a ferroelectric, alloy phase transitions, lasers, Frohlich modes in biomembranes, superconductors, Higgs mechanism for origin of mass of elementary particles, Jahn-Teller effect in solid state, cosmological inflation from false vacuum, and brain coherence of the caged electron qubits as well as the Hubble flow in which a preferred frame, for the solution not the field equations, is that of the maximally isotropic cosmic blackbody background radiation. It is the extremal isotropy of the blackbody background that is the operational definition of local "absolute rest", i.e. the "Hubble flow", for that class of solutions to Einstein's holonomically covariant frame independent field equations. Again, it bears repeating, we define that isotropy as the measure of absolute rest in the vacuum solution of Einstein's locally frame independent geometrodynamical field equation.

[PZ]

OK. I think we agree on this, if you say "...does not *necessarily* apply..." I understand that all laws of physics can be rendered into generally covariant form without altering empirical content.

[JS]

Yes, I am familiar with that claim. But this is another problem that we need to look at more closely. In any case, all great theories need to both explain and predict and to explain with parsimony, more with less, big bang for a small buck. Judging this is of course difficult, debatable and delicate and takes a long time.

[PZ]

Right. I suspect you are hanging on to something here that is no longer tenable. IMO you can be a critical realist without relying on this -- like Einstein. It's all in his (Schilpp) Autobiographical Notes.

[JS]

Spell it out.

[PZ]

"Constructive" (i.e. hypothetico-deductive) physical theories are not *literally true*, and are *reliably inaccurate*. By modeling partial "slices" of physical reality in a non-literal (mythopoeic) manner, they nevertheless say something about the world and thus have "truth content" and "truthlikeness" ("verisimilitude").

[JS]

Complementarity principle better stated!

[PZ]

But in this view, since models are the semantic seeds of verisimilitude (you can quote me on that :-)), we should take them seriously, and their consistency and integrity then become centrally important in the "context of justification".

[JS]

OK

[PZ]

(I tried to argue this to my thesis supervisor *twenty five years ago* and was trampled -- even ridiculed.)

[JS]

Tell me about it. I independently discovered Bell's theorem qualitatively in 1960 at Brandeis. That is, I saw that Einstein locality and quantum theory were inconsistent before I knew of the EPR papers in any detail, Sylvan Schweber and Stanley Deser told me not to think about foundational issues and simply learn how to pragmatically calculate. Stan Klein was there at that time also.

[PZ]

In complementarity (at least as it has been interpreted and applied academically), anything goes -- as in the Bohr atom. This license was codified by Bohr as the

"correspondence principle" and "complementarity". IMO this is the pathology of "modern physics": the collapse of intellectual standards as to concrete analogical content, which latter degenerates into *mere psychological scaffolding* to be discarded when a static formal-empirical scheme has been constructed.

[JS]

Details told by Mara Beller in "Quantum Dialogue".

[PZ]

The application of this principle is however hypocritical: explanatory power is still (falsely and incoherently) claimed for the mathematical schema after its predictive sources (now derogated as "heuristics") have been discarded ("correspondence principle"). The grin without the cat. There is a great quote about disposable pheasant's wings from Gell-Mann that epitomizes this systematically shallow approach.

[JS]

Murray is a clever technician who was lucky to have an office next to Feynman's at Cal Tech. Look at his "The Quark and the Jaguar".

[PZ]

The predictive power of such theories derives from the existence of *archetypes* that establish "natural classifications" of phenomena (Duhem). Thus the well-spring of such "verisimilitude" is the human psyche, and not sense perception -- although of course experience and praxis must ultimately decide which archetypes are most relevant and applicable in any particular case. A "fabric of reality" can be woven by "analogical continuation" of the given structure of sense experience (e.g. Riemannian geometry), and the relative weight of *entrenched principle* and empirical evidence is balanced in a *rational architectonic* of well-founded belief which refers ultimately to the whole of our knowledge (this is 33 degree eye-on-pyramid stuff). I agree with Kant that the only real knowledge (episteme) we have is that the ideas we impose on our experience are what they are. All else is belief (doxa) -- either (relatively) well-founded, or not.

[JS]

OK sounds good. "Archetypes" as intrinsic meanings as invariants of categories of transformations - the ultimate Glass Bead Game of the Cabalistic Magisters of the Super-Illuminati, the Magi of Tech Gnosis, the Lords of Super Cosmos. :-) What's is all about Alphy?

[PZ]

But archetypes transcend the logico-mathematical structures that they generate (contra John Worrall). We are talking about the rebirth of *critical metaphysics*. Yes, this is *esoteric wisdom* and can be psychologically destabilizing to many lesser minds -- especially those with PhDs in theoretical physics -- so we have to be careful.:-)

"Don't mess with the icons" -- Jay Leno

[JS]

Yup. :-)

Bohm's realism is superior as explanation for our understanding. Feynman's diagrams much better for predicting. Deutsch's "The Fabric of Reality" is good on this "prediction-explanation" complementarity - we cannot eliminate Bohr completely of course. It is a matter of redressing the imbalance in the Bohr-Einstein dialectical complementarity in the Bohmian synthesis.

[PZ]

We have to be very careful with this "complementarity" word. I think you are talking here about dialectical interaction.

[JS]

Yes, "complementarity" is vague I suppose.

[PZ]

In my book this Bohr-speak counts as "philosofarcicality".

[JS]

I second that. I think Bill Casey imitated Bohr. :-)

[PZ]

The Chairman of Capital Cities-ABC?

[JS]

No, Reagan's CIA Chief. I meant Casey mumbled his speech just like Bohr – perhaps deliberately?

[snip]

Yes, Einstein himself said as much later e.g. his 1924 "Essay on the Aether".

[PZ]

It's nice to know that Einstein agrees. I haven't read this, but will. I suspect that the Bohr gang was too conceited and *intellectually constipated* to grok the "senile" Einstein's later -- and deeper -- thinking. After a bad divorce, though, I think the hyper-critic Pauli himself began to see *the light*. I feel his pain.

