U(1) × SU(2) × SU(3) quantum gravity successes

Nige Cook

Abstract

30 November 2011

Isotropic cosmological acceleration a of mass m around us produces radial outward force by Newton's 2nd law $F = dp/dt \approx ma \approx [3 \times 10^{52}][7 \times 10^{-10}] \approx 2 \times 10^{43}$ N[(1)], with an equal and opposite (inward directed) reaction force by Newton's 3rd law of motion (the rocket principle), in our frame of reference as observers of that acceleration (Fig. 2). Using Feynman's rules, we calculated a graviton scattering cross-section πr^2 for a fundamental particle (Fig. 1) in 1996 to correctly predict the cosmological acceleration of the universe which is required for observed gravity[(2)]. Gravity is the asymmetry in the isotropic inward force, $F = ma(\pi r^2)/(4\pi R^2)$ caused by a graviton scatter cross-section, $\sigma_{\text{gravitiy}} = \sigma_{\text{weak}} (G_N / G_{\text{Fermi}})^2 = \pi(2GM/c^2)^2$. Hence $g = Mc^4/(amR^2)$, predicting $a = c^4/(Gm) = 7 \times 10^{-10}$ ms^{-2}, or $\Lambda = c^4/(G^2m^2)$, which was confirmed by observations of supernovae two years later in 1998[(3)], so G and Λ are *not* independent but are instead *interdependent*. The Lambda-CDM FRW metric ignores this dynamic mechanism where the dark energy *causes* gravity, so it falsely treats Λ and G as *independent variables*. But since momentum is conserved, a falling apple cannot gain momentum (accelerate) from a purely "geometric spacetime" *without a backreaction upon the field* (Newton's 3rd law). We *prove using only checked facts as inputs* that a falling body has momentum imparted to it by a physical interaction with the gravitational field, which *has a backreaction*. Quantum gravity is a U(1) Abelian theory with only a single charge sign, which bypasses renormalization loop problems; *there is no antigravity charge,* preventing gravity-polarized pair production loops, so there is no running of the gravity coupling, thus quantum gravity renormalization is not required. Electromagnetism employs massless Yang-Mills SU(2) *charged bosons* (off-shell Hawking radiation). Cancellation of magnetic self-inductance for charged massless boson propagation necessitates a two-way exchange equilibrium of massless field quanta *charge* (the charge exchange equilibrium obviously doesn't extend to energy, since a particle's frequency can be redshifted to lower *energy* without any loss of electric *charge*), constraining to zero the Yang-Mills *net charge*-transfer current, $2\varepsilon A_\nu \times F_{\mu\nu} = 0$, reducing the total Yang-Mills current $J_\mu + (2\varepsilon A_\nu \times F_{\mu\nu}) = -dF_{\mu\nu}/dx_\nu = -d_\nu F_{\mu\nu}$ to Maxwell's $J_\mu = -d_\nu F_{\mu\nu}$, so the Yang-Mills field strength $F_{\mu\nu} = d_\mu W^a{}_\nu - d_\nu W^a{}_\mu + g\varepsilon_{abc} W^b{}_\nu W^c{}_\mu$ loses its term for the *net* transfer of charge, $g\varepsilon_{abc} W^b{}_\nu W^c{}_\mu = 0$, yielding Maxwell's $F_{\mu\nu} = d_\mu A_\nu - d_\nu A_\mu$. Notice that the weak coupling, g, occurs in the disappearing charge transfer term. The mechanism eliminates the weak dependence on mass, turning a Yang-Mills theory into an *effective* Abelian one. The Higgs mechanism in the Standard Model for mass and weak SU(2) massive quanta renormalization is replaced by a running Glashow-Weinberg mixing angle which mixes the gravitational charge (mass) of *repulsion-only* spin-1 Abelian U(1) quantum gravity with electroweak SU(2); the running of the angle decreases mixing to zero at high energy*, so SU(2) field quanta then become massless, thus permitting SU(2) renormalization just as for the Higgs's mechanism: boson masses disappear at high energy*. Casimir's offshell field disproves planetary drag objections.

Figure 1: extract from Table 1 in Stuart A. Raby, Richard C. Slansky, and Geoffrey B. West's article, "Particle Physics and the Standard Model," pp. 23-53 of the Summer/Fall 1984 issue of the journal *Los Alamos Science*. It empirically extrapolates the cross-section of a proton for scattering a graviton *independently of any assumed graviton spin:* $\sigma_{\text{gravition-proton}} = \sigma_{\text{neutrino-proton}} (G_N / G_{\text{Fermi}})^2 \approx (10^{-11})(10^{-38}/10^{-5})^2 = 10^{-77}$ mb or 10^{-80} barns (1 barn = 10^{-28} m^2). G_N is the gravity coupling, *written in the same* $m_{\text{proton}}{}^2$ *units as the weak coupling,* G_{Fermi} and using the $\hbar = c = 1$ convention. This scaling uses Feynman's rules: two-vertex interaction probability and cross-section are proportional to (coupling)^2. The cross-section is a black hole's event horizon ($r = 2Gm_{\text{proton}}/c^2$): $\sigma_{\text{graviton-proton}} \approx \pi(2Gm_{\text{proton}}/c^2)^2 = 1.93 \times 10^{-79}$ barns. This check for protons is only approximate, since a proton is not a fundamental particle (it contains onshell quarks). Detailed calculations substantiate this result. Additional evidence for the black hole cross-sections is an offshell SU(2) Hawking radiation mechanism for charged black holes, giving the electromagnetic coupling.

Weak interaction

Neutrino-Proton Scattering

$$\nu + p \rightarrow \nu + p \qquad \sigma \sim 10^{-11} \text{ mb}$$

$$G_{\text{Fermi}}\, m_{\text{proton}}{}^2 = 2^{1/2} g^2 m_{\text{proton}}{}^2/(8M_w{}^2) \sim 10^{-5}$$

Gravitational interaction

Graviton-Proton Scattering

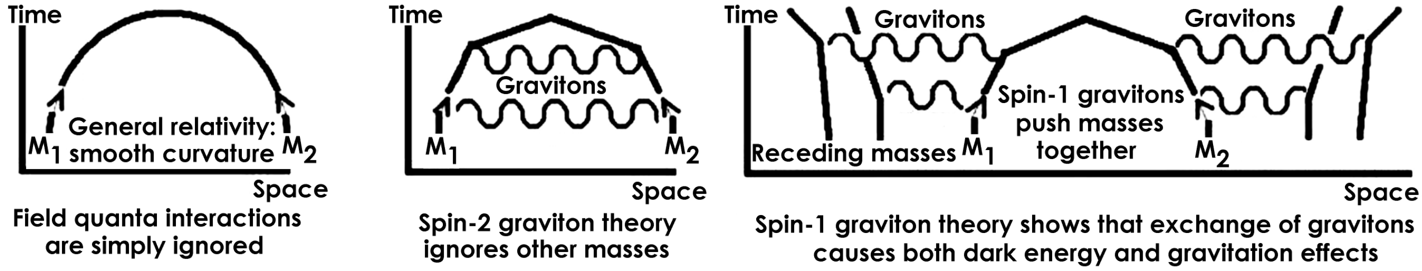
$$g + p \rightarrow g + p \qquad \sigma \sim 10^{-77} \text{ mb}$$

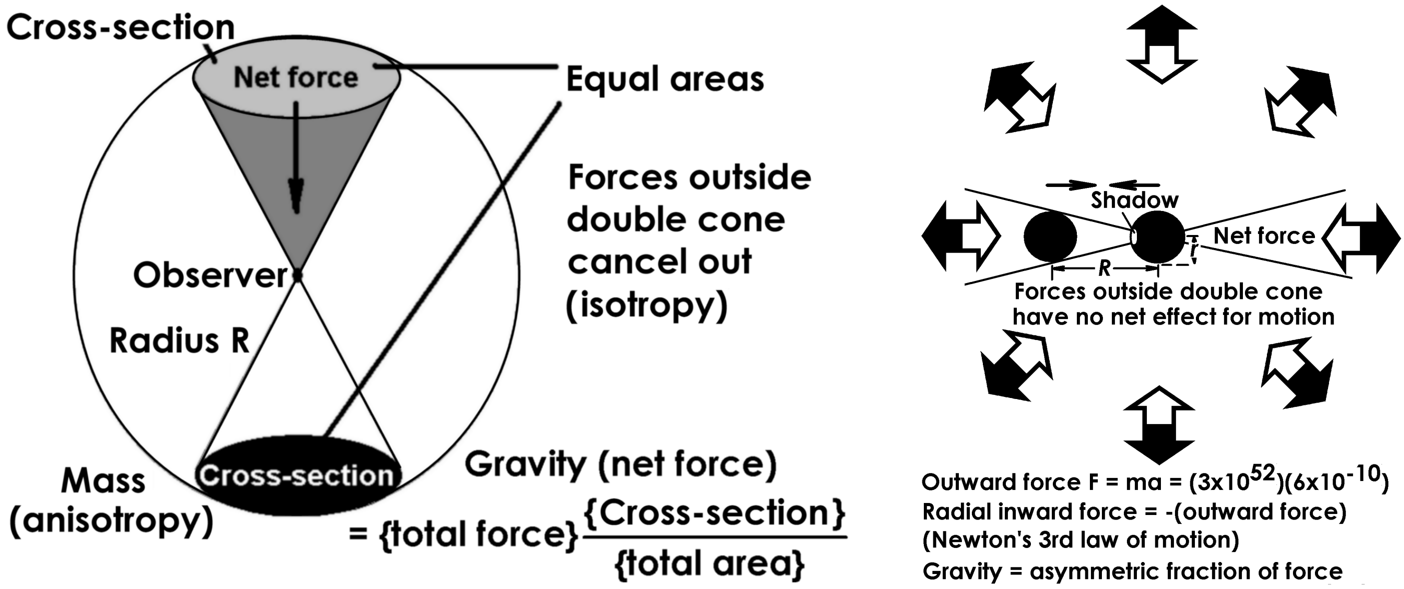
$$G_{\text{Newtonian}}\, m_{\text{proton}}{}^2 \sim 10^{-38}$$

[The predominant low energy interaction is the tree-level single propagator Feynman diagram with two vertices, in which the cross-section is proportional to {coupling}^{2}.]

Part 1. U(1) quantum gravity repulsion: the checked cosmological predictions

A particle physics "cross-section" is defined as the effective cross-sectional target area which must be hit (by a "point" particle) in order to produce 1 interaction of the type specified. If the radiation is isotropic, the probability p of one "point" particle of radiation hitting a target of cross-section A located at distance R is given by $p = A/(4\pi R^2)$. Hence, for a fixed distance, the interaction probability is *directly proportional* to the cross-section. The interaction probability in quantum field theory can be calculated by Feynman's rules, which multiply couplings together for interactions (each interaction is one vertex on a Feynman diagrams) and propagators for the momenta of internal lines (off-shell quanta). Feynman obtained the rules empirically, by normalizing the path integral to correspond to S-matrix results. For a proton, the graviton scattering cross-section is roughly 10^{-80} barns (Figure 1) or 10^{-108} m^2, far smaller and more fundamental than the square of the Planck length (the "barn" is Los Alamos's Manhattan Project short-hand for 10^{-28} m^2). This *very small* cross-section makes the mean free path immense, so the probability that two fundamental particles in the earth "overlapping" one another in the earth is trivial. It is simply the *measured* weak interaction coupling (the Fermi constant) scaled to gravity by Feynman's *empirical* rule: *low energy (tree-level) interaction probabilities are proportional to the square of the coupling strengths of the fundamental interactions.* Since the cross-section and coupling are known for the weak interaction and G is known for gravity, the cross-section for gravity is the weak interaction cross-section, multiplied by the square of the ratio of gravitational to weak interaction couplings (Fig. 1). Dark energy is qualitatively analogous to Moller scatter (QED 2-vertex Feynman diagram repulsion). By the crossing-symmetry rule, the Moller scatter cross-section equals Bhabha's attraction cross-section. Quantum gravity's lagrangian can be inferred from a single charge sign QED lagrangian. This graviton scatter cross-section is from a *fact-based calculation,* because all three inputs are well-checked and the fact that cross-sections are proportional to the square of the coupling at low energy is also *well established experimentally for all Standard Model interactions.* It does *not* rely on any assumptions about the spin of the graviton.





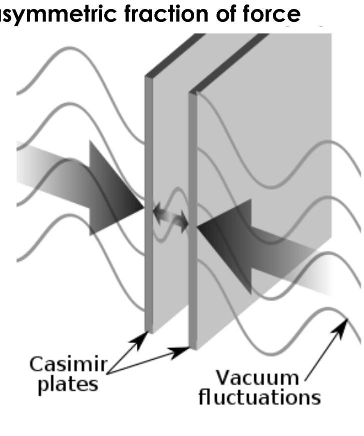
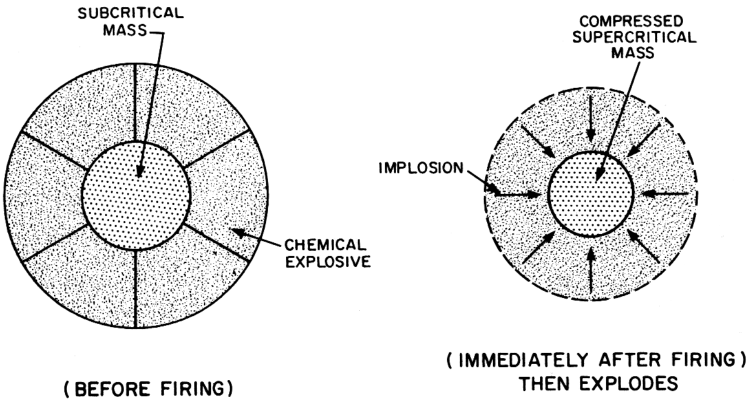


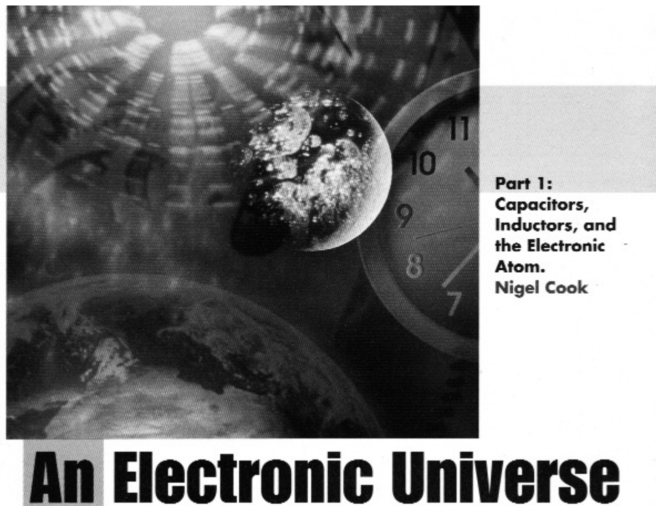
Fig. 2: the graviton exchange repulsion force between an apple and the earth is trivial compared to the converging inward graviton exchange force from the 3 x 10^{52} kg mass of the surrounding universe. Immense masses like galaxy clusters do repel one another significantly by the exchange of gravitons, causing cosmological acceleration *a,* which causing a radial *outward* force from us, *F = ma* by Newton's 2nd law, implying equal inward force by Newton's 3rd law (the mediator we shall call the *graviton,* although it is also dark energy). The force of gravity is the asymmetric portion of the total inward isotropic force, due to intervening cross-sections. The fraction of the total inward force intercepted by cross-section πr^2 at distance *R* from an observer is $(\pi r^2)/(4\pi R^2)$. Net force = $F_{total}[(\pi r^2)/(4\pi R^2)] = m_{universe} a_{cosmological} (r/R)^2/4$, where $r = 2GM/c^2$. Hendrik Casimir's 1948 force is *another* experimentally-validated vacuum pushing force, giving rise to "attraction" without planetary drag. Parallel conducting plates are pushed together, since the *full spectrum of Casimir radiation* exists and pushes on the outer sides of the plates (pushing them together) but *only* the *wavelengths shorter than the distance between the plates* arise in the gap, pushing them apart. (*Right: Wikipedia*.)

In Fig. 2, "gravity" is just the net force at distance R from a local mass with a cross-section A which introduces an asymmetry into the otherwise isotropic graviton exchange field, is equal to the total force multiplied by the ratio $A/(4\pi R^2)$, this ratio being the proportion of the total isotropic force which is stopped from the direction of local mass. Hence, $F = maA/(4\pi R^2) = maG^2M^2/(R^2c^4)$. Comparison to the Newtonian law $F = M_1M_2G/R^2$ shows $G = c^4/(ma)$ and $M^2 = M_1M_2$ is the basis of the quantization of mass in quantum gravity: *all particle masses are derived from a single mass unit, implying a simple model to predict particle masses, as we prove later.*

The mean free path is the mean distance travelled by the radiation or graviton between collisions, $\lambda = 1/(A\rho N)$, where ρ is the mass density and N is the number of fundamental particles of matter per unit mass (Avogadro's number is 6.022×10^{26} nucleons/kg), for fundamental particles of individual graviton scatter cross-section A. If A is the cross-section for a nucleon like a proton, then the mean free path in water ($\rho = 10^3$ kg/m^3) is $\lambda = 1/(10^{-108} \times 10^3 \times 6.022\times10^{26}) \sim 10^{78}$ m. This means that individual gravitons have an extremely low probability of interacting with any nucleus in the earth, so there is absolutely no significant chance that nuclei in the earth or sun will lie directly behind one another on a given radial line. This alleged effect is a LeSage gravity prediction which is a departure from Newtonian gravity, because part of the mass is shadowed by other mass and thus is "invisible" to the gravitons, so that the effective strength of gravity is no longer Newton's direct proportionality to mass and the inverse square law, but also includes the well known exponential attenuation law, so Newtonian gravity is a Yukawa $e^{-R/\lambda}/R^2$ force. However, since λ is on the order of 10^{78} m so usually $e^{-R/\lambda} \sim 1$, and the immense mean free path prevents multiple scattering of gravitons and their non-radial diffusion into shadows.

As Fig. 2 shows, the radial outward force of isotropically distributed mass m with radial cosmological acceleration a induces by Newton's 2nd and 3rd laws and equal inward force $F = ma$, apparently mediated by spin-1 radiation, which we term gravitons, although the term graviton is more usually associated with a hypothetical Pauli-Fierz spin-2 propagator. Because of the isotropic cosmological acceleration and mass distribution around us, the radial forces are themselves isotropic, and so cancel out apart from the radial compression of matter, which is Feynman's "excess radius" of general relativity's spacetime curvature; earth has a radial compression of 1.5 mm due gravitational Lorentz contraction in general relativity (discussed later). To "cancel out," the forces from opposite directions are normally similar, so no net acceleration is induced. Normal air pressure on opposite sides of a person causes a similar effect; a compressive force is exerted but it does not exert a *net translational* force (wind pressure) unless the object is moved. With gravitons, this force which appears in response to acceleration is given the name "inertia." Motion in the vacuum causes asymmetry in radiation fields, as Feynman points out with the example of running into rain and thus receiving more rain on the front side than the reverse side (analogous to the measured cosine curve of angular blueshift and redshift in the cosmic background radiation due to our motion through that onshell field). But Lorentz's transformation compensates, preventing drag from uniform motions. Only accelerations which alter the Lorentz contraction are resisted (thus inertia).





An Electronic Universe

Inability to explain fundamental concepts to a wide audience leads to a severe problem in communication: to being regarded as a 'technician' who hides ignorance behind jargon. The ability to design circuits, but inability to explain everything, causes a frustrating lack of self confidence for engineers in the boardroom. Jargon without clear explanation leads to shunning by a society which doesn't appreciate mere description of crucially important phenomena, e.g., 'capacitance' and 'inductance', and who want proper underlying explanations. So electronics, as jargon-dominated trivia, is being left out of newspapers and TV, despite the increasingly important reliance of society and science upon electronics.

History

A century ago, 'electronics' was the name of the latest and most prestigious science. But the researchers ended up in chaos, with Ampere's original theory of 'current' finally culminating in the calculated typical 1 mm/s flow of drifting 'electrons', versus Heaviside's 300,000 km/s transverse electromagnetic (TEM) energy wave (whose exact speed, like the local speed of light in a medium, is determined solely by the dielectric insulating material, such as air or plastic, between the conductors, not by the nature of the conductors themselves). This particle-versus-wave problem was not a new problem; it had its roots originally in 1680 when Christian Huygens proposed that light is waves, in direct opposition to Isaac Newton's particle theory. Eventually, in 1927, Niels Bohr invented a 'correspondence principle' to suppress critics by accepting 'particle-wave duality', permitting whichever calculation was appropriate for the problem in hand. Consequently, explanations became submerged by semi-empirical equations, while experimental electronics applications flourished.

It is obvious that even if the entire mass of the cable was electrons, they would carry negligible kinetic energy travelling at 1 mm/s (since the kinetic energy equation is E = mv^2). Hence, a 1 mm/s electron current cannot be the predominant mechanism of energy transfer. Ivor Catt (b. 1935) started developing TEM wave-based explanations with David Walton and Malcolm Davidson in May 1976, and published them between 1978-88 as *Wireless World* articles, which unfortunately were produced in an abstruse manner (absurdly rejecting electric current and displacement current out of hand using Ockham's razor, without including a proper replacement theory or using the new facts which they established to produce an understanding of the unanswered problems in science).

Continuity of electric current in a circuit: a Science Fiction Story

Once upon a time, everyone grasped the basic law of

Fig. 3 (above and right): Fatio, a friend of Newton, put forward a gas-type gravity "shadow" theory which failed to make any checkable predictions, but it was repeatedly "disproved" by "greats" who claimed that *gas type* (*on-shell*) particles in space would diffuse into "shadows" and cancel gravity, slow down planets, heat them up, etc. But field quanta are off-shell, and have a very low amplitude to scatter off one another. The implosion assembly device (illustration from Glasstone and Dolan's *Effects of Nuclear Weapons*, 3rd ed., Fig. 1.53) uses an *explosive force to push nuclei closer together*, the key "missing link" in the gravity mechanism. We published via *Electronics World*, in the October 1996 issue, page 896, *Science World* ISSN 1367-6172 in February 1997, and "An Electronic Universe," beginning in the August 2002 issue. *PRL* editor Stanley Brown emailed us that spin-2 gravitons are dogma: "*Physical Review Letters does not, in general, publish papers on alternatives to currently accepted theories.*"[4]

"What does the planet do? Does it look at the sun, see how far away it is, and decide to calculate on its internal adding machine the inverse of the square of the distance, which tells it how much to move? ... [According to Fatio/LeSage] If the sun were not there, particles would be bombarding the Earth from all sides ... However, when the sun is there the particles which are coming from that direction are partly [*scattered by the graviton scattering cross-sections of the sun's mass*] ... Therefore, the number coming from the sun's direction towards the Earth is less than the number coming from the other sides ... Therefore there will be an impulse on the Earth towards the sun that varies inversely as the square of the distance. ... Therefore the ... fundamental operation is much simpler than calculating the inverse square of the distance. ...

"The only trouble with this scheme is that … If the Earth is moving, more particles will hit it from in front than from behind. (If you are running in the rain, more rain hits you in the front of the face than in the back of the head, because you are running into the rain.) So, if the Earth is moving it is running into the particles coming towards it and away from the ones that are chasing it from behind. So more particles will hit it from the front than from the back, and there will be a force opposing any motion. This force would slow the Earth up in its orbit… So that is the end of that theory. 'Well,' you say, 'it was a good one … Maybe I could invent a better one.' Maybe you can, because nobody knows the ultimate. ...

"... it is not true to say that you cannot tell if you are going around. You can. I might say that you would get dizzy. ... It is possible to tell that the earth is rotating by ... Foucault pendulums that prove that the earth is rotating, without looking at the stars. ... people have proposed that really the earth is rotating relative to the galaxies ... Well, I do not know ... Nor, at the moment, do we have any theory which describes the influence of a galaxy on things here ... That it should be the case is known as Mach's principle ... We cannot say that all motion is relative. That is not the content of relativity. Relativity says that uniform velocity in a straight line relative to the nebulae is undetectable."

- Richard P. Feynman, *The Character of Physical Law*, November 1964 Messenger Lectures, BBC TV (see also the 1965 book version).

Feynman failed to mention that the Casimir effect proves that planets are *not* slowed down in the vacuum by drag effects, because *offshell* field quanta don't cause drag, unlike onshell Fatio gas particles. *But in dismissing it, he honestly stated:* "Maybe you can, because nobody knows the ultimate."

Since quantum gravity is an *effect from anisotropic repulsion of surrounding matter*, the quantum gravity Lagrangian is similar to the QED for low energy (minimal coupling) approximates the classical Lagrangian of general relativity. In the Newtonian (or weak field) limit, gravitation is given by the scalar *traces of the Ricci and stress-energy tensors* (top-left to bottom-right diagonal sums of the tensor matrices):

$$R = g^{\mu\nu}R_{\mu\nu} = R_{00} + R_{11} + R_{22} + R_{33},$$
$$T = g^{\mu\nu}T_{\mu\nu} = T_{00} + T_{11} + T_{22} + T_{33}.$$

For the Newtonian fall of an apple, Ricci's curvature is well approximated by Poisson's law, $R_{00} \approx \nabla^2 k = 4\pi G\rho/c^2$, while $T = g^{00}T_{00} = \rho$. For radial symmetry about radius r, the Laplacian of k is $\nabla^2 k = (a/r_x) + (a/r_y) + (a/r_z) = 3a/r$.

Einstein's field equation is derived in two ways, first by Einstein's first heuristic, physically intuitive way (Newton's law as a tensor spacetime field, with a correction for energy conservation), and then more rigorously by stating the lagrangian and using the Euler-Lagrange law to find the classical Einstein field equation from the least action of the gravity field's empirically-based "proper path" lagrangian.

(1) Convert Newtonian gravity's Poisson law, $\nabla^2 k = 4\pi G\rho/c^2$, into a tensor equation by substituting $\nabla^2 k \rightarrow R_{00} \rightarrow R_{\mu\nu}$ and $\rho \rightarrow T_{00} \rightarrow T_{\mu\nu}$, so that $R_{\mu\nu} = 4\pi G T_{\mu\nu}/c^2$ (note that $E = mc^2$ converts energy density ρ to *mass density* ρ/c^2).

(2) Recognise the local energy conservation error: *both* sides must have zero divergence, and while this is true for the Ricci tensor, $\nabla^\mu R_{\mu\nu} = 0$, it is not correct for the stress-energy tensor, $\nabla^\mu T_{\mu\nu} \neq 0$.

This makes $R_{\mu\nu} = 4\pi G T_{\mu\nu}/c^2$ fail a self-consistency test, since both sides must have *identical* divergence, but they don't: $\nabla^\mu R_{\mu\nu} \neq \nabla^\mu(4\pi G T_{\mu\nu}/c^2)$. To give an example, the free electromagnetic field energy density component of the gravitational field source tensor is $T_{00} = (\varepsilon E^2 + B^2/\mu)/(8\pi)$, which generally has a divergence.

(3) Correct $R_{\mu\nu} = 4\pi G T_{\mu\nu}/c^2$ for local energy conservation by recognising that Bianchi's formula allows the replacement of the wrong divergence, $\nabla^\mu T_{\mu\nu} \neq 0$, with: $\nabla^\mu(T_{\mu\nu} - \frac{1}{2}Tg_{\mu\nu}) = 0$, implying the stress-energy tensor correction, $T_{\mu\nu} \rightarrow T_{\mu\nu} - \frac{1}{2}Tg_{\mu\nu}$.

The term $T_{\mu\nu} - \frac{1}{2}Tg_{\mu\nu}$ has zero divergence because subtracting $\frac{1}{2}Tg_{\mu\nu}$ removes non-diverging components from the stress-energy tensor, giving the correct formula, $R_{\mu\nu} = (8\pi G/c^2)(T_{\mu\nu} - \frac{1}{2}Tg_{\mu\nu})$, which is exactly equivalent to field equation $R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 8\pi G T_{\mu\nu}/c^2$.

Einstein originally used trial and error to discover this. In his 11 November 1915 communication to the Berlin Academy[5] Einstein suggested that the solution is that the scalar trace, T, has zero divergence. But after correspondence with Hilbert who had ignored the physics and concentrated on the least action derivation, Einstein around 25 November 1915 realized from Bianchi's identity was compatible with Hilbert's tentative more abstract and guesswork mathematical approach, and the *simplest* correction is $T_{\mu\nu} \rightarrow T_{\mu\nu} - \frac{1}{2}Tg_{\mu\nu}$, which gives zero divergence. In this nascent approach, Einstein was *exploring various possibilities and trying out general ideas to solve problems, not working on an axiomatic proof.* After Einstein had the insight from Bianchi's identity, he able to grasp the *physical significance* of the result from finding the least action to free-field "proper path" Lagrangian,

$$L = Rc^4(-g)^{1/2}/(16\pi G),$$

where R is the Ricci scalar and g is the determinant $g = |g_{\mu\nu}|$ for metric tensor $g_{\mu\nu}$. Action is the Lagrangian energy density integrated over spacetime, which for a free field (with no matter) is given by gravitational field energy density:

$$S = \int L d^4x = \int R(-g)^{1/2} c^4/(16\pi G) d^4x,$$

and the law of least action states that classical laws are recovered in the limit of least action, which must be an action minima where $dS = 0$ (the Euler-Lagrange law):

$$dS = \int \{d[R(-g)^{1/2} c^4]/(16\pi G dg^{\mu\nu})\} dg^{\mu\nu} d^4x = 0,$$

hence the derivative $d[R(-g)^{1/2}]/dg^{\mu\nu} = 0$. Employing the product rule of differentiation gives:

$$d[R(-g)^{1/2}]/dg^{\mu\nu} = (-g)^{1/2} dR/dg^{\mu\nu} + (-g)^{-1/2} R d(-g)^{1/2}/dg^{\mu\nu}.$$

Therefore, in order that $dS = 0$, it follows that $(-g)^{1/2} dR/dg^{\mu\nu} + (-g)^{-1/2} R d(-g)^{1/2}/dg^{\mu\nu} = 0$, where the partial derivative of the Ricci scalar is $dR = R_{\mu\nu} dg^{\mu\nu}$, and by Jacobi's formula $dg = g g^{\mu\nu} dg_{\mu\nu}$, so that $(-g)^{-1/2} R d(-g)^{1/2}/dg^{\mu\nu} = -\frac{1}{2} R g_{\mu\nu}$. Thus,

$$d[R(-g)^{1/2}]/dg^{\mu\nu} = R_{\mu\nu} - \tfrac{1}{2} R g_{\mu\nu}.$$

This $R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu}$ rigorously corrects $R_{\mu\nu} = 4\pi G T_{\mu\nu}/c^2$. The celebrated $8\pi G/c^2$ multiplication factor of Einstein's field equation is not a G prediction, but is just the Newtonian law normalization for weak fields. Set $R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \kappa T_{\mu\nu}$ and multiply out by $g^{\mu\nu}$ (to give contractable tensor products):

$$g^{\mu\nu} R_{\mu\nu} - \tfrac{1}{2} R g^{\mu\nu} g_{\mu\nu} = \kappa g^{\mu\nu} T_{\mu\nu}.$$

Introducing the scalars $T = g^{\mu\nu} T_{\mu\nu}$ and $R = g^{\mu\nu} R_{\mu\nu}$ and the identities $g^{\mu\nu} g_{\mu\nu} = \delta_\mu{}^\mu = 4$ (for 4-dimensional spacetime) and $T = g^{00} T_{00} = \rho$, yields:

$$R - 4(\tfrac{1}{2}R) = \kappa T$$
$$R = -\kappa T = -\kappa g^{00} T_{00} = -\kappa\rho.$$

Putting this scalar curvature result into $R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \kappa T_{\mu\nu}$ and repeating the contraction procedure by multiplying out by g^{00} (note of course that $g^{00} T_{00} = \delta_0{}^0 = 1$):

$$R_{\mu\nu} = \tfrac{1}{2}(-\kappa\rho) g_{\mu\nu} + \kappa T_{\mu\nu}$$

or

$$R_{00} = \tfrac{1}{2}(-\kappa\rho) + \kappa\rho = \tfrac{1}{2}\kappa\rho.$$

Thus, in the Newtonian (non-relativistic) limit, $R_{00} = \frac{1}{2}\kappa\rho = \nabla^2 k = 4\pi G\rho/c^2$, so $\frac{1}{2}\kappa\rho = 4\pi G\rho/c^2$, or $\kappa = 8\pi G/c^2$.

If a term for the kinetic energy of matter, L_m is added to the free field Lagrangian for the action, the variation of the Lagrangian by amount $dg^{\mu\nu}$ then produces a formula for the contributions by matter to the stress-energy tensor, $T_{\mu\nu} = -2(dL_m/dg^{\mu\nu}) + g_{\mu\nu} L_m$. Einstein's "cosmological constant," Λ (lambda), can be included by changing the free field part of the Lagrangian to $L = (R - 2\Lambda) c^4 (-g)^{1/2}/(16\pi G)$, which yields

$$R_{\mu\nu} - \tfrac{1}{2} R g_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi G T_{\mu\nu}/c^2.$$

This tragically *makes general relativity into a vague non-mechanistic speculative fiddle, like Ptolmaic epicycles,* and is used by obfuscationists to try to muddle the waters and "justify" incorrect fiddled models on the basis of the fact-based portions of general relativity. But Λ is not a checkable prediction in this equation, because it is not mechanistically linked to G, but instead is just an adjustable *ad hoc* parameter *which reduces the checkable falsifiability of the theory.* Einstein in his 1917 paper "Cosmological Considerations on the General Theory of Relativity" added Λ with a large positive (outward acceleration) value, to just cancel out gravity at the average distance between galaxies, to keep the universe static (as then allegedly observed by astronomers). Beyond the average distance of separation of galaxies, repulsion predominated in Einstein's model. There are serious falsehoods in Einstein's Λ-based static universe. First, Alexander A. Friedmann in 1922 showed it to be theoretically unstable: *any perturbation would cause the expansion or contraction of such Einstein's universe.*

Second, in 1929 Einstein's static universe was shown by Edwin Hubble's expansion evidence to be observationally false. Einstein then set $\Lambda = 0$, adopting the Friedmann-Robertson-Walker solution for the uniform curvature of a homogeneous, isotropic universe: $k = R^2[8\pi G\rho/3) - H^2]$ where H is Hubble's recession law parameter, $H = v/R$, and $R = ct$ is the scale factor. In flat spacetime, $k = 0$, and the Einstein-de Sitter critical density (needed to just make the universe collapse, *if gravity were a universal attractive force, rather than a mechanistic result of cosmological acceleration*) is $\rho_{critical} = 3H^2/(8\pi G)$, so that the ratio of the actual mass density to the critical density in flat spacetime is $\Omega = \rho/\rho_{critical} = 8\pi G\rho/(3H^2)$. The Friedmann-Lemaitre equation states:

$$a = RH^2 = (R/3)(\Lambda - 8\pi G\rho)$$

We define Λ as positive for outward acceleration. Readers will find other versions, where Λ is defined negative and multiplied by c^2 to give energy density (not mass density), or where the geometric multiplier is 4π (for Newtonian non-relativistic motion) rather than 8π (for relativistic motion).

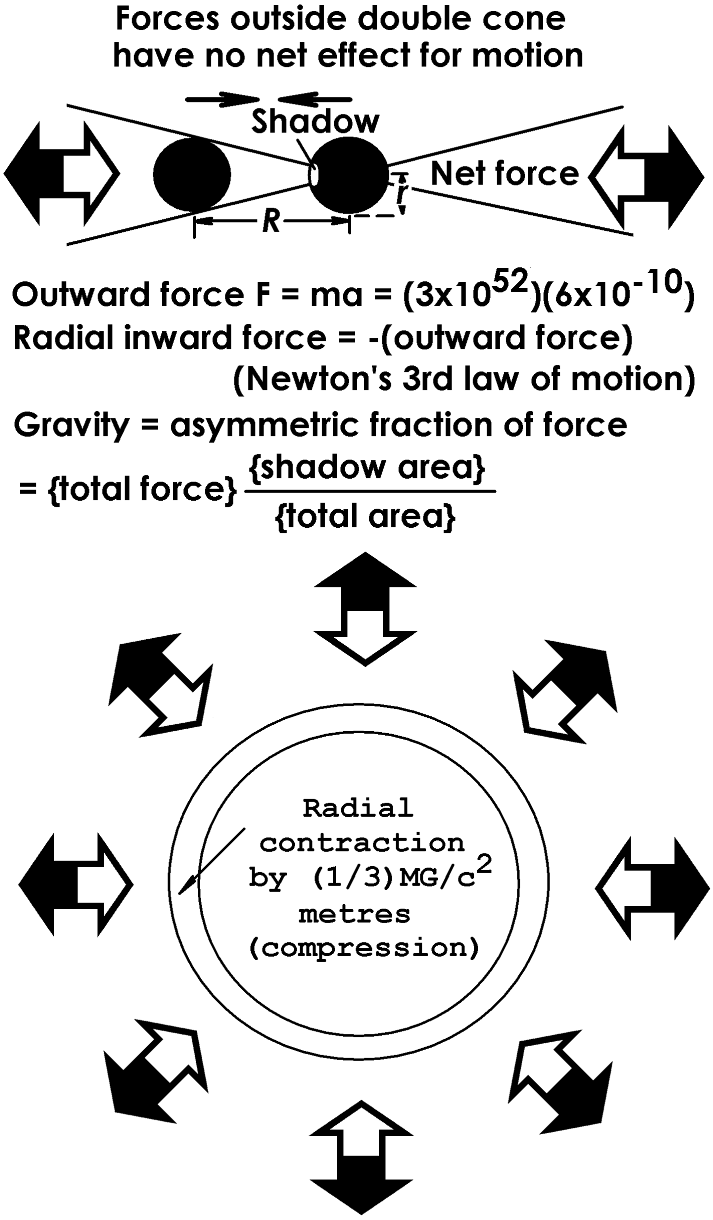


Fig. 4: Manhattan Project implosion-bomb physicist R. P. Feynman proved that 4-d "curved spacetime," reduced to 3-d, is a *radial material compression*, by "excess radius" $r = MG/(3c^2)$; the spin-1 graviton Moller-like scattering behind 3d spatial distortion which is the armwaving defence of spacetime curvature (gravitational Lorentz contraction). The gravitational potential energy for fundamental particles of mass M is $E = M^2G/r = Mc^2$, hence $r = MG/c^2$. Since the energy is spread out over three spatial dimensions, the average radial contraction is one third of that, thus $r = MG/(3c^2)$. The quantum gravity mechanism simply replaces potential energy $E = M^2G/r$, with $E = M^2c^4/(amr)$, so it *mechanically* gives Feynman's "excess radius" and "curvature." It also gives the same lagrangian as general relativity. Now derive the same result beginning with the Lorentz-FitzGerald contraction law, where lengths in the direction of motion at velocity v are contracted by the factor $(1 - v^2/c^2)^{1/2}$. The gravitational potential energy of a body in a gravity field near a mass is equal to the kinetic energy gained when the body falls (in a vacuum) to that point from a great distance; this fall velocity allows the Lorentz-RitzGerald contraction law to be applied to gravitation. Since energy is conserved, the velocity gained in such a fall is equal to the velocity needed to escape from the gravitational field, i.e., escape velocity $v = (2GM/r)^{1/2}$. Insert this into the Lorentz factor $(1 - v^2/c^2)^{1/2}$, expand by the Binomial series, and divide the length contraction by 3 to allow for contraction spread over 3 spatial dimensions in gravitation, not 1 as in the Lorentz contraction. Roger Penrose explains how general relativity uses the same average (in *It Must Be Beautiful*): "… the volume reduction is proportional to the total mass that is surrounded by the geodesics. This volume reduction is an average of the geodesic deviation in all directions …"

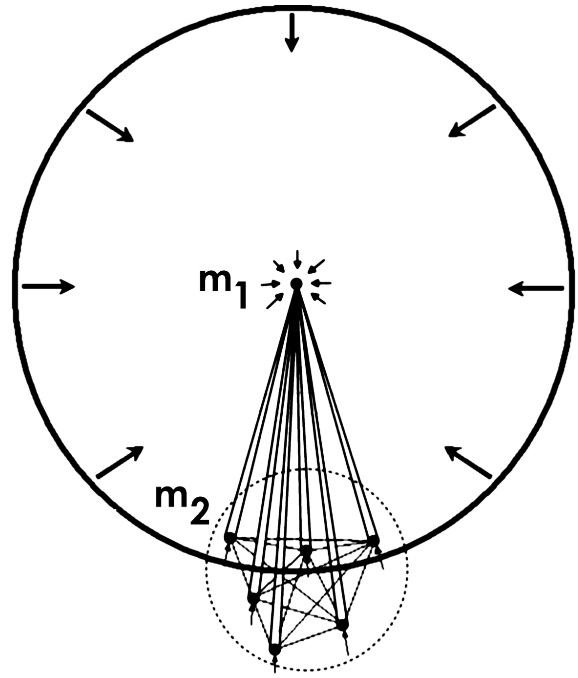


Fig. 5: The Summer/Fall 1984 *Los Alamos Science* on p24 scales the weak force neutrino-proton cross-section to graviton scattering by protons, giving the tiny black hole horizon cross-section, ~10^{-80} barns. This is so small it averts LeSage's "overlap" problem, so the amount of gravitation is proportional to the amount of mass. We therefore predicted the cosmological acceleration in 1996:

1. Large galaxy clusters repel each other by the exchange of spin-1 gravitons, causing radial cosmological acceleration *a*.

2. By Newton's 2nd law radial *outward* force $F = ma$ results (m is the accelerating universe's mass, 9 x 10^{21} stars i.e. 3 x 10^{52} kg).

3. *Newton's 3rd law predicts an equal inward force*, which turns out is mediated by gravitational force producers, spin-1 gravitons.

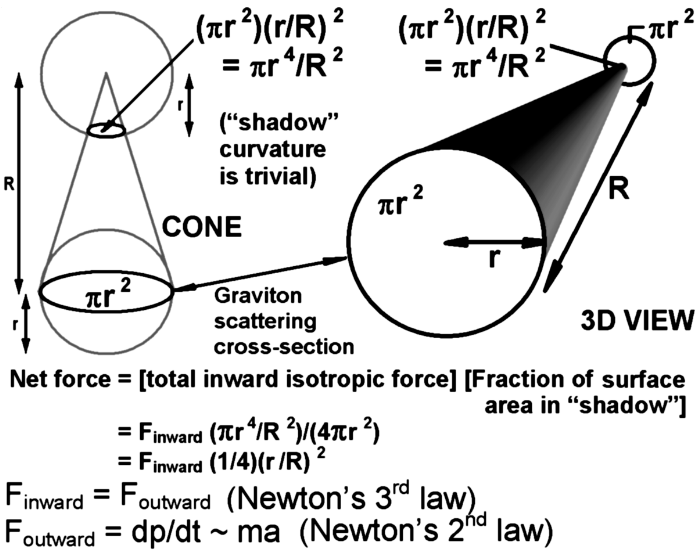


Fig. 6: this is *quantitative, permiting calculations to be made of the amount of cosmological acceleration that is required in order to produce the gravitation we actually observe when an apple falls.* So in 1996 we predicted $a = c^4/(Gm)$ before confirmation in 1998. Gravity is the *asymmetric component of the inward isotropic force*, i.e. the total inward directed radial force times the ratio of the area of a "shadow" cast on a particle to its whole surface area: $F = F_{inward}(r/R)^2/4 = ma(r/R)^2/4 = M^2G/R^2$, where $r = 2GM/c^2$, predicting $a = c^4/(Gm) = 7 \times 10^{-10}$ ms^{-2}. In "explaining" general relativity, it is a tradition to say that "raisins move away from one another in a baking cake, as dough expands." But pressure from dough *pushes nearby raisins together.* Likewise, local masses have trivial mutual repulsion, so are *pushed together by large, distant masses.*

"By the end of the 1950s, [Geoffrey] Chew was calling this [analytic development of Heisenberg's empirical scattering or S-matrix] the bootstrap philosophy. Because of analyticity, each particle's interactions with all others would somehow determine its own basic properties and ... the whole theory would somehow 'pull itself up by its own bootstraps'."

- Peter Woit, *Not Even Wrong*, Jonathan Cape, London, 2006, p148.

Quantum gravity is a "bootstrap" theory: gravitational fields are not intrinsically attractive but repulsive, and apparent attraction is an emergent geometrical effect, generated in the universe by repulsive forces converging inwards from the surrounding, outward-accelerating matter around the observer. The mainstream failure to develop a checkable quantum field theory of gravitation has been the implicit reductionist fallacy of Pauli and Fierz's 1939 analysis of gravitational forces between two masses, which *assumes* that indeed they will attract one another, despite the lack of any observational evidence for this unnatural, contrived situation which is contrary to all observations.

Nobody has ever provided any evidence for the existence of a universe containing just two masses, in which they attract. The first "bootstrap" concept started to emerge under the leadership of Geoffrey Chew in the mainstream Heisenberg scattering or S-matrix of particle physics, while gauge theory was still an "alternative idea." Gauge theory started to become mainstream after the Standard Model was confirmed experimentally in 1973:

o 1925: *Heisenberg's matrix mechanics (1st quantization)*
o 1926: *Schroedinger's wave mechanics (1st quantization, equivalent to Heisenberg's non-relativistic 1st quantization)*
o 1927-29: *Jordan's and Dirac's 2nd quantization (field is quantized as offshell "field quanta", leading to the Dirac "interaction picture" in 1931)*
o 1928: *Dirac equation predicts antimatter*
o 1929: *London and Weyl's gauge symmetry of QED, assumed U(1)*
o 1948: *Feynman's path integral (multipath interference) QM/QFT*
o 1949: *Feynman-Tomonoga-Schwinger-Dyson abelian (QED) renormalization*
o 1954: *Yang-Mills-Shaw-Utiyama non-abelian SU(2) gauge theory*
o 1967: *Glashow-Weinberg-Salam weak SU(2) gauge theory*
o 1971: *Renormalized non-abelian gauge theory (Gerard 't Hooft)*
o 1973: *SU(2) Z-boson mediated neutral currents discovered*
o 1983: *SU(2) charged W-bosons discovered at CERN*

Weyl's local gauge invariance for gravity and QED

In 1918, Emmy Noether published a theorem derived in 1915, connecting conservation laws to global symmetries and invariant lagrangians. The application to quantum gravity was first attempted by Herman Weyl in 1918, when he developed a *local* BRST (complex space)-type gauge connection of the general relativity metric(6), basically the equation

$$g_{\mu\nu}' = g_{\mu\nu} \exp[\int\{iq/(\hbar c)\} \nabla \times A_\mu \, dS].$$

This quantizes the metric of general relativity $g_{\mu\nu}$ as the real, discrete eigenvalues of the complex exponent, so the metric is now a function of Maxwell's electromagnetic vector potential, A_μ. Einstein rejected this connection between gravity and electromagnetism due to a dependence of line spectra on the metric, but Schroedinger in 1922(7) used the real solution eigenvalues from Weyl's complex exponent to "explain" quantized Bohr orbits, *assuming that the real solutions are the discrete observed electron states, while the imaginary (complex) solutions are unobservable.* In 1926, Schroedinger(8) reformulated Weyl's complex exponent into the Schroedinger wave equation of quantum mechanics, and in 1929 Weyl(9) took up London's suggestion(10) of using the complex phase factor to locally gauge the wavefunction of quantum mechanics ψ, not the metric of general relativity, thus: $\psi_S = \psi_0 e^{iS/\hbar}$. London's idea came from Schroedinger's, which in turn came from Weyl's 1918 paper. Weyl's 1929 QED gauge theory is often said to be an Abelian U(1) theory, with neutral field quanta U(1) is quantum gravity, so Weyl had quantum gravity in 1929. The fact SU(2) Yang-Mills wasn't discovered until 1954 or proved for weak interactions until 1973 allowed a hardened dogmatic mis-assignment of electrodynamics to U(1). This tragedy was due to Weyl's "beauty" bias and guesswork plunge, before Dirac's positron was first proposed in 1930 after Dirac was pushed by J. R. Oppenheimer. In 1929, Dirac was claiming the electron's antiparticle to be the *proton*. Weyl ignored the SU(2) spinors of electrodynamics (Pauli and Dirac matrices) when claiming in 1929 that electrodynamics is U(1). Also, *nobody has every observed any fundamental charge core,* only the *charged* fields surrounding it, *which do have "inductive" charge properties expected for charged bosons.* The imbalance between "matter" and "antimatter" shows that U(1) is not correct for electrodynamics. Moving electrodynamics to massless SU(2) fields, *the left-handed neutrino prejudice for massive weak SU(2) fields translates to SU(2) electrodynamics as the excess of matter over antimatter.*

The real wavefunction, $\psi_S = \psi_0 e^{iS/\hbar}$ is obviously variable, but the squared modulus of its product with its conjugate or adjoint field, $\bar{\psi}_S = \bar{\psi}_0 e^{-iS/\hbar}$, is invariant: $|\psi_S \bar{\psi}_S|^2 = |\psi_0 \bar{\psi}_0|^2$. Although the *real wavefunction* ψ must vary, the *conjugate of the wavefunction*, ψ, is also varying, but in precisely *opposite phase to the real wavefunction.* This is exactly analogous to the opposing, out-of-phase radio emissions from accelerating charges in the two conductors of a power transmission line. Employing the product and exponent differentiation rules, $d(uv) = (u\,dv) + (v\,du)$ and $de^{f(x)}/dx = f'(x)e^{f(x)}$, gives:

$$\begin{aligned} d_\mu \psi_S &= d_\mu(\psi_0 e^{iS/\hbar}) \\ &= e^{iS/\hbar} d_\mu \psi_0 + \psi_0 (d_\mu e^{iS/\hbar}) \\ &= e^{iS/\hbar} d_\mu \psi_0 + \psi_0 (i e^{iS/\hbar} d_\mu S/\hbar) \\ &= e^{iS/\hbar} [d_\mu \psi_0 + (i/\hbar)(d_\mu S)\psi_0] \end{aligned}$$

This local phase transformation, $d_\mu \psi_S = e^{iS/\hbar} [d_\mu \psi_0 + (i/\hbar)(d_\mu S)\psi_0]$, differs from the value of $d_\mu \psi_S = d_\mu \psi_0 e^{iS/\hbar}$ which is required for local phase invariance. Note that $d_\mu \psi_S = d_\mu \psi_0 e^{iS/\hbar}$ is simply obtained by replacing ψ_S and ψ_0 with the incremental variations $d_\mu \psi_S$ and $d_\mu \psi_0$ respectively, in $\psi_S = \psi_0 e^{iS/\hbar}$. Weyl thus realised that the term $(i/\hbar)(d_\mu S)\psi_0$ prevented local phase invariance, and had to be eliminated, which he achieved by replacing the ordinary derivative d_μ by one which eliminates this variance, which is the covariant derivative, $D_\mu = d_\mu - iqA_\mu$. This is called the "minimal coupling procedure" of QED, and iqA_μ is the effect of the *simplest* quantum interaction between the charge q and the field A_μ, so it is the first in an infinite series of Feynman diagrams. Since the corrections for more complex Feynman diagrams are tiny, this "minimal coupling procedure" is Dirac's equation law and is a very good approximation at low energy (it omits the higher order vacuum looped diagram corrections, which are depicted by the Feynman diagrams with more than two vertices). Dirac's minimal coupling equation underestimates the electron's magnetic moment by only 0.116%. *In U(1) quantum gravity only this minimal coupling procedure exists, because there is no anti-gravity charge so no gravitational pairs or loops can form which are polarized by gravitational fields.* (Mass renormalization in QED comes from the electromagnetic fields, *not* gravity, as we prove later.).

This definition for D_μ has been selected to give a Lagrangian with the correct local phase transformation. Inserting $D_\mu = d_\mu - iqA_\mu$ into the local phase transformation and solving yields the modified field vector potential, $(A_\mu)_S = (A_\mu)_0 + \{1/(q\hbar)\}d_\mu S$. The term $\{1/(q\hbar)\}d_\mu S$ therefore prevents the *overall* Lagrangian of the electromagnetic field from being changed when the phase changes. Classical laws follow the principle of least action and thus are represented by the equation $d_\mu S = 0$. Therefore, there is a simple relationship between the classical and quantum laws. The scalar kinetic energy density in a Lagrangian is proportional to $\frac{1}{2}(d_\mu \psi)^2$. Performing the minimal coupling procedure on the generic $\psi_S = \psi_0 e^{iqZ}$ results in $d_\mu \psi_S = e^{iqZ} (d_\mu \psi_0 + iq\, \psi_0 dZ)$.

Thus, summarizing Weyl's 1929 gauge theory: the wavefunction phase change $\psi_S = \psi_0 e^{iS/\hbar}$ is accompanied by field vector potential change $(A_\mu)_S = (A_\mu)_0 + d_\mu S/(q\hbar)$. This shows quantitatively how the field A_μ is modified when the wavefunction ψ changes. The modification keeps the lagrangian invariant, by adding a local phase symmetry to the global symmetries inherent from the conservation laws enbodied by the Lagrangian, so *adding the field interaction term to the Dirac Lagrangian, gives a new Lagrangian called the "quantum electrodynamics" Lagrangian, which includes both the electromagnetic field Lagrangian and the the Dirac Lagrangian, and does have local phase invariance.* Modifying field vector potential A_μ to make the Lagrangian invariant for local wavefunction phase changes is the basic Dirac interaction between matter and photons.

This Dirac interaction corresponds to the simplest of all Feynman interaction diagrams; the interaction of a charged particle with a photon, depicted on a Feynman spacetime diagram as a straight line (the charged particle) being deflected by interaction with a wavy line (the photon). Since there is only one vertex on the diagram, the interaction amplitude is proportional to three factors: (1) the relative electromagnetic interaction charge size or "coupling", *q*, (2) the size of the current, J^μ, caused by the motion of the charge in spacetime, and (3) the amplitude of the electromagnetic field strength delivered by the photon's field A_μ. Therefore the interaction amplitude is proportional to $qJ^\mu A_\mu$. The electromagnetic Lagrangian energy density, $\mathcal{L}_{\mathrm{EM}}$, is then the sum of the field energy density, $-\frac{1}{4}F^{\mu\nu}F_{\mu\nu}$, and the Dirac matter energy density: $\mathcal{L}_{\mathrm{EM}} = -\frac{1}{4}F^{\mu\nu}F_{\mu\nu} + \mathcal{L}_{\mathrm{Dirac}}$, where Dirac's equation $(i\gamma^\mu d_\mu - m)\psi = 0$ produces a free field Lagrangian energy density (for the simplest Feynman diagram), $\mathcal{L}_{\mathrm{Dirac}} = \bar{\psi}\,(i\gamma^\mu d_\mu - m)\psi$, where γ^μ are the Dirac gamma matrices. In the minimal coupling procedure for local phase invariance (already explained), Dirac's d_μ is replaced by $D_\mu = d_\mu - iqA_\mu$, so:

$$\begin{aligned}\mathcal{L}_{\mathrm{EM}} &= -\tfrac{1}{4}F^{\mu\nu}F_{\mu\nu} + \mathcal{L}_{\mathrm{Dirac}}\\ &= -\tfrac{1}{4}F^{\mu\nu}F_{\mu\nu} + \bar{\psi}\,(i\gamma^\mu D_\mu - m)\psi\\ &= -\tfrac{1}{4}F^{\mu\nu}F_{\mu\nu} + \bar{\psi}[i\gamma^\mu (d_\mu - iqA_\mu) - m]\psi\\ &= -\tfrac{1}{4}F^{\mu\nu}F_{\mu\nu} + i\,\bar{\psi}\gamma^\mu d_\mu\psi - \bar{\psi}\gamma^\mu qA_\mu\psi - \bar{\psi}m\psi\\ &= -\tfrac{1}{4}F^{\mu\nu}F_{\mu\nu} + i\,\bar{\psi}\gamma^\mu d_\mu\psi - qJ^\mu A_\mu - \bar{\psi}\,m\psi,\end{aligned}$$

where the electric current density $J^\mu = \bar{\psi}\gamma^\mu\psi$.

Hence, Dirac's Lagrangian *field interaction* term, $qJ^\mu A_\mu$, appears in the electromagnetic Lagrangian. Note it is a continuous differential equation, which doesn't model the discrete impulses from quanta exchanges. The electromagnetic field strength tensor, $F_{\mu\nu} = d_\mu A_\nu - d_\nu A_\mu$, is invariant under local symmetry phase changes, $(F_{\mu\nu})_S = (F_{\mu\nu})_0$. $F^{\mu\nu} = d^\mu A^\nu - d^\nu A^\mu$. The mass term in the electromagnetic Lagrangian above, $\bar{\psi}m\psi$, purely ascribes mass to the electron of wavefunction ψ, not to the field. A separate term must be added for the mass of field quanta, so a separate field gives mass to SU(2) weak field quanta. *Although such mass terms can be added in such a way that the local phase invariance (Langrangian symmetry) is maintained, the mass of field quanta leads to unphysical momenta at high energy which prevents successful renormalization unless their mass disappears at very high energy. A Higgs mechanism is usually used to do this, breaking electroweak symmetry.*

The spin-2 gravitons myth: an arm-waving falsehood

"There is a general belief, reinforced by statements in standard textbooks, that: (i) one can obtain the full non-linear Einstein theory of gravity by coupling a massless, spin-2 field h_{ab} self-consistently to the total energy momentum tensor, including its own; (ii) this procedure is unique and leads to Einstein-Hilbert action and (iii) it only uses standard concepts in Lorentz invariant field theory and does not involve any geometrical assumptions. … we prove that it is *impossible* to obtain the Einstein-Hilbert (EH) action, starting from the standard action for gravitons in linear theory and iterating repeatedly. ... Second, we use the Taylor series expansion of the action for Einstein's theory, to identify the tensor S_{ab}, to which the graviton field h_{ab} couples to the lowest order (through a term of the form $S_{ab}h_{ab}$ in the lagrangian). We show that the second rank tensor S_{ab} is *not* the conventional energy momentum tensor T_{ab} of the graviton and provide an explanation for this feature. Third, we construct the full nonlinear Einstein's theory with the source being spin-0 field, spin-1 field or relativistic particles by explicitly coupling the spin-2 field to this second rank tensor S_{ab} order by order and summing up the infinite series. Finally, we construct the theory obtained by self consistently coupling h_{ab} to the conventional energy momentum tensor T_{ab} order by order and show that this does *not* lead to Einstein's theory."

- T. Padmanabhan, *From Gravitons to Gravity: Myths and Reality,* http://arxiv.org/abs/gr-qc/0409089, p. 1.

In May 2007, the comments section at *Cosmic Variance* weblog for its post *String theory: not dead yet* [11] contained the following comments on spin-2 graviton prejudices. String theory was defended on the basis that it "predicts the spin-2 graviton," but nobody has any *evidence* for a spin-2 graviton, and the 1939 Pauli-Fierz arm-waving[12] was wrong.

Dr Rob Knop (May 24th, 2007 at 12:37 pm):

"I hear this 'string theory demands the graviton' thing a lot, but the only explanation I've seen is that it predicts a spin-2 particle."

Dr Aaron Bergman (May 24th, 2007 at 12:44 pm):

"A massless spin 2 particle is pretty much required to be a graviton by some results that go back to Feynman, I think."

This contradicts *The Feynman Lectures on Gravitation,* p. 30.

Moshe (May 24th, 2007 at 2:12 pm):

"Rob, in addition to all the excellent reasons why a massless spin 2 particle must be the graviton, there are also explicit calculations demonstrating that forgone conclusion …"

Such calculations can be found in Professor Zee's book,[13] *Quantum Field Theory in a Nutshell.* They *implicitly assume* a universe containing *only two masses, which somehow attract.* It is a fact that *if* the universe only contained two masses and *if* they *attracted,* then gravity *would* be mediated by spin-2 gravitons. But it *doesn't* contain just *two* masses, and even if it *did,* in 1996 we showed they just *repel* (spin-1 quanta exchange).

Professor John Baez (May 25th, 2007 at 10:55 am):

"Aaron Bergman wrote: 'A massless spin 2 particle is pretty much required to be a graviton by some results that go back to Feynman, I think.'

"Hmm. That sounds like a 'folk theorem': a theorem without assumptions, proof or even a precise statement. Whatever these results are, they need to have extra assumptions. … So, it would be interesting to look at the results you're talking about, and see what they actually say. ..."

Professor John Baez (May 25th, 2007 at 12:23 pm):

"B writes: 'The spin 2 particle can only couple to the energy-momentum tensor - as gravity does..' Oh? Why?"

Professor Sean Carroll (May 25th, 2007 at 12:31 pm):

"…the point is that the massless spin-2 field is described by a symmetric two-index [rank-2] tensor with a certain gauge symmetry. … So its source must be a symmetric divergenceless two-index tensor. Basically you don't have that many of them lying around, although I don't know the rigorous statement to that effect."

Proof is "unfashionable physics." *If you "don't know" a "rigorous statement" to that effect, then you have no scientific, objective basis to claim gravity "must" be a symmetric divergenceless rank-2 tensor.* Only pseudoscience relies on *ignorance* being used to "*defend" speculation*s. Making an *assertive* claim that something "must" be needed, and then adding at the *end* an admission that you *simply don't know any rigorous proof of that,* is a classic tactic of political obfuscation, not science. (It's like recent hour-long BBC2 TV *Horizon* pro-string pseudo-physics adverts, spending almost an hour hyping falsehoods and a minute, or less, self-righteously preaching that science relies on *critical scepticism,* despite the long-hyping string deception.)

Later, *Cosmic Variance* hosted *String Wars: the Aftermath* [14]:

Dr Peter Woit (April 13th, 2009 at 8:42 am):

"If you look at the history of any failed speculative idea about physics, what you'll find is that the proponents of the failed idea rarely publicly admit that it's wrong. Instead they start making excuses about how it could still be right, but it's just too hard to make progress. … This is what is happening to the speculative idea of string-based unification."

Dr Peter Woit (April 13th, 2009 at 2:49 pm):

"What I see as a big negative coming out of string theory is the ideology that the way to unify particle physics and gravity is via a 10/11d string/M-theory. ... note that we don't understand the electroweak theory non-perturbatively ..."

General relativity prejudices in quantum gravity

Tolman, Ehrenfest, Podolsky and Wheeler asked this question[(15)] of general relativity's treatment of light photons: if light has gravitational charge, why don't photons moving parallel to one another, from distant stars, "attract" one another, contracting the beam of starlight while it travels many light years to reach us? Various answers are possible. The weak 10^{-40} strength of the relative gravitational coupling suggests that the effect is likely to be small, so that observations do not automatically rule it out. Another suggestion[(16)] is that gravity is alleged to have a repulsive component, in *addition* to the usual assumption of spin-2 for attraction, to conveniently cancel out the *assumed* attraction between photons moving parallel to one another. (An ever-downplayed problem, when theorizing utilizes the kind of Einstein "thought experiments" that are *not solidly founded on hard facts,* is that "logic" easily "proves" false conclusions, due to biased assumptions. The old example is the person who *isolates the wrong variable by a flawed theoretical analysis of observation data:* if drinking whisky and water, or gin and water, makes you ill, then the "common factor" is water, so you then claim to deduce that water is making you unwell.)

Where gravitational research goes wrong is searching for solutions to general relativity, *instead of examining and correcting the foundations of general relativity, namely its explicit assumption that Newtonian gravity is correct as the low energy, non-relativistic asymptotic limit, which is used to normalize general relativity.* G. Sparano, G. Vilasi and S. Vilasi's January 2011 paper, *The gravity of light,*[(17)] is a fascinating example of the rigor (*mortis*) constraining mainstream researchers working within epicycle-type general relativity dogmas. In this quotation note the vague (non-quantitative) *intuitive idea* that a spin-1 gravitiphotons may *contribute* to dark energy):

"... there exist physically meaningful solutions of Einstein equations which are not Fourier expandable and nevertheless whose associated energy is finite. For some of these solutions the standard analysis shows that spin-1 components cannot be killed [F. Canfora and G. Vilasi, *Phys. Lett.* B 585, 193 (2004); F. Canfora, G. Vilasi, and P. Vitale, *Int. J. Mod. Phys.* B 18, 527 (2004)]; this implies that repulsive aspects of gravity are possible within pure General Relativity, i.e. without involving spurious modifications. In previous works it was shown that light is among possible sources of such spin-1 waves. … It is not clear to what extent calculations of the gravitational cross-section using QFT methods are consistent with classical GR. First studies go back to Tolman, Ehrenfest and Podolsky [*Phys. Rev.* 37, 602 (1931)] and, later, to Wheeler [*Phys. Rev.* 97, 511 (1955)] who analysed the gravitational field of light beams and the corresponding geodesics in the linear approximation of Einstein equations. … the sources of asymptotically flat PP [photon-photon] waves (which have been interpreted as spin-1 gravitational waves) repel each other. Thus, in a field theoretical perspective, PP-gravitons must have spin-1. … This repulsion turns out to be very weak ... but it could play a relevant role at cosmic scale and could give not trivial contributions to the dark energy. Therefore, together with gravitons (spin-2), one may postulate the existence of graviphotons (spin-1) and graviscalar (spin-0). ... These fields might give [F. Stacey, G. Tuck, and G. Moore, *Phys. Rev.* D 36, 2374 (1987)] two (or more) Yukawa type terms of different signs, corresponding to repulsive graviphoton exchange and attractive graviscalar exchange (range >> 200m)."

Note that the claim that "it is not clear to what extent calculations of the gravitational cross-section using QFT methods are consistent with classical GR" is obviously the major topic of concern to us, and which we have been publishing since 1996, wherever we can overcome prejudiced dogmatic hostility and bias (which is the Einstein relativity legacy).

Einstein's curved spacetime versus quantum fields

An analogy to curved spacetime in quantum field theory is Bohr's correspondence and complementarity principles to "resolve" the alleged paradox of wave-particle duality.

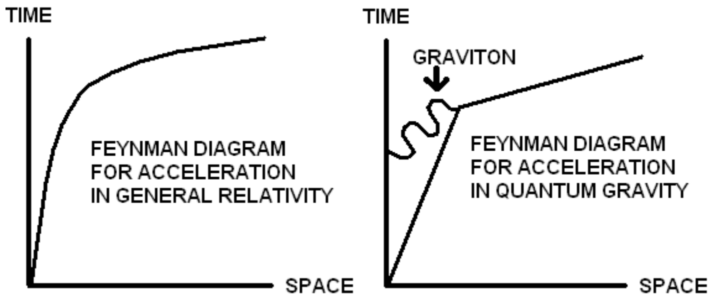


Fig. 7: if gravity is due to quantum fields like QED, there is no curved spacetime. Instead of curved spacetime, there is no mechanism for a curved path inbetween graviton impacts. The accelerating object in quantum field theory consequently is only accelerated in impulses due to discrete graviton exchanges. The difference between smooth (differentiable) acceleration and discrete impacts causes effects even in classical physics, where Brownian motion is the breakdown of the theory of continuous air pressure for small areas, where individual air molecule impulses become important. In the 1950s, early efforts to predict fallout from high mushroom clouds used Stokes's law for drag, which underestimate the fallout of small particles at high altitudes (low density air). This is because *fallout particles decends with freefall acceleration in between discrete air molecule impacts*, which occur at a reduced rate in low density air. The point we are making is that *even in classical physics,* the concept of continuously differentiable force breaks down, and becomes very dangerous and misleading in our discontinuous real world. Today's quantum field theory is only *half quantized,* since it still contains continuous Maxwell and Yang-Mills differential field equations (the bending field line picture), which is a classical concept like spacetime curvature. Calculus is strictly valid as an approximation *only for very large rates of discrete interactions.* The strictly correct mathematical description of quantum fields is a *Monte Carlo random sum over histories,* not a path integral of differential approximations.

For example, consider possible sophistry in the 2009 paper, *The Formulation of Quantum Field Theory in Curved Spacetime,*[(18)] by Dr Robert Wald (author of *Quantum Field Theory on Curved Spacetimes and Black Hole Thermodynamics*), which states:

"Quantum field theory in curved spacetime is a theory wherein matter is treated fully in accord with the principles of quantum field theory, but gravity is treated classically in accord with general relativity. It is not expected to be an exact theory of nature, but it should provide a good approximate description in circumstances where the quantum effects of gravity itself do not play a dominant role. Despite its classical treatment of gravity, quantum field theory in curved spacetime has provided us with some of the deepest insights we presently have into the nature of quantum gravity."

The "deepest insights" from quantum field theory in curved spacetime were *speculations,* and no situation exists "where the quantum effects of gravity itself do not play a dominant role." *Wald may possibly be assuming that quantum gravity effects are only apparent at very high energy, and that some other effect more classical effect causes gravity at low energy.* However, he *doesn't explain what he thinks is causing low-energy gravitational phenomena.* This convenient confusion is analogous to the bias in theoretical physics which only considers quantum field theory effects in high-energy physics phenomena, *when in fact all fundamental force phenomena are due to quantum fields, regardless of the energy.* In other words, the classical laws which work approximately at low energy are falsely treated as a correct theory of physics, and quantum field theory phenomena is then treated as a modification to the classical low-energy approximation that you just add when treating phenomena occurring at high energy. However, *checked* black hole thermodynamics, a *corrected, fully confirmed theory* of Hawking radiation from black holes (not the simplistic error-filled treatment by Hawking), are due to the *non-curved spacetime* quantum gravity gauge theory, *so claims about the "deep insights" from curved spacetime* act as obfuscation, drawing researcher "peer"-reviewers from carefully reading checked theories. Wald:[19]

"... we know from general relativity that spacetime is not flat, and, indeed, there are very interesting quantum field theory phenomena that occur in contexts - such as in the early universe and near black holes - where spacetime cannot be approximated as nearby flat."

But spacetime is *fundamentally* flat observationally; there is *no curved space behind general relativity predictions since accelerations are better modelled by discontinuous quantum impacts in flat spacetime. This predicted the cosmological acceleration of the universe correctly in 1996, ahead of observational confirmation.* The claim "we know from general relativity that spacetime is not flat" is a circular argument, a conflation of general relativity with fact; general relativity is *a poor description* of gravitational phenomena. General relativity *assumes* curved spacetime, so you cannot claim that general relativity *predicts or proves curved spacetime is flat.* Wald conveniently confuses *assumptions* for *results.*

General relativity's confirmed predictions are not dependent upon the assumption of curves spacetime. In order to claim that its curved spacetime is an output from the theory, you would a separate proof that general relativity's curved spacetime is a the only possible model. Wald doesn't supply that. Our point is that Wald's approach is holding up physics. The Pythagoreans, an elitist academia cult, used secrecy and obfuscation as a power base, similar to maintaining secrecy over magic tricks in order to "attract curiosity and interest," while drowning the discoverer of irrational numbers. This is what happens when unproved claims are asserted dogmatically in science by well-respected authority figures; the little messengers who discover problems are easily shot or censored out by popular fashion. Fashion which is not based on hard proved fact will by definition cause problems when by promoting prejudice or bias. Some effect from a high rate of graviton exchange can be modelled approximately by curved spacetime, but this isn't a hard proof for curvature.

After his assertion that curved spacetime is the basis of successful black hole thermodynamic predictions of general relativity and the big bang (disproved later in this paper), Wald then adds his own view that the search for a preferred vacuum state is "fruitless," *based not on a proof but on decades of failure:*[20]

"In my view, the quest for a 'preferred vacuum state' in quantum field theory in curved spacetime is much like the quest for a 'preferred coordinate system' in classical general relativity. After our more than 90 years of experience with classical general relativity, there is a consensus that it is fruitless to seek a preferred coordinate system for general spacetimes, and that the theory is best formulated geometrically, wherein one does not have to specify a choice of coordinate system in order to formulate the theory. Similarly, after our more than 40 years of experience with quantum field theory in curved spacetime, it seems similarly clear to me that it is fruitless to seek a preferred vacuum state for general spacetimes ..."

It is clearly vacuous to dismiss a search as fruitless after 90 or 40 years of failure, when evidence for Aristarchus's solar system, proposed circa 250 A.D., emerged from the research of Copernicus, Kepler and Newton over 1750 years later. This is also a good argument against taking the Michelson-Morley experiment's *failure* to detect absolute motion to be proof that absolute motion does not exist, especially when FitzGerald and Lorentz showed that the $(1 - v^2/c^2)^{1/2}$ contraction factor for the instrument in the direction of motion by a spacetime fabric cloaks absolute motion, preventing the instrument from detecting it. Wald simply *ignores* the discovery of the 3 mK cosine redshift/blueshift anisotropy in the cosmic background radiation proving a motion of the Milky Way towards Andromeda at 600 km/s.

This discovery was made originally from U2 aircraft detectors by Richard A. Muller and publicised in his *Scientific American* article *The cosmic background radiation and the new aether drift,*[21] which states that the anisotropy in the cosmic background radiation "reveals the earth's motion with respect to the universe as a whole." More sensitive measurements with satellites like COBE and WMAP have increased the accuracy of this data, but it is nevertheless ignored by relativists, who refuse to accept the cosmic background radiation as the "reference frame" of the universe, despite the fact that this radiation was in thermal equilibrium with the ions and electrons in the universe until the universe became transparent when atoms formed.

The search Wald claims to have been "fruitless" was a success, but hardened dogmatic delusion keeps media and obfuscation funding from seeing through the "groupthink" orthodox fashion, politics, history and literature. Contrived "arguments" are now replaced by bitter *status quo* prejudice:

Sent: 02/01/03 17:47
Subject: Your_manuscript LZ8276 Cook
... Physical Review Letters does not, in general, publish papers on alternatives to currently accepted theories. ...
Yours sincerely,
Stanley G. Brown, Editor, Physical Review Letters

nature

Porters South
4-6 Crinan Street
London N1 9XW

Tel: +44 (0)171 833 4000
Fax: +44 (0)171 843 4596/7
email: nature@nature.com

25 November 1996

Nigel Cook
[redacted]

Dear Mr Cook:

Thank you for your letter of 20 November. I am writing to confirm that we are not able to offer to publish your manuscript and I am therefore returning all the copies that we have. I should add that this is an editorial decision and that we have not communicated the contents of your paper to any person outside this office.

Yours sincerely,

Dr Philip Campbell
Editor

Macmillan Magazines Ltd
Registered Office:
Brunel Road, Houndmills
Basingstoke, Hampshire RG21 6XS
Registered Number: 939565 England

nature

Porters South
4-6 Crinan Street
London N1 9XW

Tel: +44 (0)171 833 4000
Fax: +44 (0)171 843 4596/7
email: nature@nature.com

26 November 1996

Nigel Cook
[redacted]

Dear Mr Cook,

Thank you for your proposal for a review article on the unification of electricity and gravity. I regret that after some discussion, we feel that such an article would be unsuitable for publication in *Nature*. Thank you, nevertheless, for your interest.

Yours sincerely,

Karl Ziemelis
Physical Sciences Editor

Macmillan Magazines Ltd
Registered Office:
Brunel Road, Houndmills
Basingstoke, Hampshire RG21 6XS
Registered Number: 939565 England

Fig. 8: why is this checked prediction not hyped by all "suitable" journals? The more "suitable" a journal is, the more red tape elitism, pedantics and fashion-prejudice, protecting short-term prestige/funding. On 25 and 26 November 1996, after months of waiting, *Nature's* editor Dr Campbell and his Physical Sciences Editor Dr Ziemelis responded to reject as "unsuitable" a vital prediction of the cosmological acceleration, in the paper, *Review of the Unification of Electromagnetism and Gravitation.* Having checkable predictions published in "irrelevant" journals (e.g., via page 896 of the October 1996 issue of *Electronics World,* which was more appreciative of fact-based predictions than *Nature*) *destroyed any hope of overcoming local bigotry and gaining any PhD research funding, and also ensured that Dr Saul Perlmutter and others who confirmed the prediction did not bother to mention the confirmation in 1998. This censorship is still essential for the continued funding of spin-2 graviton superstring "theory".* Attempts to publish *after the discovery was confirmed* were and are met with abuse dressed as a patient explanation that spin-2 string hype is more lucrative.

NewScientist

151 Wardour Street, London W1V 4BN
Phone: 0171 331 2701 Fax: 0171 331 2777 http://www.newscientist.com Email: enquiries@newscientist.com

June 9, 1998

Nigel Cook
[redacted]

Dear Nigel Cook,

Thank you for your letter of June 1. I am sorry to say that we do not accept original scientific work for publication in *New Scientist*. We are a popular science magazine, not an academic journal. You need to send the work to which you refer to a peer-reviewed specialist journal which represents the appropriate discipline. They will have the experts able to provide a solid opinion of your work.

Thank you for your interest in *New Scientist*

Yours sincerely,

John Hoyland
pp Alun Anderson PhD
Editor

Fig. 9: all popular science journal editors think alike (this is called *fashion*). *Why not simply publish somewhere else that's also fashionable, thus overcoming fashion prejudice?* After publishing (in *Electronics World* and *Science World* ISSN 1367-6172) the correct prediction of the cosmological acceleration in October 1996 and February 1997, and having it confirmed in 1998, we sent the news (censored by string "theorist" "peer-"reviewers for *Classical and Quantum Gravity*, *Nature, PRL, et al.*) to the *New Scientist,* and received this letter, alleging that it was "original scientific work" (*we had already published in 1996/7, as our unread article pointed out*) and *assumed that there was already an "appropriate discipline" with existing "peers,"* when this is a totally new science, opposed by the bitter, deluded spin-2 string theory hyping *status quo*. John Hoyland and Alun Anderson *continued to send letters declining to publish the fact that Perlmutter had confirmed quantum gravity in 1998.* It is not an incompetent error, but a deliberate policy backed by false, contrived "excuses," *ignoring* all clear repudiations. Unfashionable facts contradict the spin-2 fiction.

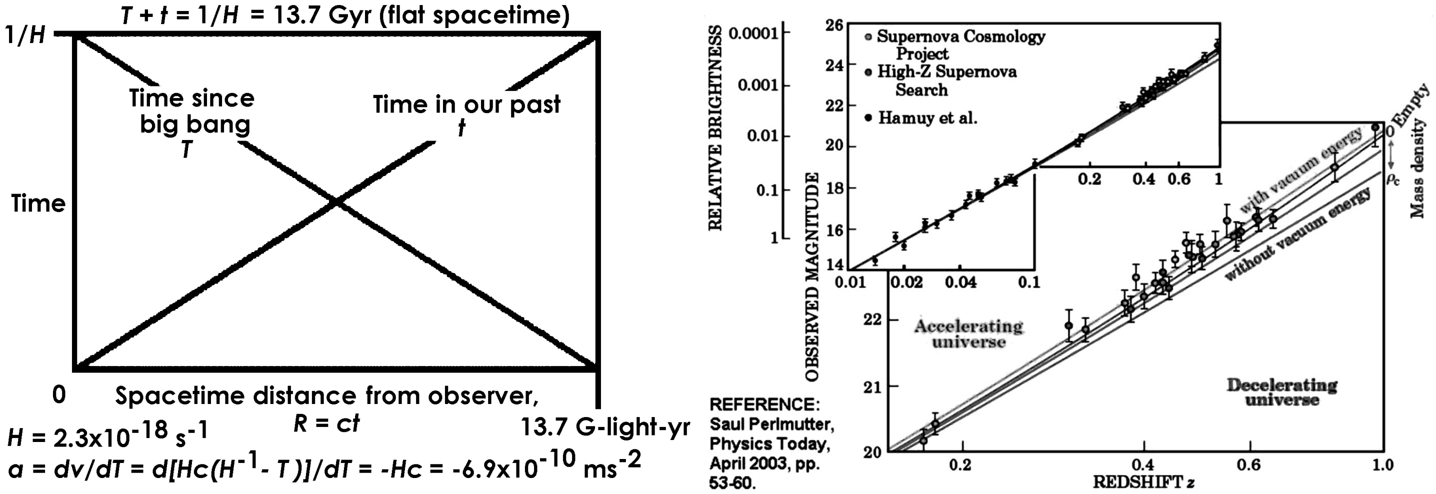


Fig. 10: alternative prediction of the *effective* spacetime cosmological acceleration, by using Hubble's empirical recession law, $v = HR = Hct$. This also predicted in 1996 the cosmological acceleration $a = Hc = 6.9 \times 10^{-10}$ ms^{-2}, *independently of the quantum gravity mechanism*. The graphs on the right show experimental data first published in 1998, confirming our 1996 predictions. The observed acceleration ($a \sim Hc$) is given in Lee Smolin's book, *The Trouble with Physics* (Houghton Mifflin, N. Y., 2006, p. 209).

In the general relativity based model, cosmological acceleration and gravity are treated as physically separate variables, and gravity is assumed to oppose outward acceleration, analogous to gravity opposing the thrust of a rocket launch from earth in Newtonian physics. In 1996, we showed that this $a = (R/3)(\Lambda - 8\pi G\rho)$ model is an *obfuscation of the physical mechanism for cosmological acceleration,* and the correct cosmological acceleration is predicted by simply taking the observed Hubble parameter H to be a constant within our observable spacetime (in which time past is linked to observable distances by Minkowski's $R = ct$), rather than a variable due to falsely assuming that G and Λ are independent constants with no physical mechanism interdependence. We also showed that the cosmological acceleration is actually *predicted* by $a = RH^2 = (ct)H^2 = Hc = (2.3 \times 10^{-18})(3 \times 10^8) = 6.9 \times 10^{-10}$ ms^{-2}, with H a constant in observed spacetime. See Fig. 10 for rigorous treatment.

Consider a galaxy cluster at observable distance $R = ct$ from the observer, in other words, we are seeing it at a time past t. If the age of the universe for the observer is H^{-1} in flat spacetime, then the time after the big bang for that galaxy cluster when it emitted the light we see from it, will be equal to T, so that $t + T = H^{-1}$ (see Fig. x). Therefore, Hubble's observational law of recession versus distance can be written in terms of time since the big bang, rather than distance:

$$v = HR = Hct = Hc(H^{-1} - T),$$

so the *apparent (effective)* acceleration with respect to the age of the universe as far as observers are concerned is:

$$a = dv/dT = \mathrm{d}[Hc(H^{-1} - T)]/dT = -Hc = -6.9 \times 10^{-10} \text{ ms}^{-2}.$$

The minus sign is a matter of definition: time into our past *increases* linearly with increasing distance ($R = ct$), but the "absolute time" since the big bang for a galaxy cluster *decreases* with increasing distance from us. By taking the former as positive, the latter must be negative, as proved by Fig. x. More crudely, differentiating the Hubble law $v = HR$ with respect to time past gives $a = dv/dt = d(HR)/dt = Hv$, which in the limit $v = c$ gives $a = Hc = 6.9 \times 10^{-10}$ ms^{-2}. Extensive efforts were made to get this published widely in 1996 and thereafter. Another *Electronics World* contributor (Mike Renardson) in 1996 produced a new journal called "First Thoughts" *deliberately dedicated to non-mainstream ideas, but still rejected this prediction for publication, writing that he thought this acceleration was simply far too small to ever detect.* Small accelerations become significant over the immense times involved in cosmology, so this acceleration was discovered within two years using automated CCD-telescope searches for supernovae. It also showed in Moon data and Pioneer data:[22]

"Thanks to reflectors left on Moon by Apollo and Lunokhod missions, using laser impulses, highly accurate measurements of ... the time taken by light to go to the Moon and back to Earth, have been performed over the last fourty years (Dickey et al. 1994). ... this yields $a_c = -9.4 \times 10^{-10}$ ms^{-2}. ... a time-dependent blue-shift has already been observed, by analyzing radio tracking data from Pioneer 10/11 spacecrafts (Anderson et al. 1998). ... An apparent anomalous, constant, acceleration, a_p, directed towards the Sun was left unexplained, with $a_p = 8.74 \pm 1.33 \times 10^{-1}$ ms^{-2} (Anderson et al. 1998) ... confirmed by at least two other independent analyses of the data ... [For type Ia supernovae] a "gold set" of 182 Sne Ia (Riess et al. 2004, 2007) ... yields $a_c = -6.6 \times 10^{-10}$ ms^{-2}."

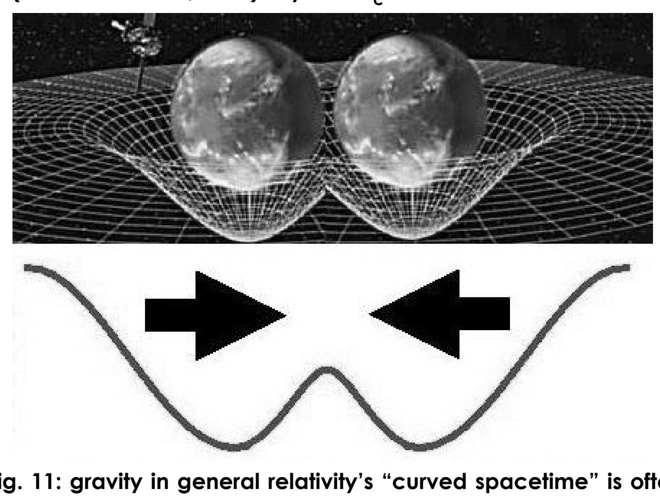


Fig. 11: gravity in general relativity's "curved spacetime" is often explained using indentations by balls on a 2-d mattress; the mattress pushes balls together. In 3-d, this is just Fatio-LeSage gravity.

"The special theory of relativity ... does not extend to non-uniform motion ... *The laws of physics must be of such a nature that they apply to systems of reference in any kind of motion.* Along this road we arrive at an extension of the postulate of relativity... *The general laws of nature are to be expressed by equations which hold good for all systems of co-ordinates, that is, are co-variant with respect to any substitutions whatever (generally co-variant)*."

- Albert Einstein, "The Foundation of the General Theory of Relativity," *Annalen der Physik,* v49, 1916. (*Emphasis by Einstein.*)

General relativity replaces *relative motion* with general covariance, the concept that the *laws of nature* (*not* motions) are independent of the reference frame selected. *General covariance permits absolute accelerations,* necessitating a "preferred" absolute coordinate system. General covariance states that the *laws of nature,* not motions, are invariant. "General relativity" is a serious misnomer, and should be changed to "general covariance." Spacetime contraction makes light speed appear invariant by distorting spacetime, FitzGerald's mechanism for light speed relativism:

"The Michelson-Morley experiment has thus failed to detect our motion through the aether, because the effect looked for - the delay of one of the light waves - is exactly compensated by an automatic contraction of the matter forming the apparatus [the Lorentz contraction itself is physically caused by the head-on pressure of the vacuum field quanta against the front of the moving particle, squeezing it] ... The great stumbing-block for a philosophy which denies absolute space is the experimental detection of absolute rotation."

- Professor Arthur S. Eddington (who confirmed Einstein's general theory of relativity in 1919), *Space Time and Gravitation,* Cambridge University Press, Cambridge, 1921, pp. 20, 152.

General covariance of the laws necessitates absolute *motion.* Time dilation was predicted by Joseph Larmor in 1901, just as Soldner in 1801 predicted the deflection of starlight by the sun's gravity. Light can't be speeded up like a bullet approaching the sun, so the gravitational potential energy gained causes *twice* the deflection predicted by Newton's law. Spacetime was *not* introduced by Minkowski in 1907 or by Einstein, but had been popularized by H. G. Wells' 1894 *Time Machine:* "There are really four dimensions, three which we call the three planes of Space, and a fourth, Time."

"A decision upon these questions can be found only by starting from the structure of phenomena that has been approved in experience hitherto, for which Newton laid the foundation, and by modifying this structure gradually under the compulsion of facts which it cannot explain."

- Georg Riemann (1826-66), lecture at Gottingen University, *On the hypotheses which lie at the foundations of geometry,* 10 June 1854

Gregorio Ricci-Curbastro (1853-1925) took up Riemann's 1854 suggestion and wrote a 23-page article in 1892, developing absolute differential calculus to express differentials in such a way that they remain invariant after a change of coordinate system. In 1901, Ricci and Tullio Levi-Civita (1873-1941) wrote a 77-page paper on this, *Methods of the Absolute Differential Calculus and Their Applications,* which showed how to represent equations invariantly of any absolute co-ordinate system. Einstein in five major papers of 1905 used only algebra and calculus, but in 1911 Georg Pick suggested the work of Ricci and Levi-Civita to him, and Marcel Grossmann helped him to learn it and apply it. Ricci had expanded Riemann's system of notation to allow spatial dimensions to be defined by a "Riemann metric" (renamed the "metric tensor" by Einstein in 1916). Einstein's summation convention is that indices represent the sum over of the term for all of its dimensional elements; a 4-dimensional matrix produces $4^2 = 16$ elements, but 6 are trivial so Einstein called them "tensors" (10 significant components).

A usual vector is an covariant rank-1 tensor, like x_μ, while $x_{\mu\nu}$ is a rank-2 covariant tensor, i.e. a second-order differential equation such as an acceleration, while x^μ (μ is not an indice) is the contravariant counterpart to the covariant vector x_μ. Einstein's metric looks like simple, and logical:

$$\mathbf{g} = ds^2 = g_{\mu\nu} dx^\mu dx^\nu$$
$$= \sum g_{\mu\nu} dx^\mu dx^\nu =$$
$$g_{11}dx^1dx^1 + g_{21}dx^2dx^1 + g_{31}dx^3dx^1 + g_{41}dx^4dx^1 + g_{12}dx^1dx^2 + g_{22}dx^2dx^2 + g_{32}dx^3dx^2 + g_{42}dx^4dx^2 + g_{13}dx^1dx^3 + g_{23}dx^2dx^3 + g_{33}dx^3dx^3 + g_{43}dx^4dx^3 + g_{14}dx^1dx^4 + g_{24}dx^2dx^4 + g_{34}dx^3dx^4 + g_{44}dx^4dx^4.$$

But one of the four dimensions must be given a negative sign, since it represents the time dimension and is a resultant. This metric matrix must be "fixed" by inserting a minus sign, a contrived, fiddled *ad hoc,* epicycle-like, delusional "spacetime":

$$dx^1dx^1 = -d(ct)^2,$$
$$dx^2dx^2 = dx^2,$$
$$dx^3dx^3 = dy^2,$$
$$dx^4dx^4 = dz^2.$$

The rank-2 Ricci tensor is an *ad hoc*, contracted rank-4 Riemann tensor. General relativity relies on a contrived, *unphysically smoothed, perfect fluid* source representations for the stress-energy tensor, because *the real, discontinuous, particulate mass-energy distribution does not produce a differentiable curvature:*

"In many interesting situations ... the source of the gravitational field can be taken to be a perfect fluid. ... A fluid is a continuum that 'flows' ... A perfect fluid is defined as one in which all antislipping forces are zero, and the only force between neighbouring fluid elements is pressure."

- B. Schutz, *An Introduction to General Relativity,* Cambridge University Press, Cambridge, 1986, pp. 89-90.

"... the concepts of density and velocity at a point in the fluid pertain only to the idealised notion of a continuous fluid and are not strictly applicable to a real fluid. The mathematical difficulties ... arise from the fact that a real fluid is a discrete assemblage of molecules and is not a continuous fluid."

- Dr D. E. Rutherford, *Fluid Dynamics,* Oliver and Boyd, London, 1959, p. 1.

Check: ripple sizes in the cosmic background radiation

As mentioned earlier, in 1996 we proposed a "bootstrap" quantum gravity generated in the universe by an outward acceleration of distant, isotropic matter, giving outward force $F = ma$ by Newton's 2nd law, and an equal and opposite inward reaction force under Newton's 3rd law (the rocket principle). Before the cosmological acceleration of the universe was discovered, in 1996 we thus published the *checkable, falsifiable* prediction than if the outward cosmological acceleration was $a = Hc$, or $\Lambda = (H/c)^2$, the observed highly isotropic distribution of matter receding from us produces an observed gravity coupling $G = c^4/(aM) = c^3/(HM)$ by such an inward reaction force (H is Hubble's parameter and M is the mass of the surrounding accelerating matter in the universe). This small positive cosmological acceleration was subsequently confirmed in 1998 by the CCD telescope observations of distant supernovae by Perlmutter *et al.*[23]

G is an emergent coupling generated by the motion of the isotropic distant matter surrounding us. This prevents the simplistic application of the field equation of general relativity to cosmological applications. For instance, G and Λ are *not* independent: $\Lambda = c^4/(G^2M^2)$. If "spacetime curvature" is just an approximation for a large number of random discrete accelerations by individual graviton interactions with matter, we have the problem that it will fail on very small scales, and also on very large scales.

Our quantum gravity result $G = c^4/(aM) = c^3/(HM)$ suggests (if other factors are constant) that G is *directly proportional to the age of the universe,* since the Hubble parameter, H, in flat spacetime is equal to the reciprocal of the age of the universe. This time dependence of G does not affect the gravitational compression that causes fusion in the stars (such as the sun) or in the first minutes or the (dense) big bang, because nuclear fusion is not just a function of gravitational compression: the electromagnetic Coulomb repulsive force produces a resistant barrier that opposes increasing gravitational compression. As G varies, the equivalent electromagnetic force coupling increases likewise because of the gauge theory relationship between gravity and electromagnetism. Fusion rates are increased by additional gravitational compression, but reduced if the Coulomb barrier between nuclei increases. The increase in both gravity and electromagnetic couplings therefore has opposing effects on the fusion rate, offsetting one another. Thus, fusion in the dense early big bang, and in stars is unaffected by the variation in G, contrary to Edward Teller's 1948 assertion that temperature effects due to the sun's heat output in Dirac's varying G theory would have prevented evolution.[24] Teller's argument contains the implicit assumption that *only* the gravitational coupling G is varying with time, not electromagnetism. This is an unnatural assumption, given the similarity between electromagnetism and gravity, e.g. both are long-range inverse-square law interactions. Even without the specific mechanisms being examined, one could expect both couplings to vary similarly, abolishing Teller's objection. Louise Riofrio[25] investigated the formula $G = c^3/(HM) = tc^3/M$ from another perspective, obtaining the equation dimensionally instead than deriving it from the quantum gravity mechanism that we published in 1996. Riofrio, possibly influenced by Teller's vacuous dismissal of Dirac's G time-variation theory, *assumed* that G is not a variable, and investigated instead whether the velocity of light varies as the inverse cube-root of time, $c = (MG/t)^{1/3}$.

Quantum gravit shows that the outward force of matter in the universe can be represented by a formula containing the Hubble parameter, H: $a = Hc$. Thus, outward force is $F = ma = mHc$. In flat spacetime, $H = 1/t$, where t is the age of the universe; this is because, if the most distant visible matter is receding from us at the velocity of light, then Hubble's parameter is $H = v/R = c/(ct) = 1/t$. Therefore, $F = mHc = mc/t$, so the outward force is *inversely proportional to time,* and by Newton's 3rd law the equal and opposite inward reaction force is *also inversely proportional to time.* This fall is mirrored by the fall in the cosmological acceleration of the universe with time: $a = Hc = c/t$.

The mechanism for this fall in cosmological acceleration is the fall in the rate of exchange of constant velocity gravitons between increasingly distant galaxies and clusters of galaxies as the universe expands and ages, an effect that can also be described as a result of the redshift of the gravitons (the Casimir effect provides experimental evidence for the significance of the frequency spectrum of offshell quanta). Gravitons cause the cosmological acceleration by pushing against masses, like expanding dough pushing raisins apart in a baking cake. But as the universe expands and ages, the gravitons exert less force because of redshift, equivalent to the conversion of the potential energy of the gravitons into the kinetic energy of the accelerated matter, and the time taken for gravitons to be exchanged between masses increases as the masses recede to grater distances, reducing the graviton flux (rate of exchange per unit time). Consequently, the *rate of graviton impacts decreases inversely with time* if the universe expands at a linear rate, and if the gravitons travel with a constant velocity of light.

The graviton-scattering cross-section area is πr^2, where $r = 2GM/c^2$. Thus, if G varies in direct proportion to time, the graviton scattering cross-section is proportional to the square of time. The *net* gravitational force is proportional to the product of the total inward graviton force (which is inversely proportional to time) and the graviton scattering cross-section (which is proportional to the square of time), i.e. to the product $(1/t)(t^2) = t$. This indicates a direct proportionality between G and the age of the universe. *The small size of the non-cosine anisotropies (ripples) in the cosmological background radiation corresponding to "galaxy seeding" fluctuations by gravity confirmed this result, and dispensed with "inflation" theory.*

Although the similar variation in electromagnetic coupling offsets effects on fusion rates in the big bang and in stars from the gravitational compression variation, one significant effect of this direct proportionality between G and the age of the universe is well established: the very small size of the ripples observed by COBE and WMAP satellites in the cosmic background radiation emitted about 300,000 years after the big bang shows that the gravitational field or curvature was much smaller at that time than predicted by simple big bang models using constant G.

The *ad hoc* "explanation" for this smaller than expected gravitational clumping of matter at 300,000 years after the big bang is a faster-than-light "inflation" of the universe to an immense size at times of 10^{-43} to 10^{-34} of a second, thus distributing the isothermal, uniformly distributed early mass-energy rapidly over a vast volume, hence reducing the gravitational curvature and the growth rate of density variations. This inflation idea does not falsifiable predict the exact size of the ripples in the cosmic background radiation, unlike the quantum gravity mechanism which correctly predicts that G was only 300,000/13,700,000,000 = 2×10^{-5} of its current strength at 300,000 years after the big bang. The fall in the cosmological acceleration with time, $a = Hc = c/t$, implies some similarity to inflation at very early times after the big bang, when the cosmological acceleration was greater. As with inflation, this varying acceleration does not affect the *relative* abundances of the elements (e.g. the 3:1 ratio of hydrogen to helium abundance in the universe, calculated by models of nuclear fusion in the big bang).

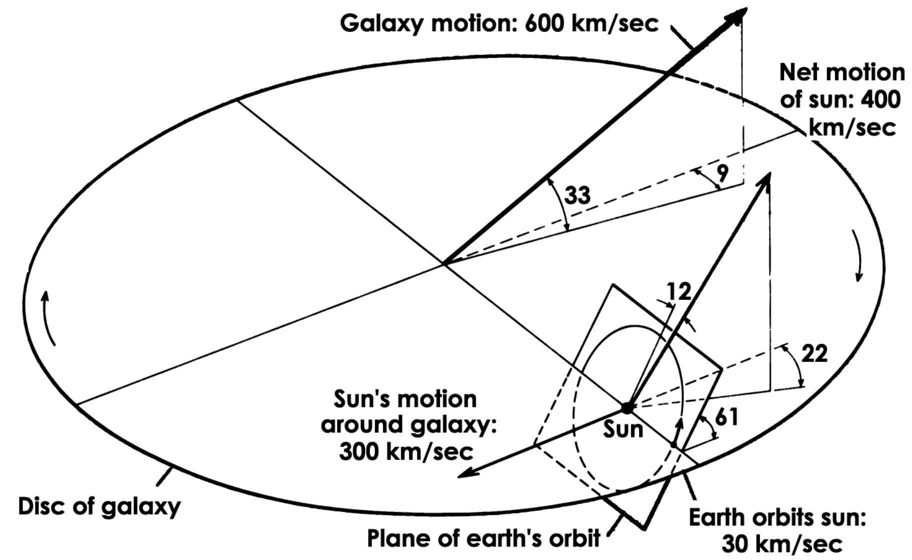
Dirac's guesswork "large numbers hypothesis" the idea that G varies with time, although Dirac made several errors: he neglected to evaluate whether the electromagnetic force coupling strength varies similarly (which allowed the theory to be rejected by Teller in 1948 using the spurious argument that nuclear fusion rates are varied by gravity via compression, when of course the increased Coulomb repulsion offsets this effect), he failed to come up with the quantum gravity mechanism to substantiate the details of how G varies with time, and he guessed wrongly that G decreases with time, instead of increasing. As a wild guess (analogous to Dirac's initial guess that the anti-electron was the proton!), this looked appealing sensible to Dirac because a higher value of G in the high-energy universe at early times could make the strength of gravity similar to that of electromagnetism when the universe formed, suggesting a numerological similarity of coupling parameters. Such a contrived numerical equality of coupling parameters was widely supposed, in default of causal mechanisms for fundamental interactions, to represent "unification", and a similar guesswork numerology remains a primary selling point of superstring theory today (although it uses a different scheme to increase G at high energy).

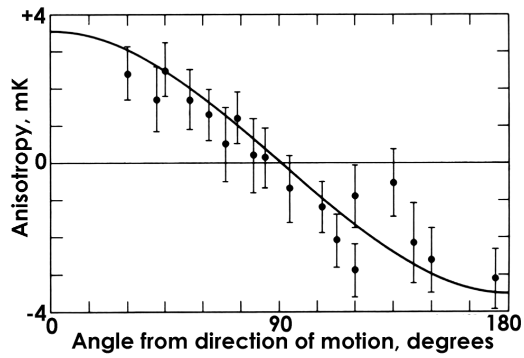
One further aspect of the direct proportionality between G and the age of the universe is that since the event horizon radius of a black hole is $2GM/c^2$, it follows that the radius of a black hole of unit mass is directly proportional to the age of the universe, and therefore to the size of the universe. Black hole cores of fundamental particles expand exactly in scale to the expansion of the universe itself. The ratio of effective scale radius of the universe in flat spacetime, $R = ct = 1.3 \times 10^{26}$ m, to the event horizon radius of a black hole electron, $2GM/c^2$, is therefore a constant, on the order 10^{82} which is approximately the number of fermions in the universe, so that if all the fermion cores were laid side to side they would stretch the diameter of the universe. This is significant for the mechanism of electromagnetism, whose coupling depends on a random or "drunkards walk" path integral of gauge bosons between charges of opposite signs: the electromagnetic coupling is then larger than that for gravity (which has a single sign only) by the square root of the number of fermions.

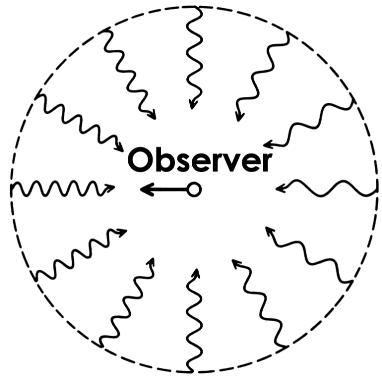
The large-scale failure of "smooth spacetime curvature" ideas under quantum gravity applies to the universe as a whole. If light-velocity gravitons produce the gravitational interaction as a 3rd Law reaction to the force of the surrounding accelerative expansion, then a simple spherical fireball-in-space model of the big bang may replace the now-popular unproved "boundless" curved spacetime waffle. The alleged "Copernican" pontificating principle of cosmology - which claims we're not in an "special place" or (in popular fairy tales) that "the universe around you looks the same for everyone, no matter where they are located" - is simply an re-assertion of unchecked theoretical speculation in place of honest ignorance. Copernicus did not prove or claim that unchecked theoretical assertions about the "boundless spacetime" should take the place of admitted ignorance and should be used to fend off new knowledge. If a modern "Copernican principle" had been in place before Copernicus asserted that the earth orbited the sun, he could have been accused of claiming that the sun was in a "special place". Nobody has travelled across the universe to verify such popular claims about spacetime curvature, and no test of "general relativity" is a test of the *nature of the gravitational interaction,* merely of the basic physical principles (e.g. energy conservation) that cause the distinctions between general relativity and Newton's gravity.

The obsessive dictatorship by delusional dogma fans

"If the sun orbits the earth (not *vice versa*), then we must invent a new alternative dogma, so let's now adopt the dogmatic assumption that we know for certain there is no 'centre' in the universe, so everywhere throughout the universe, the surrounding are isotropic. Let's take this as proved fact." - Delusional Copernican Principle (*aka* Bohr's Copenhagen Principles). This swaps one dogmatic prejudice for another. *Just because you have a failure, that is not a disproof of the existence of something, let alone a proof for relativism, despite Einstein's fans.*







"ABSOLUTE MOTION OF THE EARTH through space has been determined by measuring slight differences in the temperature of the 3 K cosmic background radiation reaching the earth from various directions. ... The net aether-drift experiment shows that the earth's net motion in space is about 400 km/sec." - R. A. Muller, Scientific American, 1978.

Fig. 12. Richard A. Muller's May 1978 *Scientific American* article, "The cosmic background radiation and the new aether drift," used measurements of the 3.5 mK cosine angular anisotropy in the 2.73 K microwave background cosmic radiation, to determine earth's motion with respect to the average locations of matter in the universe which emitted that radiation at 300,000 years after the big bang origin. Michelson and Morley's 1887 null result led FitzGerald in *Science* in 1889 to predict a "contraction" of matter in the direction of motion, so that Maxwell's relativity is physically caused by "aether" force contracting measuring apparatus in the direction they move (like water pressure on the bow of a ship causing a contraction of the ship in the direction of motion); Einstein mathematically removed the aether physically causing the contraction.

The Cosmic Background Radiation and the New Aether Drift

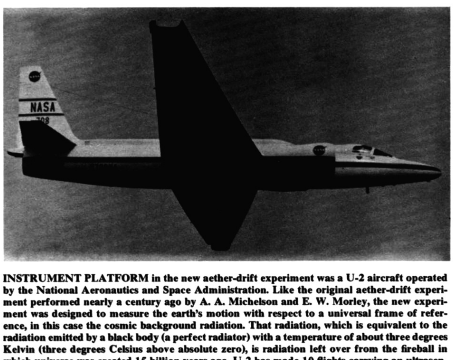
Sensitive instruments have found slight departures from uniformity in the radiation left by the primordial "big bang." The experiment reveals the earth's motion with respect to the universe as a whole

by Richard A. Muller

A curious radiation that bathes the earth almost uniformly from every direction has turned out to be a unique source of information about the nature and history of the universe. The faint radiation was identified 13 years ago during a search for noise sources capable of interfering with satellite communications systems. The "noise" proved to be of cosmic origin and soon became known as the three-degree cosmic black-body radiation because it has the spectral characteristics of a black body, or perfect emitter of radiation, whose temperature is about three degrees Kelvin (three degrees Celsius above absolute zero). Most astrophysicists now believe this microwave radiation was emitted shortly after the "big bang," the cataclysmic explosion in which the universe was created some 15 billion years ago. Not only is it the most ancient signal ever detected; it is also the most distant, coming from well beyond the quasars, the most remote luminous sources known. The three-degree radiation is a background in front of which all astrophysical objects lie.

The observation of the cosmic background radiation is the closest we have come to a direct study of the primordial explosion itself. The very existence of the radiation is the strongest evidence in favor of the big-bang theory. The isotropy of the radiation, that is, the uniformity of the radiation from different directions in space, tells us that the big bang, although it was unimaginably violent, also went quite smoothly. The slight departure from isotropy that has recently been discovered indicates that our galaxy is hurtling through the universe with the surprisingly high velocity of 600 kilometers per second. It is this cosmological velocity that has been called "the new aether drift," in reference to the "aether drift" that A. A. Michelson and E. W. Morley sought unsuccessfully to discover nearly a century ago by measuring the velocity of light over paths rotated at different angles with respect to the earth's motion in space. The three-degree cosmic background radiation provides an all-pervasive radiation "aether" for performing an analogous experiment.

The cosmic background radiation was discovered in 1965 by Arno A. Penzias and Robert W. Wilson of Bell Laboratories; its significance was immediately recognized by Robert H. Dicke and his group at Princeton University. Since then much has been learned about the spectrum of the radiation. Its intensity has now been studied at wavelengths ranging from 30 centimeters down to half a millimeter, confirming the initial conjecture that its spectral curve conforms to that of a black body at a temperature of three degrees K.



INSTRUMENT PLATFORM in the new aether-drift experiment was a U-2 aircraft operated by the National Aeronautics and Space Administration. Like the original aether-drift experiment performed nearly a century ago by A. A. Michelson and E. W. Morley, the new experiment was designed to measure the earth's motion with respect to a universal frame of reference, in this case the cosmic background radiation. That radiation, which is equivalent to the radiation emitted by a black body (a perfect radiator) with a temperature of about three degrees Kelvin (three degrees Celsius above absolute zero), is radiation left over from the fireball in which universe was created 15 billion years ago. U-2 has made 10 flights carrying an ultrasensitive microwave receiver designed by the author, George F. Smoot and Marc V. Gorenstein.

One of the most important observations reported by Penzias and Wilson was the constancy of the temperature of the radiation from different directions in space. Their measurements indicated that the temperature varies by less than 10 percent in any direction. Subsequent experiments set even lower limits on the departure from isotropy. Two independent groups have recently carried out measurements sensitive enough to show, however, that the temperature of the radiation is not precisely the same in all directions. One set of experiments was performed at Princeton by David T. Wilkinson and Brian E. Corey, the other set at the Lawrence Berkeley Laboratory of the University of California by a group that included George F. Smoot, Marc V. Gorenstein and me. It is now known that the temperature of the three-degree back-

The radiation you are moving into is Doppler blueshifted; that you are receding from is redshifted. This effect in the gravitational field causes inertia (the force of resistance to acceleration). Objects are contracted by the compressive force due to the blueshifted field quanta. Muller stated: "There can be only one inertial frame in any region of space where the background radiation is completely isotropic. In any other frame, an observer's motion will reveal itself as a variation in temperature of the radiation ... P. J. E. Pebbles, one of the physicists in Dicke's group who correctly identified the origin of the radiation, coined the term 'the new aether drift' to describe the expected motion. ... it is motion with respect to the most natural frame of reference in cosmology: the expanding coordinate system in which the galaxies are nearly at rest."

Special relativity is based on two observational facts: that light appears to have the same velocity to all observers, and that physical laws *depend on relative motions*, not absolute motions. Special relativity mathematically re-derives the FitzGerald-Lorentz-Larmor-Poincare transformation and $E = mc^2$ from two empirical postulates, *without consideration of any mechanism*. Einstein obtained contraction, mass increase, time-dilation, etc. without modelling any of the physical dynamics of underlying field interactions which FitzGerald, Lorentz, and Larmor modelled. Poincare's 1904 relativity paper has three postulates. It was first seen by Einstein in 1954, when Pais loaned him his own copy[xx].

Einstein's *postulate* that light velocity *appears invariant* was defended by the Michelson-Morley experiment's *null result*. Einstein's *postulate* that the laws of nature depend only on relative not absolute motion was defended by Maxwell's equations, showing that a magnetic field appears when an electric charge moves *relative to the observer*, regardless of "absolute motion."

***But it is just one derivation, not a valid reason for the biased banning of the publication of confirmed predictions from mechanistic models.* Theoretical dogma bias such as "thought experiments" led J. J. Thomson to *ignore X-ray evidence in 1894*. "I did not think, I investigated," said X-ray discoverer Wilhelm Röntgen in 1896, after Sir James Mackenzie-Davidson asked, "What did you think?" Einstein's first PhD advisor was H. F. Weber and his first draft PhD thesis in November 1901 was on special relativity which led to hostility between Weber and Einstein. Einstein then switched adviser to Alfred Kleiner, then swtiched research topic to Brownian motion. No Nobel Prizes were awarded for the "checked predictions" of special relativity, which also came from aether theory:**

"... according to the general theory of relativity, space is endowed with physical qualities... According to the general theory of relativity space without ether is unthinkable." - Albert Einstein, "Either and Relativity," in *Sidelights on Relativity*, Dover, 1952, pp. 15-23.

Fig. 13: in February 1997, the journal *Physics Today* published Gordon Kane's "String theory is testable, even supertestable." Instead of grasping the physical evidence for the black hole scale, far smaller and theoretically fundamental than the dimensional-analysis contrived unnatural numerology "supporting" the Planck scale, Kane claimed that the Planck length and mass are "natural scales ... I will call this theory the primary theory, a name I like because it suggests that as we go through a hierarchy of effective theories ... we end at a primary one that is not related to another at a deeper level." Abject speculation is more exciting to media quacks than the *checkable hard facts published the same month*. February 1997 was the very month we published the facts in *Science World* (ISSN 1367-6172). We also published the cosmological acceleration via *Electronics World*, October 1996, p. 896.

From: Physical Review Letters
Sent: 22/01/03 14:13
Subject: Your_manuscript LZ8276 Cook
... The enclosed comments advise against publication in Physical Review Letters ...
Yours sincerely,
Stanley G. Brown Editor, Physical Review Letters, Email: prl@aps.org
Fax: 631-591-4141
http://prl.aps.org

Report of the Divisional Associate Editor - LZ8276/Cook
... You are proposing a very nonstandard mechanism ... Physical Review Letters is not the appropriate journal ...
Sincerely,
Richard Price
Divisional Associate Editor
Physical Review Letters

STRING THEORY IS TESTABLE, EVEN SUPERTESTABLE

Many believe that superstring theory, because of its extraordinarily tiny length scale and gargantuan energy scale, cannot be tested. That belief is a myth.

Gordon Kane

Suppose we could understand the laws of nature that govern the particles and their interactions, and in addition why the laws are as they are, and also how the universe evolved and perhaps even how it originated—an active research area today. That understanding—a theory—would be formulated not in terms of everyday units, but rather units built from constants such as the speed of light, Planck's constant and Newton's constant. From these constants one obtains the natural scales: the Planck length ($\sim 10^{-33}$ cm) and the Planck mass ($M_P \sim 10^{19}$ GeV/c^2). I will call this theory the primary theory, a name I like because it suggests that as we go through a hierarchy of effective theories, from macroscopic sizes to atoms to nuclei, we end at a primary one that is not related to another at a deeper level.

right-handed fermions are treated differently)—that is, why there is a muon and a tau so like the electron—will have passed a big test. It must also explain why matter comes as quarks and leptons but not as other possible forms such as leptoquarks. The theory will predict that there should or should not be additional kinds of matter that can be detected in collider experiments, such as particles to complete a representation of a larger group.

Similarly, the Standard Model of particle physics is based on certain symmetries under interchange of the particles: an SU(3) symmetry for interchanging quarks of different colors, an SU(2) symmetry for interchanging the up and down quarks and so on, and a U(1) symmetry for which the particles have different eigenvalues. Why those symmetries and no others?

Physics Today, February 1997

"Our own galaxy system is only one of a great many, and observations made from any of the others would show exactly the same thing: all systems are receding, not from any particular centre, but from each other: the whole system of galaxies is expanding."

- Willem de Sitter, *Kosmos*, 1932.

"... astronomers accept the 'cosmological principle': the belief that the universe is essentially the same everywhere. ... an exploding clump of matter sitting somewhere in space offers no natural way to account for the existence of the cosmic background radiation ... the radiation would no longer be around to be observed. In the big bang theory there is no primordial clump of matter and no center to the explosion. ... there is no outer edge to the distribution of matter. The big bang was not an explosion of matter within space but an explosion of space itself."

- Richard A. Muller's, "The cosmic background radiation and the new aether drift," *Scientific American*, 1978.

"Einstein and his successors have regarded the effect of a gravitational field as producing a change in the geometry of space and time. At one time it was even hoped that the rest of physics could be brought into a geometric formulation, but this hope has met with disappointment, and the geometric interpretation of the theory of gravitation has dwindled to a mere analogy, which lingers in our language in terms like 'metric,' 'affine connection,' and 'curvature,' but is not otherwise very useful. The important thing is to be able to make predictions about images on the astronomers' photographic plates, frequencies of spectral lines, and so on, and it simply doesn't matter whether we ascribe these predictions to the physical effect of gravitational fields on the motion of planets and photons or to a curvature of space and time."

- Steven Weinberg, *Gravitation and Cosmology*, John Wiley and Sons, 1972.

Willem de Sitter's 1932 statement misrepresents dogmatic *speculation as being proved fact, a piece of falsehood, and misleading, pseudoscientific assertion.* Willem de Sitter *didn't travel throughout the universe to check his dogmatic assertion about isotropy throughout the universe. He conflated speculation and fact by deliberately omitting vital caveats.* Willem de Sitter's words "would show" is just an effort to pass off an interpretative guess disguised as a fact. The 2d surface of an expanding balloon, not the 3d gas within it, is then falsely asserted as the correct analogy to a 3d spatial volume. Muller falsely ignores factual simulations of nuclear explosion fireball developed after American and Russian nuclear tests in outer space in 1962.

A hot gas fireball is opaque to radiation as it initially expands, limited by light velocity, containing radiation with a short mean free path until the ions and electrons combine and the fireball becomes transparent to radiation, by which time a great deal of expansion has occurred and the fireball is very large. This is analogous to the moment of radiation decoupling at 300,000 years after the big bang origin, when the temperature fell low enough to deionize. So the cosmic background radiation was unleashed *throughout a large fireball, not a point source,* thereby removing all of Muller's objections. Spacetime curvature is a falsehood and the universe is not geometrically boundless. Its late-time features, such as the Hubble recession law, are analogous to the expanding fireball from a $\sim 10^{55}$ megatons explosion in a *pre-existing space.* The features of the fields in space are dependent upon the motions of the matter and energy of the big bang, but that is not solid proof for de Sitter's arm-waving philosophical speculations. The *failure* of the "earth centred universe" when Copernicus's theory was published in 1500 is not solid *eternal proof* that space is "curved and boundless," the most ignorant, extravagant and dogmatic falsehood in science.

Curved spacetime has been replaced by quantum interactions, and the location of matter at 0.3 Gyr when the cosmic background radiation decoupled from that matter is *an effective* absolute motion indicator. If a measured 600 km/s velocity in this radiation were taken as representative of its order of magnitude over the past 13.7 Gyr (speeds increase and decrease slightly, as the Milky Way's mss approaches and recedes from other masses), then we are located at 600/300,000 = 0.002 of the "radius" of the universe, which is so near the "centre" that it explains the isotropy we see, like a raisin at 0.002 of the radius of an expanding cake.

The Fatio-LeSage pushing gravity irrelevancies/errors

Nicolas Fatio de Duillier, a Swiss mathematician, between 1689-93 attempted to persuade Issac Newton to both accuse Liebniz of plagarizing the calculus from Newton, and to accept the hypothesis that gravity is caused by a gas of aether particles, pushing masses together and thus pushing people and apples down on planets, due to the mutual shielding of the gas pressure by subatomic masses. Newton accepted the former (which was wrong), but was uncertain about the latter.(26) Fatio's gas analogy is to quantum gravity what Lamarke's evolution is to Darwin's evolution. "Critics" try to conflate quantum gravity with Fatio's errors to falsely allege "guilt by association" (an invention of politicians like Joseph McCarthy), *to avoid reading and publishing new facts.* In his 1893 letter to Richard Bentley, Newton was careful to be open-minded, considering possible a gravity mechanism:(27)

"You sometimes speak of gravity as essential & inherent to matter; pray do not ascribe that notion to me ... That gravity should be innate inherent & essential to matter so yt one body may act upon another at a distance through a vacuum wthout the mediation of any thing else by & through wch their action or force may be conveyed from one to another is to me so great an absurdity that I believe no man who has in philosophical matters any competent faculty of thinking can ever fall into it. Gravity must be caused by an agent acting constantly according to certain laws, but whether this agent be material or immaterial is a question I have left to ye consideration of my readers."

Newton also revised his major book *Opticks* to include the possibility of a gravitational mechanism in *Query 31:*

"How these attractions may be performed I do not here consider. What I call attraction may be caused by impulse, or by some other means unknown to me. I use that word here to signify only in general any force by which bodies tend toward one another, whatsoever be the cause."

It is essential to make LeSage's errors crystal clear. Ptolemy used Aristotle's guesswork-yet-fashionable "laws" of motion outside their validated range in a "no go theorem" to falsely dismiss Aristarchus's solar system (alleging people would be thrown off a rotating earth).

1. *Gas drag slows down planets,* so they spiral into the sun.

2. *Gas drag heats up planets* until they vaporize (the earth would receive $>10^{21}$ times the Sun's total radiant power). *Henri Poincare calculated that to overcome such problems (he falsely assumed a large classical electron size cross-section), the gas particles need a velocity* $>10^{17}$ *times the velocity of light, conflicting with special relativity.* But these "calculations" were guesswork, using an excessively large cross-section for graviton interactions with matter (e.g. the classical electron size), and assuming gravity is due to *on-shell* particles (causing drag and heating), not an *offshell* boson exchange process like Casimir's radiation, causing no drag.

3. *Gas pressure diffuses into all directions* so gravity doesn't exist beyond a few mean free paths of the gas molecules.

4. *Gas pressure anisotropies would distort objects when they rotated.* This is analogous to crackpot attempts to "disprove" special relativity by saying that an astronaut in a spaceship at $v = 0.5c$ would see the Lorentz contraction of a ruler when he rotated it, indicating absolute motion to him. But he wouldn't, because everything the observer sees is contracted the same way, cancelling out the anisotropy's gross effects.

5. *Gravity would not work for a planet orbiting the sun, because it is constantly moving so the gravitons exchanged between it and the sun would need to travel faster than light or they would "miss" due to the 8.3 minutes travel time at light velocity from sun to earth.* This is actually a *disproof for spin-2 superstring theory gravitons,* which cause gravity by *being exchanged between sun and earth.* It clearly doesn't apply to the pushing gravity mechanism of *spin-1* gravitons, where planets are pushed towards the sun by a net inward graviton force *from the side facing away from the sun,* which *exists as an inward-directed acceleration field before the sun has even moved into that path.* So it only discredits spin-2 gravitons.

The seed of Maxwell's electromagnetism was LeSage aether-based. Leonard Euler had calculated the fluid pressures of aether needed to produce gravity, after Georges-Louis Lesage (1724-1803) obtained Fatio's papers, developing his theory in his 1782 paper *Lucrece Newtonien.* LeSage tried there, and in later papers published by Pierre Prevost, to use Fatio's mechanism to predict constraints upon the nature of gravitons (a small cross-section and immense mean-free-path between mutual interactions), and upon the nature of matter (predicted to be mostly void, to correspond to Newtons's law with trivial overlap of shadows; this was confirmed by Rutherford's atom too late for any newspaper headlines and celebrations in Popper's style).

In 1873, William Thomson (Lord Kelvin) vaguely suggested that particle exchange might mitigate the heating problems. Gauge theory shows that fundamental forces are mediated by quantum field theory exchange (*offshell*) bosons, *which do carry fundamental forces, but don't cause drag. One charge loses as much as it gains in this quantum field theory exchange, so there's no net transfer of energy* (thus no drag, and no heating).

Casimir vacuum radiation has experimentally been shown to push metal plates together, since the full spectrum of wavelengths can only press on the outer surfaces, and the inner (facing) sides of the plates only experience a partial spectrum of vacuum radiation, namely wavelengths smaller than the distance between the two plates. Because the repulsion force between the plates is therefore smaller than the full spectrum of vacuum radiation pushing them together, the net force is that they are pushed together. *Casimir radiation doesn't slow down the planets, heat them up, etc.* Fatio's gravity idea is wrong, like a rubber sink plunger pushed against a wall by air pressure, so it only models the *short-ranged* nuclear forces.

Part 2. SU(2) electroweak theory and its mixing with U(1) quantum gravity hypercharge

"One must either find new symmetry groups beyond those already known, or one must find more powerful methods for exploiting the mathematics of representation theory to get physical understanding."

- P. Woit, *Not Even Wrong* (Jonathan Cape, London, 2006, p. 266).

"The ideas must later take the mathematical form of a quantitative theory, to make possible the comparison with experiment."

- Albert Einstein and Leopold Infeld, *The Evolution of Physics,* 1938 (Simon and Schuster, N. Y., 1966, p. 277).

SU(2) is the original 1954 Yang-Mills gauge theory. In most dogmatic pseudoscientific-orthodoxy propaganda, SU(2) represents *only* weak isospin, while U(1) is *purely* electrodynamics. But this very popular self-delusion *doesn't even represent the physical content of the real Standard Model,* where electrodynamics is *not* purely U(1) but is *one of the products of a mixing* of U(1) hypercharge with SU(2) weak isospin.

We have to overcome a severe bias which comes from very effective pedagogical brainwashing of students, who gain prejudice from bad teaching. The simplistic U(1) model taught first is wrong, but is defended by an arm-waving claim: it is *nearly right* and just needs some mixing with SU(2).

This is a monumental error. All of the major quantum field theory textbooks present the Pauli SU(2) spin matrices of allegedly U(1) electrodynamics w*ithout any discussion of the link between particle spin and the mechanism for the magnetic field in electrodynamics*. SU(2) isospin is the basis for *magnetism.* Deluded searches for "magnetic monopoles" to preserve *mathematical* U(1) symmetry are like hunting for epicycles/red-herrings. Maxwell's equation's *show an asymmetry between electric and magnetic fields, because no magnetic monopoles have ever been observed.*

$$\partial_n F^{mn} = 0$$
$$\partial_p F_{mn} + \partial_m F_{np} + \partial_n F_{pm} = 0$$

$$F^{mn} = \begin{bmatrix} F^{\mu\nu} & -S^{\mu} & -T^{\mu} \\ S^{\mu} & 0 & -\eta \\ T^{\mu} & \eta & 0 \end{bmatrix}$$

$$F^{\mu\nu}_{\ \ ,\nu} = \partial_u S^{\mu} + \partial_v T^{\mu} = J^{\mu}$$
$$\partial_\mu S^{\mu} = -\partial_v \eta$$
$$\partial_\mu T^{\mu} = \partial_u \eta$$
$$\partial_\alpha F_{\mu\nu} + \partial_\mu F_{\nu\alpha} + \partial_\nu F_{\alpha\mu} = 0$$
$$\partial_u F_{\mu\nu} = \partial_\mu S_\nu - \partial_\nu S_\mu$$
$$\partial_v F_{\mu\nu} = \partial_\mu T_\nu - \partial_\nu T_\mu$$
$$\partial_\mu \eta = \partial_u T_\mu - \partial_v S_\mu = K_\mu$$

Pauli-Lubanski spin vector

But we also know (as Maxwell pointed out) that every electron current observed has a magnetic field which curls the same left-handed way.

Maxwell's now fully-censored out mechanism for this chiral magnetism is the angular momentum exchanged between onshell charges by "vacuum gear cogs" (field quanta); the angular momentum is now called "spin." Helical spin (spin around the direction of propagation) has two possible directions, and if Maxwell's magnetic field mechanism is correct, *electric currents and electrons have isospin-like left-handed helicity.*

This is the highly-censored and heretical key to SU(2) electrodynamics. The lack of magnetic monopoles is one consequence of Maxwell's mechanism for magnetism: the chiral nature of magnetism in electrodynamics (*Heinrich Lenz's law, i.e. left-handed helicity of magnetic fields around electron currents*) *necessitates* spin-dependent SU(2) symmetry for magnetism.

The popular arm-waving claim that U(1) is electromagnetism is false, but is highly fashionable. What has gone wrong is a premature formulation of theoretical dogma, due to the merely accidental sequence of experimental and theoretical discoveries, with a bias against mechanistic understanding.

Fig. 14: Danny Ross Lunsford's mathematical SO(3,3) unification[28] of SU(2) spin and electrodynamics. This 3 × 3 matrix of field strength space and time components is a trivial pattern, but it permits the classical electrodynamic Maxwell's field strength tensor to predict the quantum mechanical SU(2) Pauli-Lubanski spin vector using 3 spatial and 3 time-like dimensions. This simple symmetry between space and time is consistent with the quantum gravity. Space and time are asymmetric degrees of freedom with three dimensions each, producing an SU(2) symmetry (space and time represent two charge elements) and an SU(3) symmetry, where the three charge elements and their anti-charges for each chiral handedness of SU(2) are explained by the three dimensions for both space and time. Tony Smith kindly confirmed how SU(3) colour charges may be represented by an emergent geometric symmetry.[29]

Lunsford simply writes out the field strength tensor for the correct number of symmetric space-time dimensions, and *shows that the extra time dimensions describing spin allow a separation of space and time in such a way matter's spin is predicted correctly.* Lunsford's paper was peer-reviewed and published in a journal in 2004, but was then deleted after being sponsored and put up on arXiv.org, which just happened to have superstar "superstring theory" advisers at work, whose grossly delusional attitude to physics rejects work which doesn't fit into an *expert consensus,* alleged to be *science.*

Fig. 15 (right and below): James Clerk Maxwell's paper in the March 1861 *London, Edinburgh and Dublin Philosophical Magazine and Journal of Science:* "XXV. On Physical Lines of Force. Part I. The Theory of Molecular Vortices applied to Magnetic Phenomena." It is pretty heretical reading for quantum field theory students today. Maxwell discusses "lines of force" and magnetic forces caused by "pressures" from "centrifugal forces" in an assumed mechanical spin aether, which he uses to conveniently yield the velocity of light:

"... if we draw a line so that in every part of its course it coincides in direction with the force at that point, this line may be called a *line of force* ... Thus if we strew iron filings on paper near a magnet, each filing will be magnetized by induction, and the consecutive filings will unite by their opposite poles so as to form fibres, and these fibres will *indicate* the direction of the lines of force. The beautiful illustration of the presence of magnetic force afforded by this experiment, naturally tends to make us think of those near magnetic poles of the same name; but we know that the mechanical effect is that of attraction instead of repulsion ... In order to produce the effect of attraction, the stress along the lines of gravitating force must be a *pressure*. ... The explanation which most readily occurs to the mind is that the excess of pressure in the equatorial direction arises from the centrifugal force of vortices [*spinning field quanta, i.e. spin angular momentum in a modern path integral QFT*] ... having their axes parallel to the lines of force. ... *Proposition* XVI. To find the rate of propagation of transverse vibrations through the elastic medium ... By the ordinary method of investigation we know that $v = \sqrt{(m/\rho)}$ where m is the coefficient of transverse elasticity, and ρ is the density of the matter of the vortices.

THE
LONDON, EDINBURGH AND DUBLIN
PHILOSOPHICAL MAGAZINE
AND
JOURNAL OF SCIENCE.

[FOURTH SERIES.]

MARCH 1861.

XXV. *On Physical Lines of Force.* By J. C. MAXWELL, *Professor of Natural Philosophy in King's College, London*.*

PART I.—*The Theory of Molecular Vortices applied to Magnetic Phenomena.*

IN all phenomena involving attractions or repulsions, or any forces depending on the relative position of bodies, we have to determine the *magnitude* and *direction* of the force which would act on a given body, if placed in a given position.

In the case of a body acted on by the gravitation of a sphere, this force is inversely as the square of the distance, and in a straight line to the centre of the sphere. In the case of two attracting spheres, or of a body not spherical, the magnitude and direction of the force vary according to more complicated laws. In electric and magnetic phenomena, the magnitude and direction of the resultant force at any point is the main subject of investigation. Suppose that the direction of the force at any point is known, then, if we draw a line so that in every part of its course it coincides in direction with the force at that point, this line may be called a *line of force*, since it indicates the direction of the force in every part of its course.

By drawing a sufficient number of lines of force, we may indicate the direction of the force in every part of the space in which it acts.

Thus if we strew iron filings on paper near a magnet, each filing will be magnetized by induction, and the consecutive filings will unite by their opposite poles, so as to form fibres, and these fibres will *indicate* the direction of the lines of force. The beautiful illustration of the presence of magnetic force afforded by this experiment, naturally tends to make us think of

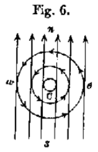
* Communicated by the Author.

172 Prof. Maxwell *on the Theory of Molecular Vortices*

element will be urged in the direction of $-x$, transversely to the direction of the current and of the lines of force; that is, an *ascending* current in a field of force magnetized towards the *north* would tend to move *west*.

To illustrate the action of the molecular vortices, let sn be the direction of magnetic force in the field, and let C be the section of an ascending magnetic current perpendicular to the paper. The lines of force due to this current will be circles drawn in the opposite direction from that of the hands of a watch; that is, in the direction $n\,w\,s\,e$. At e the lines of force will be the sum of those of the field and of the current, and at w they will be the difference of the two sets of lines; so that the vortices on the east side of the current will be more powerful than those on the west side. Both sets of vortices have their equatorial parts turned towards C, so that they tend to expand towards C, but those on the east side have the greatest effect, so that the resultant effect on the current is to urge it towards the *west*.

Fig. 6.



The fourth term,

$$+\mu\gamma\frac{1}{4\pi}\left(\frac{d\alpha}{dz}-\frac{d\gamma}{dx}\right), \text{ or } +\mu\gamma q, \quad . \quad . \quad . \quad (10)$$

may be interpreted in the same way, and indicates that a current q in the direction of y, that is, to the north, placed in a magnetic field in which the lines are vertically upwards in the direction of z, will be urged towards the *east*.

The fifth term,

$$-\frac{dp_1}{dx}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

merely implies that the element will be urged in the direction in which the hydrostatic pressure p_1 diminishes.

We may now write down the expressions for the components of the resultant force on an element of the medium per unit of volume, thus:

$$X=\alpha m+\frac{1}{8\pi}\mu\frac{d}{dx}(v^2)-\mu\beta r+\mu\gamma q-\frac{dp_1}{dx}, \quad . \quad . \quad . \quad (12)$$

$$Y=\beta m+\frac{1}{8\pi}\mu\frac{d}{dy}(v^2)-\mu\gamma p+\mu\alpha r-\frac{dp_1}{dy}, \quad . \quad . \quad . \quad (13)$$

$$Z=\gamma m+\frac{1}{8\pi}\mu\frac{d}{dz}(v^2)-\mu\alpha q+\mu\beta p-\frac{dp_1}{dz}. \quad . \quad . \quad . \quad (14)$$

The first term of each expression refers to the force acting on magnetic poles.

"The velocity of transverse undulations in our hypothetical medium, calculated from the electro-magnetic experiments of M. M. Kohlrausch and Weber, agrees so exactly with the velocity of light calculated from the optical experiments of M. Fizeau, that we can scarcely avoid the inference that *light consists in the transverse undulations of the same medium which is the cause of electric and magnetic phenomena*."

Maxwell there dimensionally relates aether elasticity and density to the coefficients in the equations for electric permittivity and magnetic permeability, yielding 310.74 Mm/s, which he compares to Fizeau's optical measurement of light, 314.858 Mm/s. Notice the unwarranted precision by Maxwell, the lack of any error bar estimates, and the fact that both estimates are higher than 300 Mm/s. Maxwell's calculation of "light" velocity by using electric and magnetic force coefficients was not an innovation by Maxwell in this 1861 paper; it had already been done using dimensional analysis by Weber in 1856. Maxwell's innovation of vacuum displacement current is an *aether theory*. Maxwell accidentally conflated *light* velocity with his calculation of the velocity of propagation of electrical energy in circuits. Maxwell writes in Article 574 of his *Treatise on Electricity and Magnetism*, 3rd ed., 1873 (J. J. Thomson, editor) that he knew of no measurement of electrical current speed, he was *sure* of (Fizeau's) velocity of light, because the ratio of electrical constants yielded it. He used *electrical measurements*, yet he *assumed* he was *modelling light*, not electric signal speed:

"... there is, as yet, no experimental evidence to shew whether the electric current... velocity is great or small as measured in feet per second." - James Clerk Maxwell, *A Treatise on Electricity and Magnetism*, 3rd ed., 1873, Article 574. (Electric energy goes at about c.)

"... we may define the ratio of the electric units to be a velocity... this velocity [assumed to be light] is about 300,000 kilometres per second." - Maxwell, *Treatise*, 3rd ed., Article 769.

Maxwell in fact proposed a Michelson-Morley experiment to find the *absolute* velocity of light in his aether force-field carrier. "Maxwell's equations" were developed by Heaviside.

Why "relativity" effects are consistent with Maxwell's SU(2) spinning field quanta mechanism of magnetism

"… the mortallest enemy unto knowledge ... hath been a peremptory adhesion unto authority ... most men, of ages present, so superstitiously do look upon ages past, that the authorities of the one exceed the reasons of the other." - Sir Thomas Browne, *Pseudodoxia Epidemica.*

The refraction of light is explained in QED by the interactions between the electromagnetic field of the photon and the electromagnetic fields in the block of glass (between electrons and electrons, and between electrons and nuclei). These quantum field interactions between photons and fields in dense media *slow down the photon, relative to its velocity in a vacuum.* All mass and energy also interacts with the gravitational field, *so a clock moving at relativistic velocities in the zero point gravitational field will also experience faster interactions with gravitons than at low velocity (like running into the rain), which slows down "time," since the particles are effectively in a denser (higher interaction rate) field, and head-on interactions causes a FitzGerald contraction of the Michelson-Morley instrument, explaining "relativity."*

SU(2) electrodynamics, U(1) hypercharge, and mixing

Fig. 16: the U(1) "weak hyper-charge," *Y*, is an epicycle taking "ugly" *ad hoc* values of 1/3, 4/3, -2/3, -1, -2, and 0. *Y* = 2(*Q* - *I*) forces electro-weak theory to "work." (*Credit as for Fig. 1.*)

		Weak Isotopic Charge I_3	Weak Hypercharge Y	Electric Charge Q $(=I_3 + \frac{1}{2}Y)$
Quarks				
Doublet	u_L	½	⅓	⅔
	d_L	−½	⅓	−⅓
Singlets	u_R	0	4/3	⅔
	d_R	0	−⅔	−⅓
Leptons				
Doublet	$(\nu_e)_L$	½	−1	0
	e_L	−½	−1	−1
Singlet	e_R	0	−2	−1
Gauge Bosons				
Triplet	W^+	1	0	1
	W_3	0	0	0
	W^-	−1	0	−1

"One of us (Wilczek) recalls that as a graduate student he considered the now standard SU(2) × U(l) model of electroweak interactions to be 'obviously wrong' just because it requires such ugly hypercharge assignments. ... it still seems fair to call the model 'obviously incomplete' for this reason."

- Savas Dimopoulos, Stuart Raby and Frank Wilczek, "Unification of Couplings," *Physics Today*, Oct. 1991.

"Stephen Weinberg and Abdus Salam tried to combine quantum electrodynamics with what's called the 'weak interactions' (interactions with W's) into one quantum theory, and they did it. But if you just look at the results they get you can see the glue, so to speak. It's very clear that the photon and the three W's are interconnected somehow, but ... you can still see the 'seams' in the theories; they have not yet been smoothed out so that the connection becomes ... more correct."

- Richard P. Feynman, *QED*, 1985, p. 142 (Penguin edition, 1990).

"It always bothers me that, according to the laws as we understand them today, it takes a computing machine an infinite number of logical operations to figure out what goes on in no matter how tiny a region of space, and no matter how tiny a region of time [perturbative expansions with an infinite number of terms; path integrals over an infinite number of paths]. How can all that be going on in that tiny space? Why should it take an infinite amount of logic to figure out what one tiny piece of spacetime is going to do? So I have often made the hypothesis that ultimately physics will not require a mathematical statement, that in the end the machinery will be revealed, and the laws will turn out to be simple, like the chequer board with all its apparent complexities."

- Richard P. Feynman, November 1964 Cornell lectures on the *Character of Physical Law*, recorded and published by the BBC.

"It was a kind of one-upmanship, where nobody knows what's going on, and they'd put the other one down as if they *did* know. They all fake that they know, and if one student admits for a moment that something is confusing by asking a question, the others take a high-handed attitude, acting as if it's not confusing at all, telling him that he's wasting their time. ... I couldn't see how anyone could be educated by this self-propagating system in which people pass exams, and teach others to pass exams, but nobody knows anything."

- Richard P. Feynman, *Surely you're joking Mr Feynman*, 1988.

Feynman's 2nd quantization multipath interference mechanism non-perturbatively *replaces* 1st quantization. Sum wavefunction amplitudes for all paths: "cancelled" paths are offshell, "uncancelled" are onshell. There is no *single* indeterministic wavefunction, so spin is simply *not* "entangled." *This fact is simply unfashionable, and shows the problem of trying to introduce a mechanistic theory today. The rest of our paper may be akin to Darwin developing genetics and DNA structure in his 1859 book, to overcome bigoted "rhetorical questions" from thuggish "peer"-review "critics," Einstein struggling to include general relativity in his 1905 special relativity paper, or Bohr struggling to include QFT in his atomic orbits paper.* Darwin's evolution was self-censored for 20 years for fear of critics, *because Lamarke had an earlier incorrect evolution.* "Peer" reviewers *always* conflate new theories with a dismissed half-baked earlier theory, thus dismissing the new theory without bothering to check it. Feynman's Preface to his 1963 *Lectures on Physics:* "the best teaching can be done only when there is a direct individual relationship between a student and a good teacher - a situation in which the student discusses the ideas, thinks about the things, and talks about the things. It's impossible to learn very much by simply sitting in a lecture, or even by simply doing problems that are assigned." Feynman's *Surely You're Joking* states:

"The first principle is that you must not fool yourself - and you are the easiest person to fool. ... One example of the principle is this: If you've made up your mind to test a theory, or you want to explain some idea, you should always decide to publish it whichever way it comes out. If we only publish results of a certain kind, we can make the argument look good. We must publish both kinds of results."

But failure, error, and even just diffidence or modest/sceptical self-criticism will appear to editors and their hostile "peer"-reviewers (consisting of ignorant competitors striving for limited funding to support their many partners/kids) as *incompetence*, which *pours away funding hopes for half-baked ideas, by presenting vital ideas as glasses half empty,* instead of as glasses half-full (needing a top-up). *Faraday said new ideas are as useful/less as new born babies.* They need heuristic (trial and error) development *before* Popper's yes/no tests or examinations, or they *will* "fail," just *due to premature testing.* Aristarchus's modest, half-baked solar system of 250 BC failed under premature examination, was unfashionable, and turned to smoke when the last copy burned with the Library of Alexandria. Thus the modern thesis marking criteria:

1. *Intention clearly stated and its originality strongly defended.*
2. *Evidence of collation of existing research and critical evaluation of that evidence and theory.*
3. *Detailed comparative analysis of evidence and theory, constructing logical judgement criteria to evaluate the existing evidence and theory.*
4. *Precise (not vague) coherent synthesis of new facts and new theory.*
5. *Strong defence of the new theory or facts, using wide range of knowledge and theoretical evidence, to consistently justify new innovations.*
6. *Think from the standpoint of your enemy: answer all objections.*
7. *Assemble attractive text and illustrations, to generate interest.*

A clear intention is synonymous with *prejudice;* there's "nothing new under the sun"; readers prefer modesty; you only need to defend if you have weaknesses that invite attacks.

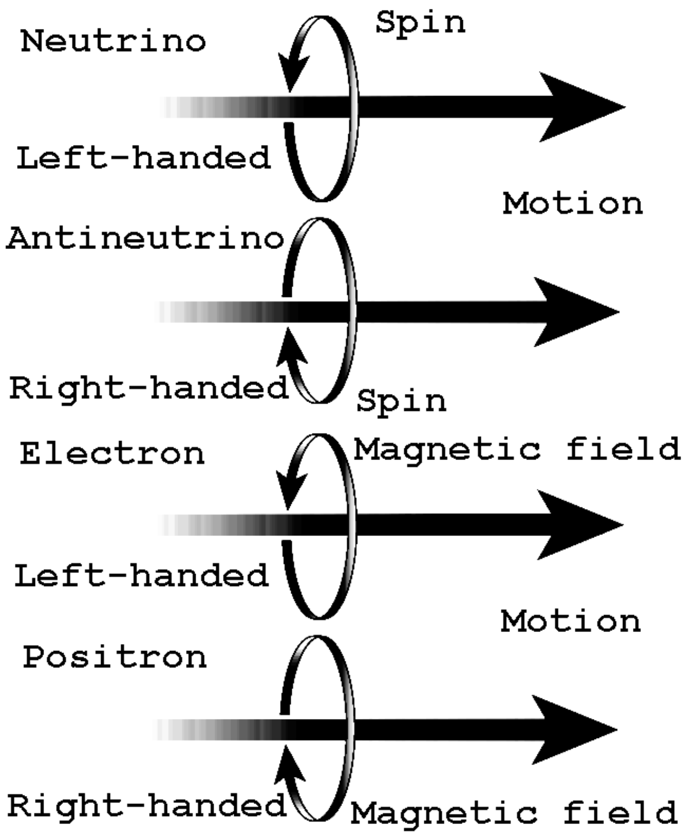


Fig. 17: The Lorentz force is *F = dp/dt = q(E + vB*sinθ), showing the origin for inertia in zero point electric fields and magnetism in spin helicity. In the weak (isospin charge) interaction, neutrinos were supposed to have left-handed helicity, i.e. they turn like a left-handed screw being tightened, and all antineutrinos have right-handed spin. A lack of right handed neutrinos and left-handed antineutrinos breaks Pauli's "conservation of parity" law. But the neutrino mixing shows that right-handed neutrinos (like innovators in physics) although largely suppressed, are not totally absent.

In 1929, Herman Weyl dismissed electrodynamics parity in his analysis of Dirac's spinor, but Pauli rejected Weyl's idea in 1932. At that time the weak interaction was unknown, and the basis for spin was the SU(2) Pauli spin matrices of QED, yet QED was assumed dogmatically to be a U(1) interaction, not an SU(2) symmetry.

However, Maxwell had earlier shown that the helicity of magnetic fields around electric currents suggests that *magnetic* fields in ordinary electrodynamics must be *mediated by field quanta having left-handed spin*. When Maxwell's *mechanical spin mechanism* (a crazy-looking gear box aether) was rightly thrown out of physics by the great genius Einstein, the baby was thrown out with the bath water. The linear momentum imparted in the exchange of field quanta causes *electric* force field phenomena, but the *magnetic* fields which curl around the direction of motion of charge, as seen by an observer, are due to the intrinsic angular momentum or spin of the field quanta emitted by the electrons. If parity were conserved in electrodynamics, there would be *no net magnetic fields around electric currents*, because an electric current would consist of equal mean numbers of left-handed and right-handed electrons drifting in the direction of the current, so the mean spin of their field quanta would be zero. SU(2) electrodynamics is left-handed.

		Weak Isotopic Charge I_3	Weak Hypercharge Y	Electric Charge Q $(=I_3 + ½Y)$
Quarks				
Doublet	u_L	½	⅓	⅔
	d_L	−½	⅓	−⅓
Leptons				
Doublet	$(\nu_e)_L$	½	−1	0
	e_L	−½	−1	−1
Gauge Bosons				
Triplet	W^+	1	0	1
	W_3	0	0	0
	W^-	−1	0	−1

Fig. 18 shows the Standard Model's U(1) × SU(2) electroweak theory's hypercharge assignments for weakly interacting (left handed) particles (for right-handed particles, there is no isospin charge so electric charge is then simply half the hypercharge). Hypercharge is an empirically-based concept like epicycles, predating the 1960s theory of quarks and the Standard Model. It was necessitated by efforts to *model* the *observed* relationship between the *observed* weak isospin charge of particles and their *observed* electric charge. It was in 1953 that Gell-Mann and Nishijima found that electric charges of isospin doublet particles were given by $Q = \pm\frac{1}{2} + \frac{1}{2}Y/2$, which is the genesis of the electroweak hypercharge formula $Q = \boldsymbol{I} + \frac{1}{2}Y$, where I is weak isospin charge and Y is hypercharge. This is not a speculative guess but an *empirical law, based on data for isospins and hypercharges for many different doublets.* This $Q = \boldsymbol{I} + \frac{1}{2}Y$ law can be interpreted as a field energy conservation law for electroweak charges.

We retain a U(1) hypercharge, but U(1) is now the symmetry of repulsive quantum gravity (dark energy). In the $Q = \boldsymbol{I} + \frac{1}{2}Y$ formula, the factor of $\frac{1}{2}$ is needed *because only half of the hypercharge is able to couple to the left-handed isospin charge, thus equating to electric charge.*

For right-handed particles, Woit[30] shows how the *most trivial possible Clifford algebra representation of U(2) spinors in Euclidean spacetime yields the chiral electroweak isospin and hypercharge law.* This proves the claim that left-handed helicity electrons have a hypercharge of -1, and right-handed electrons have a hypercharge of -2 because, *in a left-handed electron, half of the hypercharge field energy appears as weak isospin charge, which doesn't happen in right-handed electrons.* This is because left-handed electrons are not a mirror-image of right-handed electrons; there is no such thing as parity.

Magnetic field SU(2) electrodynamics evidence

In this paper we use *experimentally validated facts as inputs* to make predictions, not guesswork predictions which are then *assumed to be facts if they happen by pure coincidence to give answers which match reality.* Popper's "falsifiable theory" delusion is that a large "landscape" of predictions, say the 10^{500} metastable vacua in superstring theory, have a *relatively large probability* of containing some *numerically* "good" models by change, just as Ptolemy's epicycles matched planet motions.

Wavefunction amplitude uncertainty for spin helicity

Is spin angular momentum intrinsically "indeterministic"? This is vitally important for SU(2) electrodynamics. One of the best SLAC measurements[31] of the weak mixing angle is based on >91 GeV collisions of chirally polarized (e.g. left-handed spinor) electrons with unpolarized positrons, and measuring the production rate of weak Z bosons from the annihilation (for collisions at energies below 91 GeV, gamma rays are given off; the Z boson mass is 91 GeV).

So massive particles do *not* have an entirely unbiased "superposition" wavefunction *for helical spin handedness,* despite dogmatic claims to the contrary about spin, based on fashionable indeterminism arm-waving. Those claims originate from EPR experiment as evaluated with Bell's 1st quantization-based inequality, as tested by Alain Aspect[32]. Photons in Bell's inequality are supposed to have indeterministic polarization until a measurement "collapses" their polarization vector wavefunction. But in 2nd quantization the photon *doesn't have a single wavefunction* (which would be a "hidden variable" until measured, anyway), but rather "the" photon isn't a single quantum entity, but *is the superposition of many paths, each having a separate wavefunction amplitude,* and it is the superposition of the different path wavefunction amplitudes in the path integral which determines the path of least action by a simple multipath interference *mechanism,* not a vague ESP-hogwash "theory" that the *observer's mind collapses a single wavefunction.* It is impossible to get across to the dogmatic single-wavefunction collapse propagandarists the fact that single-wavefunction quantum mechanics is wrong because it's non-relativistic, and that the *correct many-wavefunction path integral* is not "collapsed" by a measurement, but is determined by *multipath interference,* like sky wave HF radio interference from radio waves being reflected back by several partially-reflecting ionospheric layers (D, E, and F-regions), so that different path contributions arrive at a receiving antenna with the path components out-of-phase.

The *intrinsic* "uncertainty principle," Paul Forman explained in 1971[33], was born *not out of experimental necessity,* but out of the effect on German physics of the hyperinflation-induced economic misery and poverty following World War I. When the ship of science was sailing in calm and tranquil waters, determinism ruled the waves. When the storms of hyperinflation destroyed German savings from 1922-9, indeterminism ruled the waves. Hysterically dogmatic anti-mechanism rants went unopposed. As "epicycles" made clear, phenomena are *easily* modelled by abstract, non-mechanistic correlations. Such short-cuts also led to delusional "ends justify the means" fascism from Nazi nuclear research leader Werner Heisenberg and the 1927 founder of QFT, Pascual Jordan:

"... Pascual Jordan ... the main protagonist of quantum field theory ... entangled himself very much with the Nazi ideology. As a true believer in Heraklit's dictum 'war is the father of all things' he defended the idea that without what he considered as the cleansing effect of war, mankind is condemned to stagnation. This and his conviction that the 'Bolshevist peril' had to be eradicated drove him into the arms of the Nazis. ... This explains why several important contributions by Jordan which were ahead of time ... went unnoticed. ... This led to the unique and somewhat anomalous situation that the co-discoverer of quantum mechanics and the protagonist of quantum field theory was ignored by the Nobel prize committee; instead Pascual Jordan became the tragic 'unsung hero of quantum field theory.' [S. S. Schweber, *QED and the men who made it; Dyson, Feynman, Schwinger and Tomonaga*, Princeton University Press 1994] [O. Darrigol, "The origin of quantized matter fields," *Hist. Stud. Phys. Sci.* 16/2, 198] ... Pascual Jordan took the lead in the formulation of the conceptual and mathematical underpinnings of 'Matrix Mechanics' in his important paper together with Max Born [M. Born and P. Jordan, "Zur Quantenmechanik," *Zeitschr. fur Physik*, 34, (1925) 858] submitted on 27 September 1925 ... Within a matter of days he confirmed that Born's conjecture was indeed consistent. The Born-Jordan results made Heisenberg's ideas more concrete. ...

"After the submission of the joint work with Max Born on matrix mechanics, in which the p-q commutation relation appeared for the first time, there came the famous 'Dreimaennerarbeit' [M. Born, W. Heisenberg and P. Jordan, "Zur Quantenmechanik II," *Zeitschr. fur Physik* 35, (1926) 557] with Born and Heisenberg in November of the same year ... his colleagues did not accept that something which was already a quantum theory should be subjected to a second quantization ... [Jordan concluded] the year's harvest with a paper by him alone on the 'Pauli statistics'. Jordan's manuscript contained what is nowadays known as the Fermi-Dirac statistics ... Jordan's most seminal contribution is perhaps his 1927 discovery of 'Quantization of Wave Fields' which marks the birth of QFT. ... Jordan died in 1980 (while working on his pet theory of gravitation with a time-dependent gravitational coupling) ..."

- Bert Shroeder, *Physicists in times of war,* arXiv:physics/0603095 v1, 2006, pp. 7-10 and 14.

Niels Bohr was the leading defender of Heisenberg's uncertainty principle of 1st quantization, infuriatingly using it to hold up Feynman's path integral 2nd quantization approach:

"I would like to put the uncertainty principle in its historical place: when the revolutionary ideas of quantum physics were first coming out, people still tried to understand them in terms of old-fashioned ideas ... But at a certain point the old fashioned ideas would begin to fail, so a warning was developed that said, in effect, 'Your old-fashioned ideas are no damn good when ...'. If you get rid of *all* the old-fashioned ideas and instead use the ideas that I'm explaining in these lectures - adding *arrows* [*arrows = wavefunction phase amplitudes in a sum over histories or path integral*] for all the ways an event can happen - there is no *need* for an uncertainty principle! ... on a small scale, such as inside an atom, the space is so small that there is no main path, no 'orbit'; there are all sorts of ways the electron could go, each with an amplitude. The phenomenon of interference [*multipath interference, like HF radio skywave multipath interference*] becomes very important ..."

- Richard P. Feynman, *QED,* Penguin, 1990, pp. 55-6, and 84.

"I refer specifically to the phenomenon of 'quantum entanglement.' ... the experts ... all, when pushed, admit that there are 'loopholes', and when pushed still further admit that this means that no valid test has ever been done ... They stick to the belief that the quantum theory weirdness really does happen only because nobody has yet managed to publish - in *Physical Review Letters* - any reasonable alternative explanation!"

- Caroline H. Thompson, *Physics World,* November 2001, p. 17.

Sent: 02/01/03 17:47
Subject: Your_manuscript LZ8276 Cook
Physical Review Letters does not, in general, publish papers on alternatives to currently accepted theories.
Yours sincerely, Stanley G. Brown, Editor, Physical Review Letters

"Mathematicians, or people who have very mathematical minds, are often led astray when 'studying' physics because they lose sight of the physics. They say: 'Look, these differential equations - the Maxwell equations - are all there is to electrodynamics; it is admitted by the physicists that there is nothing which is not contained in the equations. The equations are complicated, but after all they are only mathematical equations and if I understand them mathematically inside out, I will understand the physics inside out.' Only it doesn't work that way. ... A physical understanding is a completely unmathematical, imprecise, and inexact thing, but absolutely necessary for a physicist."

- Richard P. Feynman, Robert B. Leighton, and Matthew Sands, *The Feynman Lectures on Physics,* vol. 2, Addison-Wesley, 1964, p. 2-1.

"As for Feynman ... He told me he lost confidence in his program of emptying space when he found that both his mathematics and experimental facts required the kind of *vacuum polarization* modification of electromagnetic processes depicted - as he found it, using Feynman graphs ... the electromagnetic field gets modified by its interaction with a spontaneous fluctuation in the electron field - or, in other words, by its interaction with a virtual electron-positron pair. In describing this process, it becomes very difficult to avoid reference to space-filling fields."

- Frank Wilczek, *The lightness of being: mass, ether, and the unification of forces,* Basic Books, N.Y., 2008, p. 89.

"Books on physics are full of complicated mathematical formulae. But thought and ideas, not formulae, are the beginning of every physical theory ..."

- Albert Einstein and Leopold Infeld, *The Evolution of Physics,* 1938 (reprint by Simon and Schuster, N.Y., 1966, p. 277).

"Is it conceivable that Maxwell actually reverse-engineered the displacement current precisely so that the equations of electromagnetism would support transverse waves at the speed of light in a vacuum? If so, he would have been consistent with a long tradition, dating back to the ancient Greeks, of arriving at results analytically, but presenting them synthetically. Einstein commented on this question in a letter to Michele Besso in 1918. He was chiding Besso for having suggested (in a previous letter) that, in view of Einstein's theory of relativity, 'speculation had proved itself superior to empiricism.' Einstein disavowed this suggestion, pointing out the empirical bases for all the important developments in theoretical physics, including the special and general theories of relativity. He concluded: 'No genuinely useful and profound theory has ever really been found purely speculatively. The closest case would be Maxwell's hypothesis for displacement current. But there it involved accounting for the fact of the propagation of light (& open circuits)'."

- Kevin S. Brown, *Maxwell's Displacement and Einstein's Trace,* www.mathpages.com/home/kmath103/kmath103.htm

"The strict deductive mathematics of Euclid and Apollonius has given rise to the impression that mathematicians create by reasoning deductively. Our review of the three hundred years of activity preceding Euclid should show that conjectures preceded proofs and that analysis preceded synthesis."

- Morris Kline, *Mathematical Thought from Ancient to Modern Times,* vol. 1, Oxford University Press, 1990, p. 99.

"Archimedes to Eratosthenes, greetings. I sent you on a former occasion some of the theorems discovered by me ... The proofs then of these theorems I have written in this book and now send to you. ... I thought fit to write out for you and explain in detail in the same book the peculiarity of a certain method, by which it will be possible for you to get a start to enable you to investigate some of the problems in mathematics by means of mechanics. This procedure is, I am persuaded, no less useful even for the proof of the theorems themselves; for certain things first became clear to me by a mechanical method, although they had to be demonstrated by geometry afterwards because their investigation by the said method did not furnish an actual demonstration. But it is of course easier, when we have previously acquired, by the method, some knowledge of the questions, to supply the proof than it is to find it without any previous knowledge. This is a reason why, in the case of the theorems the proof of which Eudoxus was the first to discover, namely that the cone is a third part of the cylinder, and the pyramid of the prism, having the same base and equal height, we should give no small share of the credit to Democritus who was the first to make the assertion* with regard to the said figure, though he did not prove it."

- Archimedes of Syracuse, Sicily (287-212 BC), *The Method* (T. L. Heath's translation).

*** Newton only *asserted* gravity's acceleration is proportional to the *attractor's mass* (e.g. the earth). Cavendish *checked* it. We prove it.**

"The conservation of isotopic spin is a much discussed concept in recent years. Historically an isotopic spin parameter was first introduced by Heisenberg in 1932 to describe the two charge states (namely neutron and proton) of a nucleon. The idea that the neutron and proton correspond to two states of the same particle was suggested at that time by the fact that their masses are nearly equal. ... The quanta of the [isotopic spin] field clearly have spin unity and isotopic spin unity. We know their electric charge too because all the interactions that we proposed must satisfy the law of conservation of electric charge, which is exact. The two states of the nucleon, namely proton and neutron, differ by charge unity. Since they can transform into each other through the emission or absorption of a [isotopic spin] quantum, the latter must have three charge states with charges ±e and 0."

- C. N. Yang and R. Mills, "Conservation of Isotopic Spin and Isotopic Gauge Invariance," ***Physical Review*****, v. 98, 1954, p. 191.**

The Yang-Mills SU(2) gauge theory equations were derived for the charged bosonic isospin field quanta of the weak nuclear interaction by Yang and Mills state in their famous 1954 paper, *Conservation of Isotopic Spin and Isotopic Gauge Invariance*. They found that for a charged SU(2) isospin field A_ν, the charge current of the exchanged bosonic field quanta adds the term $2\varepsilon A_\nu \times F_{\mu\nu}$ to a fermion current J_μ therefore making the total current $J_\mu + (2\varepsilon A_\nu \times F_{\mu\nu}) = -d_\nu F_{\mu\nu}$. This can be compared directly to the Maxwell equation for electromagnetism, $J_\mu = -d_\nu F_{\mu\nu}$. The presence of both the charged field A_ν and field strength tensor $F_{\mu\nu}$ in the charged field current term $2\varepsilon A_\nu \times F_{\mu\nu}$ is simply explained by Ohms's law: *an electric current is proportional to both the charge density (i.e. conductivity, siemens) and the field strength (volts) that pushes charge.*

The product of bosonic charge ε and field A_ν is simply analogous to the charge density, which will not constitute any current at all unless it is moved by an electromotive force, which is analogous to role of the field strength tensor $F_{\mu\nu}$. Thus, the current density delivered by charged field quanta is the product of the charge of the bosonic field, $2\varepsilon A_\nu$, and the field strength tensor $F_{\mu\nu}$ induces the motion of the charged bosonic field quanta in order to produce the bosonic field current density. The factor of 2 in the $2\varepsilon A_\nu$ charge of the bosonic field is due to the fact that *bosons have twice the isotopic charge of fermions* (isospin charge is $\pm\frac{1}{2}$ for left-handed fermions but is ±1 for bosonic field quanta).

The equation $J_\mu + (2\varepsilon A_\nu \times F_{\mu\nu}) = -d_\nu F_{\mu\nu}$ has a non-linear feedback effect where $J_\mu << 2\varepsilon A_\nu \times F_{\mu\nu}$, because then $2\varepsilon A_\nu \times F_{\mu\nu} \approx -d_\nu F_{\mu\nu}$, so that the $d_\nu F_{\mu\nu}$, the rate of variation of field strength, is directly proportional to the field strength $F_{\mu\nu}$ itself! This relationship is analogous to a supposedly problematic situation in quantum gravity, where gravitons carry energy and therefore gravitational charge (mass-energy), acting as a source term for the field. The equations for charged fields represent physical mechanisms which prevent these feedback phenomena where the charged field quanta are massless because a *light velocity* charged field quanta is relativistically "frozen" by time-dilation and therefore does not itself radiate or absorb field quanta due to its own charge.

The Maxwellian U(1) electromagnetic field strength tensor for electrically neutral and massless field quanta is:

$$F_{\mu\nu} = d_\mu A_\nu - d_\nu A_\mu,$$

whereas the Yang-Mills field strength tensor for SU(2) which includes charged gauge bosons is:

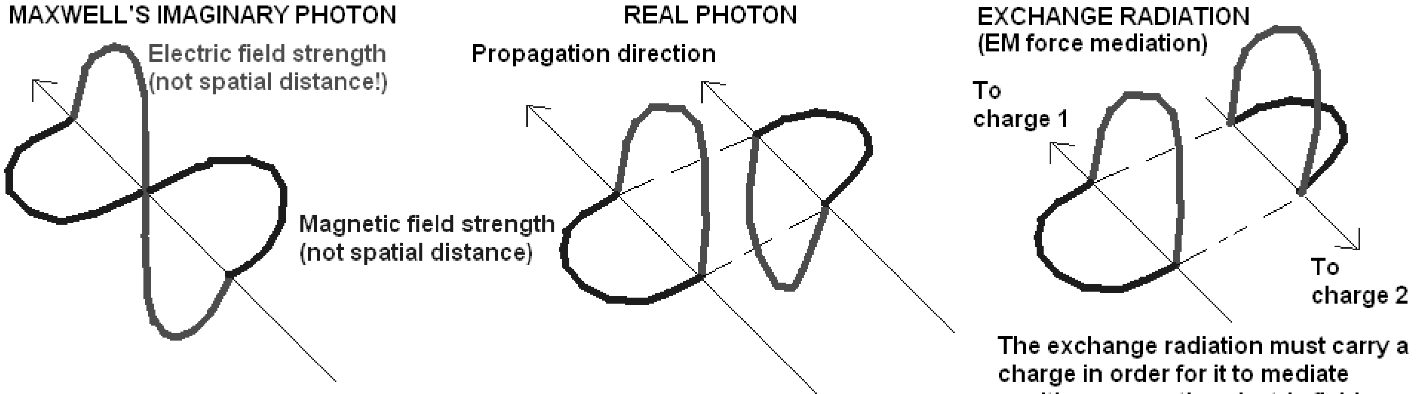
$$F_{\mu\nu} = d_\mu W^a{}_\nu - d_\nu W^a{}_\mu + g\varepsilon_{abc} W^b{}_\nu W^c{}_\mu.$$

Comparison these equations shows that the Yang-Mills field strength tensor is simply the Maxwell field strength tensor with an added charged boson term, $g\varepsilon_{abc} W^b{}_\nu W^c{}_\mu$ (where g is the weak field coupling factor and ε_{abc} is the weak boson structure constants) which allows the charged field quanta to *convey charge was well as force*, permitting charge-changing W boson weak force interactions, like beta decay. The SU(2) interaction fields involved are *a, b,* and *c*. Field *a* is the chargeless boson analogous to Maxwell's photon, so $d_\mu W^a{}_\nu - d_\nu W^a{}_\mu$ represents the Maxwell field $d_\mu A_\nu - d_\nu A_\mu$ for a neutral (uncharged) field boson. Terms $W^b{}_\nu$ and $W^c{}_\mu$ represent charged weak field bosons, so only the terms $W^b{}_\nu$ and $W^c{}_\mu$ occur in the "extra term" for charged field bosons. *A Maxwell field would therefore be equivalent to an SU(2) field in which the no net charge transfer is permitted.* However, the application of the 1954 Yang-Mills SU(2) isotopic spin gauge theory of weak interactions to reformulate Fermi's theory of beta decay was a slow process, only completed in the 1960s.

SU(2) Pauli spin matrices versus the U(1) QED theory

The mainstream theory is that SU(2) is Yang-Mills theory, and is separated from the U(1) theory of QED. It is vital to challenge and refute this destructive, anti-progress, pseudo-scientific dogma. The correct theory of QED is SU(2), yet this has been camouflaged and obfuscated by the fact that *the magnetic self-inductance of charged, massless QED gauge bosons is infinity,* preventing any charge transfer in SU(2) electromagnetism, and reducing the Yang-Mills equation to Maxwell's equations. The charged massless gauge bosons of QED cannot propagate in a one-way path because of the backreaction from magnetic self-inductance, so they cannot physically cause any charge-changing transformations.

This has led to electromagnetism being misinterpreted as a U(1) Abelian interaction. The *fact* that two charges of electromagnetism (negative and positive) exist, like the two isospin charges, shows that SU(2) with its 2 charge elements fits electromagnetism. The fact that there is a severe deficiency of "antimatter" in the universe, proves that the theory of U(1) in which opposite charges are attributed arm-wavingly, to "antimatter" is severely deficient in credibility.



Maxwell's photon: magnetic field curls can't cancel each other

A more "transverse" photon model, where the opposing magnetic fields do cancel in a photon. The transverse spatial extent is consistent with Feynman's path integrals

The exchange radiation must carry a charge in order for it to mediate positive or negative electric fields. QED gives the exchange radiation (assumed to be special photons) extra polarizations to account for attraction/repulsion phenomena. It is impossible for a massless, charged gauge boson to propagate, due to self-inductance. However, exchange radiation goes both ways all the time, so the magnetic fields are cancelled.

'Light ... "smells" the neighboring paths around it, and uses a small core of nearby space. (In the same way, a mirror has to have enough size to reflect normally: if the mirror is too small for the core of nearby paths, the light scatters in many directions, no matter where you put the mirror.)' - Feynman, QED, Penguin, 1990, page 54.

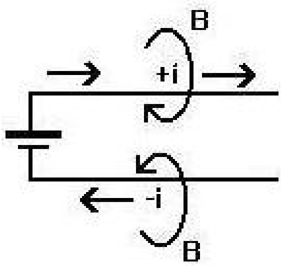
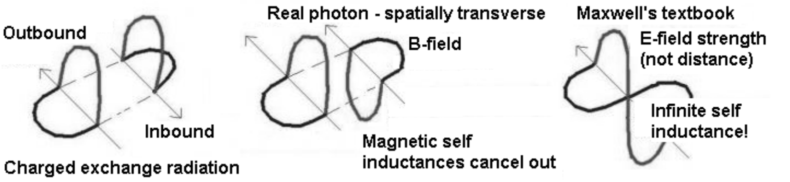
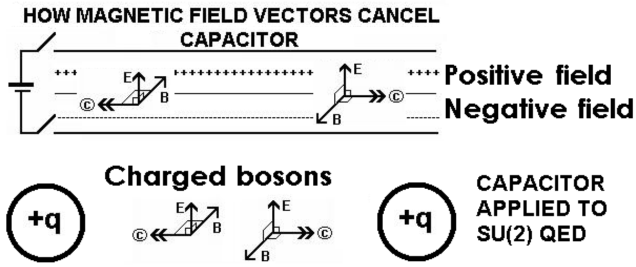


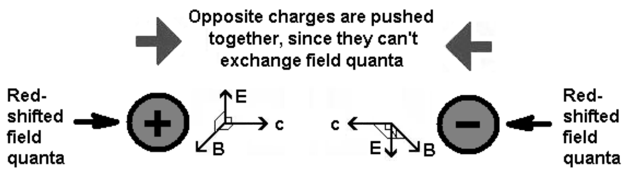
Fig. 19 (all diagrams on this page): Kirchoff's First Law, that electric current (charge flow) requires a complete circuit, implicitly assumes an infinite speed of electric current. But it takes *time* before current can get around a circuit, so and until current has gone around a circuit, electricity "doesn't know" if it is a complete or open circuit. Kirchoff's First Law was based on observations. Its subtle mechanism is that there is no *net* charge flow and no *net* current, because the "return" current in the adjacent conductor cancels out the forward current in the first conductor. This applies to SU(2) charged field quanta, as shown. Although net *charge* flows are cancelled out, *energy* is not cancelled and is conveyed to accelerate charges. *Charges produce magnetic fields when they move relative to the observer, which causes a serious backreaction (infinite self-inductance), preventing a single one-way electric current, unless there is an equal and opposite current in a second wire, whose magnetic field cancels out the infinite self-inductance of the field from the first wire.* A stream of electrons in a single conductor produces infinite self-inductance per unit length, $L = (1/i) \int B\, dr = (1/I) \int [\mu i/(2\pi r)]dr = \infty$. With two wires, the magnetic field's self-inductance is not infinite, since the opposite current in the adjacent wire produces a magnetic field with a cancelling curl direction (*left*).



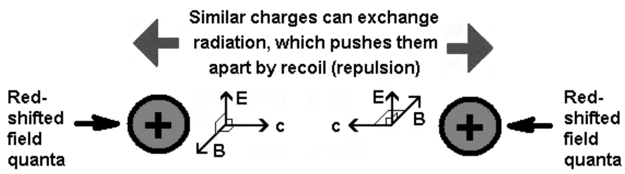
Maxwell's textbook photon is basically two massless opposite charges, one behind the other, propagating at light velocity. The apparent "spatial" waves are just plots of field intensities (not transverse spatial distances) along one axis! Therefore, the infinite magnetic self-inductances of each does not cancel out the other. It's a failure to unify electricity and magnetism.



Charged massless gauge boson exchange equilibrium: notice cancellation of B fields



Opposite charges are unable to exchange gauge bosons because the magnetic field curl directions of the passing radiations add together instead of cancelling out. Hence the magnetic self-inductance prevents the radiation.



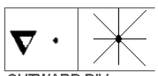
Similar charges are able to exchange gauge bosons because the magnetic field curl directions of the passing radiations cancel one another out, preventing magnetic self-inductance.

1. Opposite charges can't exchange field quanta with one another, because the curl directions of the magnetic field vectors don't cancel. Massless radiation can only propagate if the magnetic self-inductance is cancelled out.

2. Distant charges in the universe exchange redshifted Casimir off-shell radiations.

DIVERGENCE

$$\nabla \cdot E = \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z}$$



OUTWARD DIV (divergence) of field lines: simply a sum of gradients of the field

CURL

$$(\nabla \times E)_x = \frac{\partial E_z}{\partial y} - \frac{\partial E_y}{\partial z}$$

CURL

$$(\nabla \times E)_y = \frac{\partial E_x}{\partial z} - \frac{\partial E_z}{\partial x}$$

CLOSED CURL of field lines. Curls have no divergence by definition: by definition, you can't draw a CLOSED line around a charge in such a way that the divergence doesn't cancel itself

CURL

$$(\nabla \times E)_z = \frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y}$$

GAUSS

$$\nabla \cdot E = \frac{\rho}{\epsilon_0}$$

FARADAY

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

HEAVISIDE

$$\nabla \cdot B = 0$$

AMPERE + MAXWELL

$$c^2 \nabla \times B = \frac{j}{\epsilon_0} + \frac{\partial E}{\partial t}$$

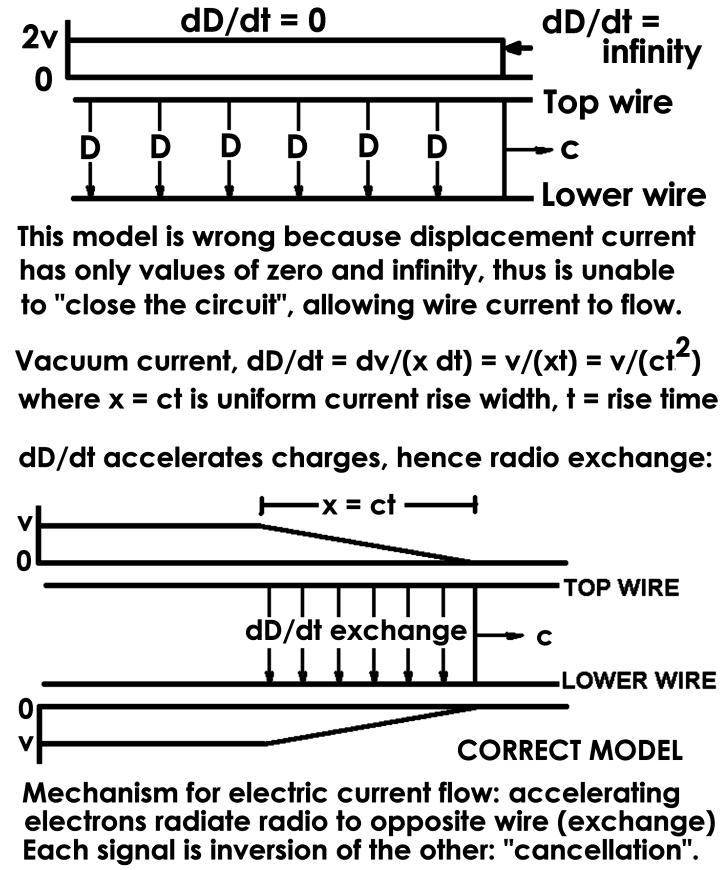
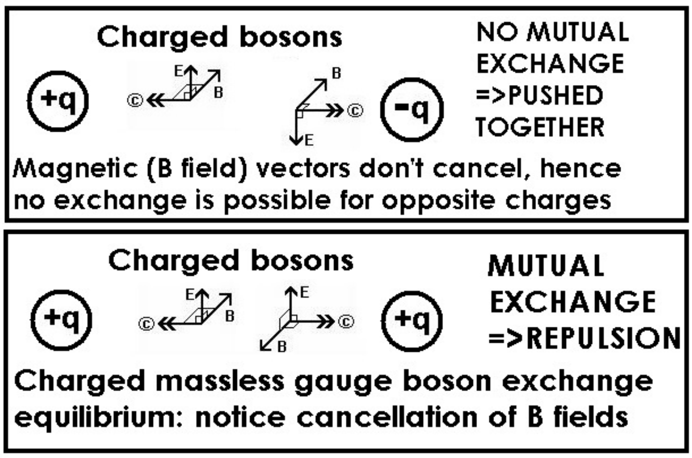
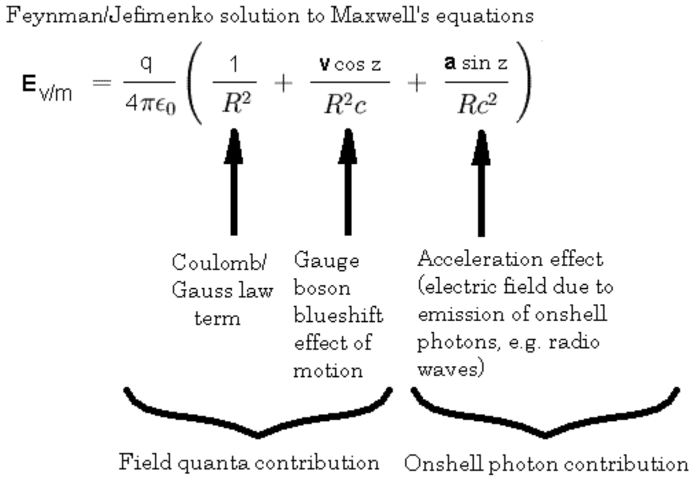
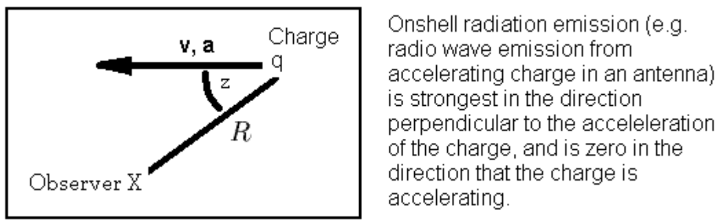


Fig. 20: epicycles in Heaviside's electrical theory for light velocity electric "logic step" energy propagation by a 2-conductor transmission line prevents a proper understanding of quantum electrodynamics. *Maxwell's displacement current is actually the exchange of radio energy between charges in each conductor.* Maxwell's "displacement current" term is radio energy exchanged between charging conductors. Maxwell's electromagnetic light theory, based on displacement current *plus* Faraday's law, is a superfluous, epicycle-like, circular argument. The corrected mechanism for the "open circuit" transmission line logic signal explains light. The top diagram is the Heaviside logic step "theory" of electric transmission in a two-conductor transmission line, *but it is wrong, containing no mechanism for current to flow into a transmission line at the velocity for the dielectric around and between the conductors.* Heaviside's logic "step" front theory is actually false because a vertical front implies zero rise time, and hence an infinite displacement current, $i = dD/dt = v/(ct^2) = v/0$. Our corrected model (lower diagram) shows that the changing electric field, *dD/dt*, causes charges in the wires to accelerate and therefore emit "radio energy." Each conductor emits an inversion of the radio energy emitted by the other, so the superimposed radio signal at distances large compared to the distance between teh conductors is zero, preventing the real loss of energy. Hence, ordinary electricity is an example of the equilibrium of exchange of radio energy, which causes the forces on electrons resulting in electric current, and explains why electricity's speed is that of energy in the medium between and around the conductors. (Pro-Heaviside Catt(34) helpfully argued that the top diagram contradicts electric current flow, but failed correct the errors, even after prolonged discussions with us; *assuming Heaviside "step" is correct,* he used Occam's razor to dismiss *electric current* like phlogiston, leaving only the EM field.)







The equation above omits retarded time from the distance *R* (retarded time allows for the light-velocity delay between a field variation due to the motion of the charge relative to the observer, and the reception of that field change at the distance $R = ct$). The 1st term is an inverse square law like Newton's gravity; the two additional terms represent field quanta Doppler shift, and onshell radiation, respectively. Gravitons are *not* exchanged between "attracting" masses to cause gravity (apples are *pushed down*), and onshell gravity waves are *very* weak. (*Feynman Lectures on Physics*, vol. 1, equation 28.3.)

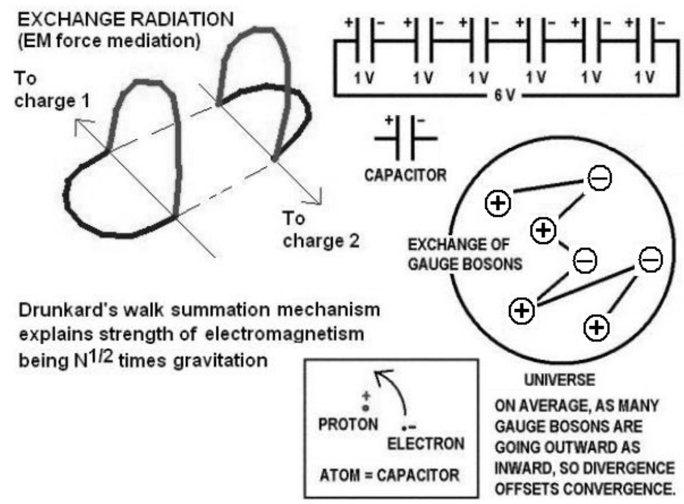


Fig. 21: charged SU(2) massless bosons *cannot be exchanged between opposite charges because their infinite magnetic self-inductances don't cancel out,* unlike the case for similar charges (which can exchange quanta with one another, thus repelling). As a result, there is no electric mutual repulsion between opposite charged, which are pushed together by redshifted offshell radiation from distant matter on their opposite sides. Charged field quanta are exchanged between *similar* charges in the universe, but most exchange paths are random arrangements of charges of both signs and cancel. The path integral or net summation, for a random walk between alternating signs of charge, involves as much divergence as convergence of radiation, and is equal to the gravity theory coupling multiplied by the square root of the number of charge pairs (about 10^{80}), about $(10^{80})^{1/2} = 10^{40}$.

Electrodynamics force mechanisms

Fig. 22: Coulomb's law or Gauss's law is a low-energy Moller scattering of similar charges, representing a tree-level two vertex Feynman diagram. Higher order Feynman diagrams (with the field affected by its own polarized pair production fermions) are trivial, because Schwinger's IR cutoff is a threshold on pair-production. You need an electric field strength *exceeding* about 1.3 x 10^{18} volts/metre (33 fm from an electron) to get the complex loopy Feynman diagrams.

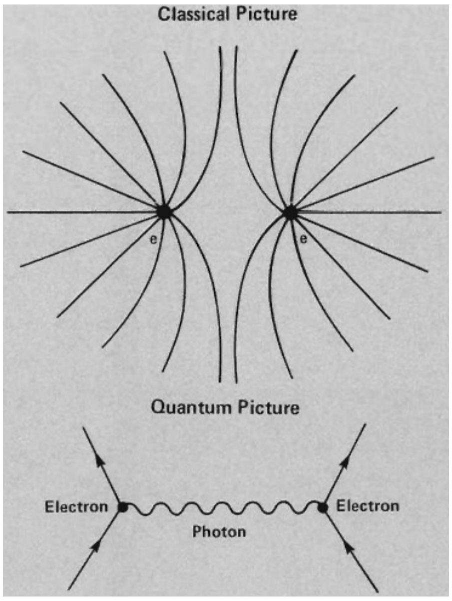


Figure xx shows the SU(2) electrodynamics mechanism. The Heisenberg uncertainty principle for light-velocity ($x = ct$) virtual particle range x and momentum p is $p = \hbar/x = \hbar/(ct)$; Newton's 2nd law predicts a fundamental QFT force:

$$F = dp/dt = d\,[\hbar/(ct)]/dt = -\hbar/(ct^2) = -\hbar c/x^2.$$

For comparison, Coulomb's empirical law states that the force between 2 electrons, 2 protons, or an electron and a proton has a larger magnitude, $F = \pm\, \hbar c/(\alpha x^2)$, which is $1/\alpha$ or ~137.036 times larger than QFT. This is evidence that the factor α represents *in the context of renormalization* the total running of the QED coupling between IR and ultimate UV cutoffs (the ratio of *bare core* very high energy electron charge to the *observed* electron charge at low energy). This is *not* the anti-mechanism mainstream dogma's accepted argument, which still prefers arm-waving numerology (α first appeared as the speed of the ground state hydrogen atom's electron, expressed as a fraction of light velocity).

Penrose ignores the conclusions above (published in the *Electronics World* journal, August 2002 and April 2003 issues) on page 678 of his 2004 book *Road to Reality,* where he suggests wrongly that the ratio of unobserved bare core charge to observable low energy (<IR cutoff energy) charge is not $1/\alpha \sim 137.036$, but is $(1/\alpha)^{1/2} \sim 11.7$. Penrose is misled by the square of electric charge appearing in electromagnetic $\alpha = e^2/(4\pi\varepsilon\hbar c)$, believing that charge is proportional to the square root of alpha. This is entirely *guesswork numerology* that just ignores our published theoretical *calculation of QFT force.* Since the bare core charge implies an ultimate UV cutoff on the running of the coupling (a logarithmic dependence of the coupling on the collision energy, which goes approximately inversely with the distance from a particle), this number indicates the size of the particle core. Thus, our large $1/\alpha \sim 137.036$ bare core charge indicates a *black hole event horizon-sized core,* whereas Penrose's 11.7 is closer to compatibility with orthodox unification numerology, the falshood that the *Planck scale* is the UV cutoff grain/core size.

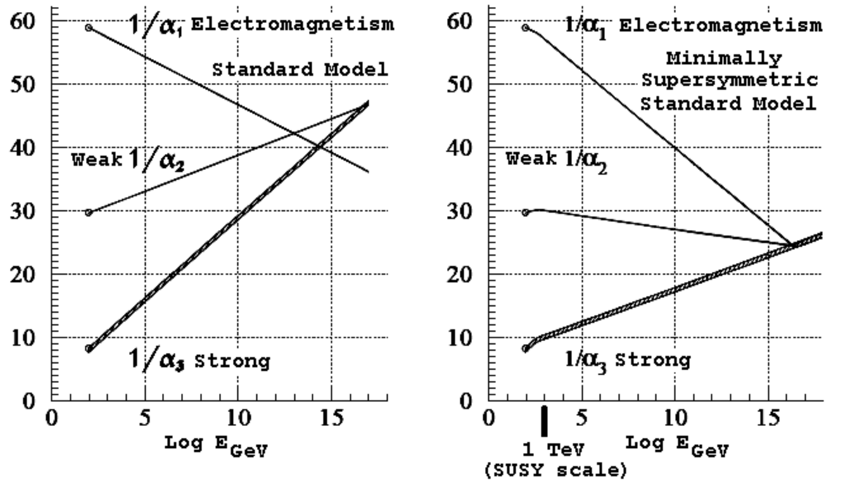
Magnetism is *always* present in direct proportion to electric fields due to the Poynting-Heaviside vector $\mathbf{E} = c \times \mathbf{B}$, but usually it is present in a "cancelled" or invisible form, due to equally opposing magnetic curls from random orientation of spinning particles with magnetic moments. Magnetic fields appear if an electric charge is in motion *relative* to the observer: $F_{\text{magnetic}} = -(v^2/c^2)F_{\text{electric}} = -\mathbf{B}qv$, which is because the normal cancellation of those magnetic fields fails in *direct proportion* to velocity, $\mathbf{B} = -(v/c^2)\mathbf{E}$, so the asymmetric portion of the otherwise hidden magnetic field is then observed. Magnetic fields are *uncloaked by motion relative to a charge.* The conservation of energy applied to the magnetic field energy density necessitates the Lorentz contraction since $F_{\text{magnetic}}/F_{\text{electric}} = -v^2/c^2$. Feynman shows magnetism is the Lorentz binomial expansion *second order* term:

$$F = d[mv(1 - v^2/c^2)^{-1/2}]/dt \approx q(\mathbf{E} + v \times \mathbf{B}),$$

connecting momentum to electromagnetism. Magnetism is due to relativistic helical spin speed, x, perpendicular to propagation at v, giving (by Pythagoras): $x^2 + v^2 = c^2$. Thus, magnetism is *represented by the exchange of spinning field quanta between moving charges, and is unavoidable in QFT, where field quanta have spin angular momentum.* Maxwell's *fixed* gear cog aether fails, as Richard P. Feynman explains in the *Feynman Lectures on Physics*, vol 2, 1964 (pp. 1-10, 15-7/8, 15-12/14, 20-9/10):

"Suppose that you finally succeeded in making up a picture of the magnetic field in terms of some kind of lines or of gear cogs running through space. Then you try to explain what happens to two charges moving in space, both at the same speed and parallel to each other. Because they are moving, they will behave like two currents and will have a magnetic field associated with them [two wires each carrying an electric current in the same direction are attracted by magnetism]. An observer who was riding along with the two charges, however, would see both charges as stationary, and would say that there is *no* magnetic field. The 'gear wheels' or 'lines' disappear when you ride along with the object! ... How can the gear wheels disappear?! The people who draw field lines are in a similar difficulty. ... What we are saying, then, is that magnetism is a relativistic effect. ... is the vector potential [$\mathbf{A}$] a 'real field'? ... it was believed that $\mathbf{A}$ was not a 'real' field. ... there are [Aharonov-Bohm] phenomena involving quantum mechanics which show that the field $\mathbf{A}$ is in fact a 'real' field ... people repeatedly said that the vector potential had no direct physical significance ... something like this can be around for thirty years but, because of certain prejudices of what is and is not significant, continues to be ignored. ... In quantum mechanics what matters is the interference between nearby paths ... $\mathbf{E}$ and $\mathbf{B}$ are slowly disappearing ... they are being replaced by $\mathbf{A}$ and ϕ."

Running couplings due to pair production and polarization screening



Source: U. Amaldi, W. de Boer and H. Fuerstenau, Physics Letters, v. B260, 1991, p447.

Fig. 23: the reciprocals of the running couplings representing electromagnetic charge, weak isospin charge and strong colour charge in the Standard Model (far left) and in the Minimally Supersymmetric Standard Model, "MSSM" (left, assuming a supersymmetric partner mass scale of 1 TeV). The energy scale is the logarithm of the collision energy in GeV, so 3 is 10^3 GeV or 1 TeV, 5 is 10^5 GeV, 10 is 10^{10} GeV and 15 is 10^{15} GeV. The MSSM is a epicycle-type contrived falsehood, since "unification" is *not mere numerology* (*making all running couplings exactly equal* at 10^{16} GeV by an abjectly speculative 1:1 boson:fermion supersymmetry). Unification instead has a physical mechanism: *sharing of conserved field energy between all different kinds of charge.*

The electromagnetic running coupling increases with collision energy as you get closer to a particle and penetrate through the shield of polarized vacuum which extends out to the Schwinger IR cutoff (~33 fm radius). This "shielded" field energy is checkably converted into short-range field quanta.

Scepticism about *undeveloped alternative ideas* is pseudoscience; science is *unprejudiced* scepticism for *mainstream speculations*.

U(1) × SU(2) × SU(3)

RUNNING MIXING ANGLE: MIXING AT LOW ENERGY BUT NO MIXING AT HIGH ENERGY, THUS SU(2) IS FULLY RENORMALIZABLE.

SU(3) is unaffected mathematically. But there is a mechanism. E.g., Yukawa's attraction is short-ranged because its massive pions are a LeSage gas-like effect, thus scattering into "shadows" with a small mean free path. Quarks have fractional electric charges compared to electrons, since electromagnetic field energy is converted into colour charges by pair production at very high energy.

U(1) is key symmetry of spin-1 dark energy and emergent gravity. Its charge is mass, which is given to weak bosons by a running mixing angle, which truncates mixing at high energy. Weak neutral bosons are the basis for all fermion masses because they form an *effective* "Higgs field" *in miring moving fermions, thus giving them inertia*.

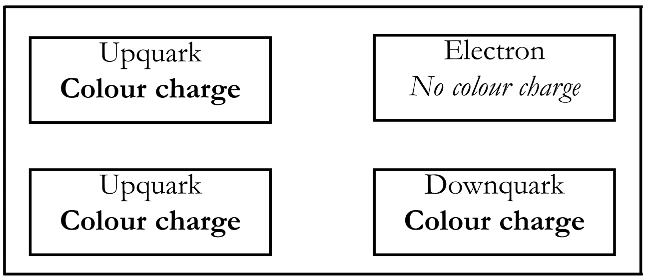
U(1) hypercharge becomes the basis for an Abelian spin-1 graviton single charge sign quantum gravity interaction, instead of electromagnetism. By a running-angle Weinberg mixing with SU(2), it provides mass to left-handed SU(2) spinors at low energy, but the mixing angle runs to kill massiveness at high energy, replacing the Higgs mechanism by making the theory renormalizable by 't Hooft's proof (massless gauge bosons at high energy avoid all of the barriers to renormalization).

"... the created [offshell] electron is slightly repelled by the [onshell] electron ... whereas the created [offshell] positron is slightly attracted to it, so there is a slight physical separation of these charges during their momentary existence [thus absorbing field energy, thereby increasing the pair's lifetime *beyond* the Heisenberg "uncertainty principle" value, $\hbar/E$]. This is happening all the time around the electron ... and the net effect, referred to as 'vacuum polarization,' is to reduce the apparent value of that electron's charge ... The vacuum serves to 'shield' the electron's charge ..." - Roger Penrose, *The Road to Reality,* 2004.

SU(2) models both electromagnetism and weak interactions; weak neutral Z bosons "mire" other particles, giving other particles masses. Yang-Mills equations reduce to Maxwell equations for massless charged bosons, since they cannot propagate in a one-way path (hence no net charge transfer). SU(2)'s charged massless field quanta can only be exchanged where an two-way exchange propagantion equilibrium of charged currents exists to cancel the field quanta's magnetic self-inductance. This two-way propagation of massless charged bosons automatically cancels out the net charge transfer term from the Yang-Mills equations, reducing them effectively to Maxwell's.

Dirac was partly correct in initially assigning the antiparticle of the electron as the proton; the imbalance between electrons and positrons is a broken symmetry. The correct symmetry is not U(1) but SU(2) for hydrogen atom with 2 positive upquarks, and 2 negative particles: a downquark and an electron. Protons predominate over antiprotons due to SU(2) chirality since *nearly all positive fermions have colour charge, but only half of the negatively charged fermions have colour charge*. The imbalance between "matter" and "antimatter" shows that U(1) is not correct for electrodynamics. T*he left-handed neutrino prejudice for massive weak isospin SU(2) fields translates to massless SU(2) electrodynamics as the mechanism for the apparent excess of "matter" over "antimatter".*

The omega minus baryon is a triplet of strange quarks of identical -1/3 electric charge, so the 1/3rd charges of quarks arises from vacuum polarization "cloaking": the *very strong superimposed electric field* from 3 electron charges gives 3 times more vacuum polarization (core shielding), so the observer attributes just *one unit electron charge* to the omega minus, attributing -1/3 per quark. Vacuum polarization thus *cloaks* an SU(2) symmetry: downquarks are leptons with 2/3rds of the electric charge energy converted into short-range colour charge. Only partly *shielded charged* fields can be observed:



There is no excess of "matter" over "antimatter": at high energy in the big bang, 100% of "positrons" became upquarks, but only 50% of the "electrons" became downquarks. This is *due to only left-handed electrons* having weak isospin charge interaction.

Fig. 24: SU(2) chiral pair production symmetry for hydrogen (>90% of the universe's visible matter): in pair production at *low energy* electron-positron pairs form, but in the big bang (*at very high energy*) 100% of positive charges, and 50% of negative charges are quarks.

The mechanisms for Moller and Bhabha interactions

"In quantum mechanics, the forces or interactions between matter particles are all supposed to be carried by particles. What happens is that a matter particle, such as an electron or a quark, emits a force-carrying particle. The recoil from this emission changes the velocity of the matter particle, for the same reason that a cannon rolls back after firing a cannonball. The force-carrying particle then collides with another matter particle and is absorbed, changing the motion of that particle. The net result of the process of emission and absorption is the same as if there had been a force between the two matter particles. ... If the force-carrying particles have a high mass, it will be difficult to produce and exchange them over a large distance, so the forces they carry will have only a short range. On the other hand, if the force-carrying particles have no mass of their own, the forces will be long-range."

- Stephen Hawking and Leonard Mlodinow, *A Briefer History of Time*, Bantam Press, London, 2005, pp. 118-9.

The cannon ball exchange theory that Stephen Hawking and Leonard Mlodinow describe in the quotation above explains *repulsion* between *similar charges,* first treated using quantum electrodynamics by C. Moller in 1932 (*Ann. d. Phys.,* v. 14, pp. 531, 568). Moller treated the simple problem of Coulomb repulsion between two negatively charged electrons.

Mechanism difficulties arose in 1936, when H. J. Bhabha treated the *attractive* force between *opposite charges,* using quantum electrodynamics (*Proc. Roy. Soc.,* v. A154, p. 195). Bhabha's attraction force model in QED was inspired by Hideki Yukawa's 1935 model of the pion-mediated strong nuclear binding force (*Proc. Phys.-Math. Soc. of Japan,* v. 17, no. 3, p. 48). Yukawa's problem was explaining the force which prevents electromagnetic repulsion between protons in a tiny nucleus from blowing the nucleus apart. This force is *obviously attractive, because it has to overcome the repulsion between protons,* to maintain nuclei stability (obvious exceptions being alpha particle radioactivity, spontaneousfission, etc.).

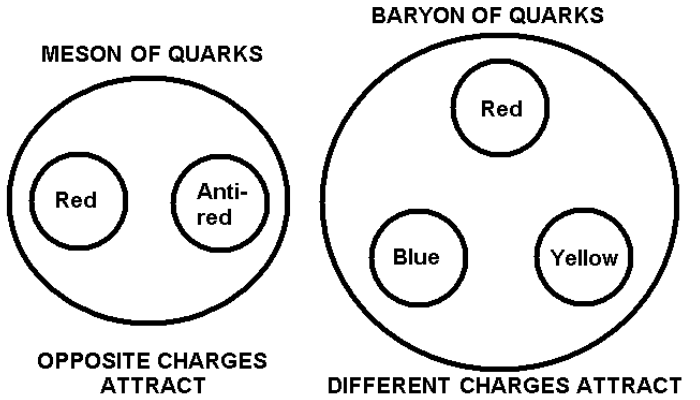
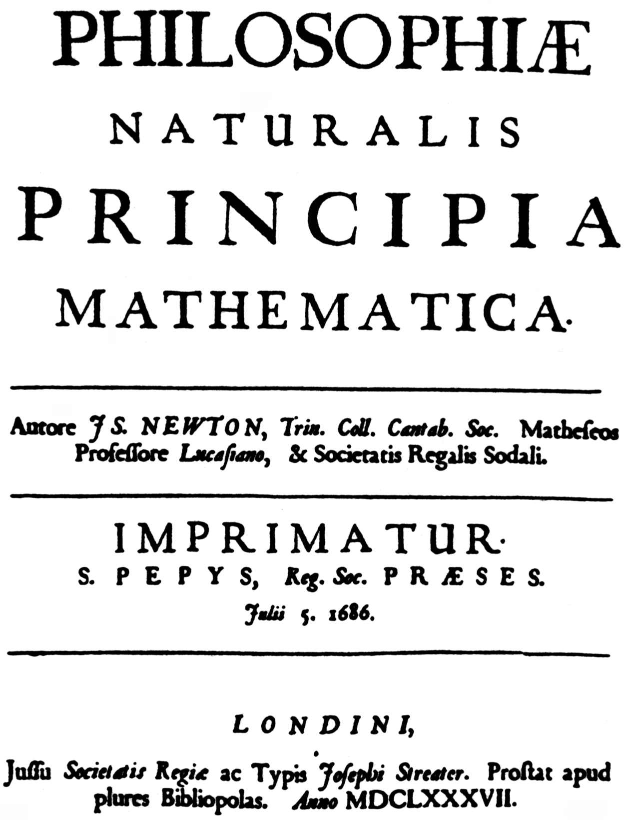


Fig. 24: the mechanism for SU(3) colour charge (leading to Yukawa's effective theory of meson mediated strong interactions) is simply an extension of the SU(2) isospin mechanism to three colour charges and their anticharges. The basic process is that SU(3) "attracts" triplets of quarks together, each with a different colour charge, to form a baryon (a quark triplet, like a neutron or a proton), and it also attracts colour-anticolour pairs together to form doublets called mesons, like Yukawa's pion. There is no actual "attraction" as such; the different colour charges simply cannot exchange field quanta (gluons) with one another, so there is no strong colour charge force of repulsion between them, but they are being bombarded by gluons in the field around them on other sides. They therefore "shield" one another, like ships being pressed together by the wave energy on opposite sides (the waves between two ships are smaller, because of mutual shielding). Another example, which shows why the force is short-ranged, is the sink plunger "attracted" to the wall by the push of air pressure. If you pull the sink plunger off the wall, air pressure fills the gap between the plunger and the wall, cutting off the "attractive" force. Thus, it only has a short range of action.



PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA.

Autore *J S. NEWTON*, *Trin. Coll. Cantab. Soc.* Matheseos Professore *Lucasiano*, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, *Reg. Soc.* PRÆSES.
Julii 5. 1686.

LONDINI,

Jussu *Societatis Regiæ* ac Typis *Josephi Streater*. Prostat apud plures Bibliopolas. *Anno* MDCLXXXVII.

Fig. 26: "The forces of attraction and repulsion between particles of matter, including gravitational attraction ... were primarily the offspring of alchemical active principles."

- R. S. Westfall, "The role of alchemy in Newton's career," in B. Righini and W. R. Shea (eds.), *Reason, Experiment and Mysticism in the Scientific Revolution*, Science History (publications), New York, 1975, pp. 189-232.

R. S. Westfall, the author of the most important biography of Newton, *Never at Rest* (Cambridge University Press, 1980), studied Newton's alchemy and found that Newton wrote 650,000 words about alchemical experiments, including manuscripts *Alchemical propositions*, *Alchemical writers* (113 alchemical authors), *De Scriptoribus* (a biography of 80 alchemical books), *Clavis*, *Praxis*, *Vegetation of Metals*, and *Essay on the Preparation of Star Reguluses*. After the *Principia* made him famous, he went further into the occult before literally making money, working for the Royal Mint. In describing his alchemical experiment of February 1696 in *Praxis* (nine years after the publication of the *Principia*), Newton actually claimed that he had discovered a philosopher's stone by which ammonium chloride had somehow multiplied the mass of metallic mercury by a factor of four. Newton was shamefully deluded, possibly due to mercury poisoning, and exhibited paranoia in his vicious battles against Leibniz, Hooke, and other enemies. He fabricated out of whole cloth an isothermal (*non-adiabatic*) theory of sound wave velocity, just to model a faulty experimental measurement, he obfuscated the mystical basis of his "law" of gravity, and he declined to investigate his friend Fatio's mechanism for gravity, or to even *publish* it. However, at the time of his death, Newton's library contained 138 books of quack alchemy. References: B. J. T. Dobbs, *The Foundations of Newton's Alchemy*, Cambridge University Press, 1975; K. Figala, "Newton as Alchemist," *History of Science*, v. 15 (1977), pp. 102-137.

"All that happens when the radius of curvature of spacetime is smaller than the Compton wavelength [~10^{-15} m] for a given species of particle is that one gets an indeterminancy in particle number or, in other words, particle creation. ... It should not be thought unreasonable that a black hole, which is an excited state of the gravitational field, should decay quantum mechanically and that, because of quantum fluctuation of the metric, energy should be able to tunnel out of the potential well of a black hole."

- Stephen W. Hawking, "Particle Creation by Black Holes," *Communications in Mathematical Physics*, v43, 1975, pp. 199-220.

Hawking's theory of black hole radiation predicts an electron has a Planck radiating temperature of $T = \hbar c^3/(8\pi Gmk)$ = 1.35×10^{53} K, predicting a Stefan-Boltzmann radiating power $P = \pi^2 k^4 T^4/(60\hbar^3 c^2) = 1.3 \times 10^{205}$ watts/m^2, giving about 10^{92} watts for the entire surface area of the black hole electron's horizon, $4\pi(2GM/c^2)^2$. *This massless charged SU(2) electrodynamics exchange radiation predicts a fundamental interaction strength similar to Coulomb's law.* It is a very simple calculation.

The absorption of energy E implies momentum gain $p = E/c$, but absorption followed by re-emission (an exchange process which is like a reflection) causes an equal additional recoil force by Newton's 3rd law, so the total momentum gain is $p = 2E/c$, thus the force generated is given by

$$F = dp/dt = 2P/c,$$

where P is the radiating power (J/s or watts), i.e. ~10^{92} watts, as found above. Hence

$$F = 2P/c = 2[10^{92}]/[3 \text{ x } 10^8] \approx 10^{84} \text{ Newtons}$$

This is about a factor of 10^{40} greater than the *gravitational* inward (and outward) exchange force we calculated earlier, $dp/dt \approx ma \approx [3 \times 10^{52}][7 \times 10^{-10}] \approx 2 \times 10^{43}$ Newtons, so this charged Hawking radiation emission produces an exchange Coulomb force around 10^{40} times stronger than gravity, *as expected from the empirical ratio of Coulomb to gravity*. Electrodynamics is about 10^{40} times stronger than gravity.

This is a very useful and revealing calculation, strongly connecting the black hole Hawking radiation feature of a fundamental particle to the SU(2) electrodynamics mechanism, making a correct calculation of the factor by which the electrodyamics coupling exceeds the gravitational coupling. Hence, putting in the gravity coupling predicted by quantum gravity lets us deduce the correct electromagnetic coupling. We have a U(1) × SU(2) × SU(3) theory predicting both electrodynamic and gravity couplings. *Independent evidence for black hole phenomena, e.g., the black hole event horizon sized graviton scatter cross-section, strongly consolidates this success.*

The charge of emitted Hawking radiation is conserved, because the rate of reception of *charge* equals the rate of emission. While the cancellation of self-inductance in this mechanism ensures an equilibrium of exchange of *charge*, energy is not of course always in this equilibrium; redshifted exchange radiations from receding charges (which are being pushed away by the exchange process carry less energy back from the charge than they deliver to the charge; the difference becomes the kinetic energy of the charge as it is accelerated by the field. Only the charge current is in perfect equilibrium; the energy delivery is not in equilibrium, and in fact it is the redshift of the energy of field quanta which causes the field to impart energy to an onshell charge, thus causing a force. Hawking's 1975 paper shows that a black hole gains the mass, angular momentum, and electric charge of the particles falling into it. We show that the Hawking radiation process completes the exchange mechanism for offshell gauge bosons. In a more recent 2005 paper, *Information Loss in Black Holes* (arXiv:hep-th/0507171 v2, 2005), Hawking admitted his error, but claimed falsely that: "No one has found a mechanism to produce correlations but most physicists believe one must exist" (*we had published the fact-validated mechanism in 2002-3 papers*), stating:

"At least in the approximation I was using, the radiation from the black hole would be completely thermal and would carry no information. So what would happen to all that information locked inside a black hole that evaporated away and disappeared completely? It seemed *the only way the information could come out would be if the radiation was not exactly thermal but had subtle correlations* [i.e., SU(2) massless boson charges]. No one has found a mechanism to produce correlations but most physicists believe one must exist. If information were lost in black holes, pure quantum states would decay into mixed states and quantum gravity wouldn't be unitary." (Emphasis added.)

This contradicts his own 1976 paper, "Breakdown of Predictability in Gravitational Collapse" (*Physical Review* v. D14, p. 2460), which claimed that the Planck spectrum Hawking radiation carries no "information" of any kind. This was a plain fiction, as he now realises. Black hole phenomena are just simple causal mechanisms, which preserve information like charge sign. Hawking elaborates on the physical interpretation of the otherwise ambiguous mathematical abstraction in his 2005 arXiv paper hep-th/0507171:

"How does information get out of a black hole? My work with Hartle [J. B. Hartle and S. W. Hawking, "Path Integral Derivation of Black Hole Radiance," *Physical Review* v. D 13, 1976, p. 2188] showed the radiation could be thought of as tunnelling out from inside the black hole. It was therefore not unreasonable to suppose that it could carry information out of the black hole. This explains how a black hole can form and then give out the information about what is inside it while remaining topologically trivial. There is no baby universe branching off, as I once thought. The information remains firmly in our universe. I'm sorry to disappoint science fiction fans, but if information is preserved, there is no possibility of using black holes to travel to other universes. If you jump into a black hole, your mass energy will be returned to our universe but in a mangled form which contains the information about what you were like but in a state where it cannot be easily recognized. It is like burning an encyclopedia. Information is not lost, if one keeps the smoke and the ashes. But it is difficult to read. In practice, it would be too difficult to re-build a macroscopic object like an encyclopedia that fell inside a black hole from information in the radiation, but the information-preserving result is important for microscopic processes involving virtual black holes. If these had not been unitary, there would have been observable effects, like the decay of baryons."

"The rotating body [black hole] produces spontaneous pair production [and] in the case when the body can absorb one of the particles, ... the other [anti-] particle goes off to infinity and carries away energy and angular momentum."

- Yakov B. Zel'dovich, *JETP Letters*, v. 14 (1971), p. 180.

Electric charge is not the only piece of information in the Hawking radiation from onshell fermions. Massless, charged SU(2) gauge boson radiation from spinning fermions also carries angular momentum, which we experience as a magnetic field. The concept that magnetic forces are due to the angular momentum (rotational momentum) imparted by gauge bosons goes back to Maxwell's mechanical space. The idea that spinning black holes radiate angular momentum in (Hawking) radiation actually predates Hawking's 1975 paper: Zel'dovich proposed it in 1971 (quoted above).

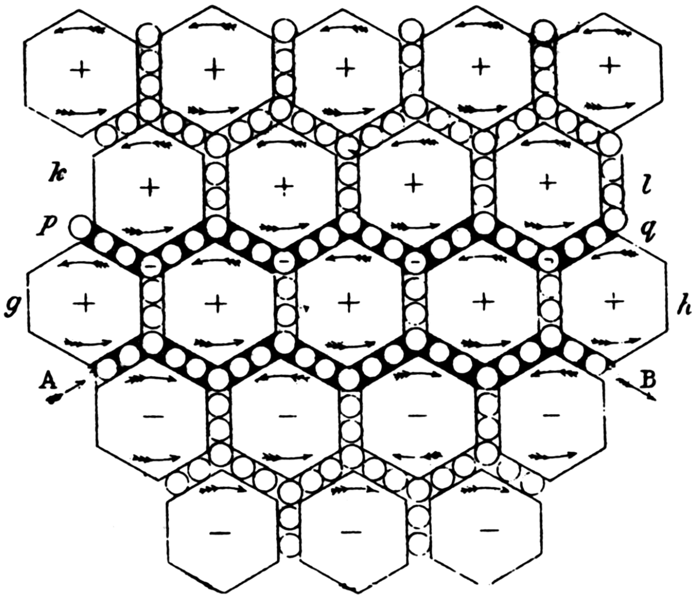


Fig. 27: Maxwell's 1861 *On Physical Lines of Force* vacuum model contains spinning particles which convey physical forces. But his "gear box with idler wheels aether" was inherently an epicycle-type *ad hoc* speculation. Lord Kelvin later also failed with an "atomic vortex" idea. Kelvin claimed falsely that atoms are stable smoke ring vortices spinning in a solid aether which supports transverse waves in space. The Michelson-Morley experiment's null result was used to kick out Maxwell's aether, while the discovery of the electron and atomic instability (radioactivity) finished off Kelvin. Einstein fashionably reformulated physics without force-mediating vortices. But the failure of aether does not disprove modern gauge boson exchange mechanisms for quantum field theory. Once mathematically abstract models have been pushed as far as possible, physically consistent predictive mechanisms are needed to make progress again. Maxwell and Kelvin's failures are no more a "disproof" of QFT vacuum gauge boson exchange, than the failure of Lamarke's evolution is a disproof of Darwin's.

Spin, helicity, magnetic fields, and SU(2) symmetry

The magnetic field of a fermion is a chiral property of its spin. The Pauli spin matrices of electrodynamics are SU(2) matrices. In 1929, Herman Weyl correctly argued using Dirac's spinor that p*arity is not conserved, i.e. particles and their oppositely charged antiparticles spin in opposite have opposite helicity* (they spin in opposite directions around the direction of their propagation, when going at relativistic velocities). However, in 1932, Wolfgang Pauli dismissed Weyl's argument because there was *allegedly* no experimental evidence for the "conservation of parity" (a purely epicycle-type *ad hoc* principle or "law," akin Bohr's correspondence and complementarity principles). The apparent lack of evidence for parity violation in electrodynamics is due to the fact that the spin orientations are random at low energy, and the violation of parity is seen only at relativistic velocities (*if we ignore magnetism and the Poynting vector, which is a fashionable convention, just like ignoring the Emperor's New Clothes*), where the plane of spin is constrained to be perpendicular to propagation direction:

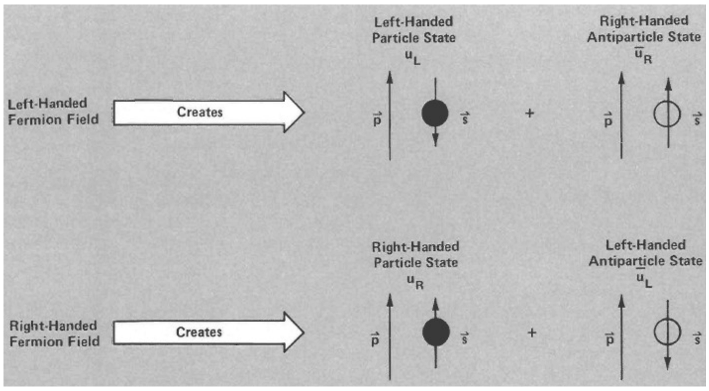


Fig. 28: Weyl in 1929 argued from Dirac's equation that the helicity does not obey the conservation of parity, i.e. that helicity is constrained to one handedness only, with reversed helicity direction being associated with antimatter. Helicity is spin around the direction of propagation, which is only supposed to emerge under Lorentzian constraints at relativistic velocities, but is actually seen as the magnetic field's curl in normal 1 mm/s electric current. Weyl's prediction was dismissed by Pauli in 1932. It was confirmed correct by experiments on the direction beta particles are emitted by cobalt-60 atoms with their nuclei aligned by a magnetic field. These experiments were only done in 1957, long after electrodynamics had been falsely "established" as a U(1) gauge theory. In fact, electrodynamics is an SU(2) theory, with spin angular momentum appearing as the magnetic field direction, which always curls the same way around the direction electrons flow in a wire, and in the opposite direction for positive currents. This magnetic field direction is the electrodynamic equivalent to the left-handedness of massive SU(2) weak fields. Both electrodynamics and weak interactions require SU(2) gauge symmetry. Our argument is that there are no right-handed helicity electrons, only left-handed ones; hence magnetic fields are caused by electric currents. If electrons were equally likely to have left and right handed helicity, there could be no magnetic field caused by an electron current, because the angular momentum of the emitted gauge bosons would be on average 50% left handed, and 50% right handed, *cancelling out and leaving no net magnetic curl.* Because this does not occur in nature, we know from the electrodynamic mechanism for magnetic fields that all electrons in nature have left handed spin, and only positrons have right-handed spin. This contradicts Pauli's parity conservation law, but it concurs with the left-handedness of SU(2) weak interactions, and with Weyl's 1929 analysis of Dirac's spinor. (Illustration source: Stuart A. Raby, Richard C. Slansky, and Geoffrey B. West's article, "Particle Physics and the Standard Model," published on pages 23-53 of the Summer/Fall 1984 issue of the journal *Los Alamos Science*.)

Left-handed spin helicity at low energy is akin to the spin of earth's rotation on the direction water spins as it goes down the sink. For a small mass of water, the earth's small angular acceleration $a = v^2/R$ can't impart a really significant force and angular momentum to that water to prejudice its helicity. Instead, statistical "noise" predominates, like the geometry of the wash basin, or the random angle of the plug as it is pulled up. But for hurricanes, the huge mass of fluid air subjected to earth's spin overcomes random forces.

Mass mechanisms, mass correlations, mass successes

"... neither the nine masses for the quarks and charged leptons nor the four parameters that specify the mixing of quarks across families are determined by any fundamental principle contained in the Standard Model. Instead, those thirteen parameters are determined from low-energy experiments and are matched to the free parameters in the Standard Model Lagrangian."

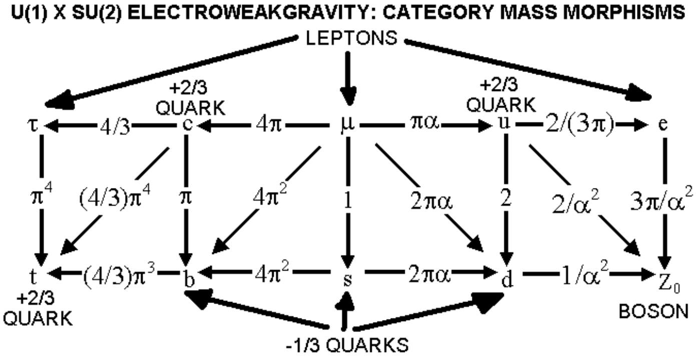
- Stuart Raby, "Family Mixing and the Origin of Mass: The Difference between Weak Eigenstates and Mass Eigenstates," *Los Alamos Science*, Number 25, 1997, p. 2.

"MR JOHN A. R. NEWLANDS read a paper entitled '*The Law of Octaves, and the Causes of Numerical Relations among the Atomic Weights.*' The author claims the discovery of a law according to which the elements analogous in their properties exhibit peculiar relationships, similar to those subsisting in music between a note and its octave. Starting from the atomic weights on Cannizzarro's system, the author arranges the known elements in order of succession ... The fifty-six elements so arranged are said to form the compass of eight octaves, and the author finds that chlorine, bromine, iodine, and fluorine are thus brought into the same line, or occupy corresponding places in his scale. ... DR GLADSTONE made objection on the score of its having been assumed that no elements remain to be discovered. ... the finding of one more would throw out the whole system. ... Professor G. F. FOSTER humorously inquired of Mr Newlands whether he had ever examined the elements according to the order of their initial letters? For he believed that any arrangement would present occasional coincidences, but he condemned one which placed so far apart manganese and chromium, or iron from nickel and cobalt. Mr NEWLANDS said that he had tried several other schemes before arriving at that now proposed. One founded upon the specific gravity [density] of the elements had altogether failed, and no relation could be worked out of the atomic weights under any system other than that of Cannizzarro."

- *Proceedings of the Chemical Society*, 1 March 1866, Professor A. W. Williamson, PhD, FRS, Vice President, in the Chair (published in *Chemical News*, March 1866 issue).

The quantum gravity mechanism we gave earlier shows that gravity is proportional to $\Sigma(n_1 n_2 M_{\text{fundamental}}^2)$, i.e., a sum of n discrete units in each piece of matter, *replacing* the continuously variable Newtonian $M_1 M_2$ law (Newton's *mere guess*), so masses arise from a *basic common quantized building block*. SU(2) massive gauge bosons and SU(2) electrodynamics massless Z (photons of light) gain mass and gravitational charge (light has no rest mass but does interact with gravity, as when found to be deflected by the sun's gravity during an eclipse) not from a Higgs field, but by *Glashow/Weinberg mixing* with U(1) Abelian quantum gravity, *whose charge is gravitational mass*. Secondly, other particles gain their mass by "miring" in the 91 GeV massive neutral weak Z bosons, which are pseudo-Higgs (or effective Higgs) bosons. Light photons in SU(2) electrodynamics gain gravitational charge from Weinberg mixing with U(1) quantum gravity. These mechanisms for mass lead to Fig. 29, extensions of correlations from Table 1 of Hans de Vries and Alejandro Rivero's 2005 arXiv hep-th/0503104 paper, *Evidence for radiative generation of lepton masses,* where the lepton's radiation-corrected magnetic moment, $1 + \alpha/(2\pi) + a[\alpha/(2\pi)]^2 + b[\alpha/(2\pi)]^3 + ...$, is correlated to lepton masses becauses the ratio of muon to Z boson mass is $\alpha/(2\pi)$, which is the largest correction, while the difference between the muon and electron magnetic anomalies is the ratio of electron to W boson mass. H. Georgi and S. L. Glashow (an architect of the Standard Model) reviewed α factors in lepton masses in "Attempts to Calculate the Electron Mass," *Phys. Rev.,* D 7, p. 2457. See also S. M. Barr and A. Zee, "Calculating the electron mass in terms of measured quantities," *Phys. Rev.,* D 17, p. 1854. The long road towards the Periodic Table and electron shells began with Newlands's empirical chemical mass periodicity "law of octaves." Vacuum polarization *pulls apart and makes virtual fermion pairs live longer than predicted by Heisenberg's law, $t = \hbar/E$,* so fermions which are *polarized* behave almost *onshell,* briefly obeying Pauli's exclusion principle, thus gaining *geometric shell structures,* with geometric circumference, area and volume factors 2π, 4π, $(4/3)\pi$, while Planck's law involves a tauon-to-truth quark factor, $15\int_0^\infty \{R^3/(e^R - 1)\}\,dR = \pi^4$, and the electric charge and mass renormalization factor is the effective coupling, $\alpha = \alpha_{\text{IR cutoff}}/\alpha_{\text{UV cutoff}} = 1/137.036...$

U(1) X SU(2) ELECTROWEAKGRAVITY: CATEGORY MASS MORPHISMS



First-order estimates of fermion (spin ½) particles mass*

Electric charge:	-1 (leptons)	-1/3 (quarks)	+2/3 (quarks)
Generation 1	$m_{e\ \text{(electron)}} = m_z\alpha^2/(3\pi) = 0.5$ MeV	$m_{d\ \text{(down)}} = m_z\alpha^2 = 4.9$ MeV	$m_{u\ \text{(up)}} = \tfrac{1}{2} m_z\alpha^2 = 2.4$ MeV
Generation 2	$m_{\mu\ \text{(muon)}} = m_z\alpha/(2\pi) = 106$ MeV	$m_{s\ \text{(strange)}} = m_z\alpha/(2\pi) = 106$ MeV	$m_{c\ \text{(charm)}} = 2m_z\alpha = 1.3$ GeV
Generation 3	$m_{\tau\ \text{(tauon)}} = (8/3)m_z\alpha = 1.78$ GeV	$m_{b\ \text{(beauty)}} = 2\pi m_z\alpha = 4.2$ GeV	$m_{t\ \text{(truth)}} = (8/3)\pi^4 m_z\alpha = 173$ GeV

*Z boson mass (central to the theory: see the blog post), $m_z = 91.19$ GeV. Alpha, $\alpha = 1/137.036$ .... The physical mechanism behind these predictions is the unification of quantum gravity with electromagnetism (weak interactions are permanently broken in symmetry from electromagnetism and gravity), where α is proved to be the complete IR to UV cutoff vacuum polarizatioin shielding factor (i.e., the ratio of the unshielded electronic charge at the UV cutoff, to the shielded electronic charge at the IR cutoff limit). This factor therefore determines the coupling of mass from vacuum charges to particle cores.

Fig. 29: this theory predicts that mass is conveyed to SU(2) bosons and photons by Weinberg mixing of U(1) quantum gravity with SU(2) weak forces (massive bosons) and SU(2) electrodynamics (massless bosons, like light photons which are deflected by gravity as photographed during eclipses, which have *gravitational charge from the mixing,* but do not have any *rest mass*). Once mass is given to the SU(2) weak bosons by this corrected Weinberg mixing with gravity's U(1), the resulting 91 GeV neutral weak bosons in the fields surrounding charges act as a pseudo-Higgs field, literally "miring" the particle cores when they move. This gives mass to fermions generally, a bit like the resistance to acceleration in a fluid like water, or syrup. Moving in a field of neutral Z field bosons (which interact with gravitons) is equivalent to being hit by a massive neutral current from the direction you are trying to move into, resisting your acceleration (hence "inertial mass"). Similarly, the effect of gravity on massive neutral Z bosons in the field around a particle acts to move the particle, just like a swimmer being swept along by a rip tide. Gravity accelerates the massive Z bosons in weak fields that are powered by electromagnetic field pair production, then those Z bosons at as neutral currents against fermion cores, conveying gravity ("gravitational mass").

Vacuum polarization, running couplings, and nuclear forces which have a short range

The fashionable guess that alpha is proportional to the square of electric charge is akin to observing that in Newton's law $F = M_1M_2G/r^2$ the force is inversely proportional to the square of distance, and then using this to guess that $F = E/x^2$, whereas in fact the correct law is $F = E/x$, or $E = Fx$. This gross error of bare core charge is crucial to GUT coupling unification energy efforts, which are based on trying to unify numerically the couplings at the Planck scale. The larger the bare core charge is, the higher the UV cutoff, and the higher the assumed unification energy in theories like the MSSM which assume (without evidence) that there is a unification which consists of equal couplings at some high energy, usually assumed to be the Planck scale.

The electromagnetic running coupling due to a electron-positron pair production is:

$$\alpha_E{}^2 = \alpha_{IR}{}^2\,[1 + \alpha_{IR}{}^2 \log(E/E_{IR})^2/(12\pi^2)]$$

where α_E is the apparent electron charge seen in collisions at energy E, α_{IR} is the shielded (textbook) electron charge (about 137 times the <1 MeV textbook low energy value), and E_{IR} is the "IR cutoff" energy corresponding to the lowest energy value of the energy-dependent coupling, i.e. the collision energy below which the running coupling ceases to run because the field strength, $\mathbf{E}_{\text{below IR cutoff}} = q/(4\pi\varepsilon_0 R^2)$, is *too weak* for pair production and vacuum polarization. The strong (colour charge or QCD) running coupling is

$$\alpha_E{}^2 = 12\pi\,/[(33 - 2n)\ln(E/E_{IR})^2]$$

(Equation 7.21 of arXiv hep-th/0510040.) n is the number of quarks active in pair production (up to 6), and $E_{IR} \sim 0.2$ GeV is the effective QCD IR (low energy or "InfraRed") cutoff. *This strong coupling gets smaller with higher energy, whereas the electromagnetic coupling increases with collision energy.* The energy density, $E_{J/m^3} = \frac{1}{2}\varepsilon_0\mathbf{E}_{\text{volts/metre}}{}^2$, lost from the electric field by its use for pair production and polarization, *creates weak vector bosons and colour-charged quarks,* so electromagnetic field energy *lost from the electric charge is converted into short-ranged fields.* The *total* energy density (all fields) is conserved.

The vacuum polarization running coupling IR energy cutoff was deduced by Julian Schwinger in his paper, "On gauge invariance and vacuum polarization" (*Phys. Rev.,* v. 82, 1951, p. 664). *Schwinger showed that pair-production doesn't occur throughout the entire spacetime vacuum (contrary to most modern physics textbooks, which ignore the IR cutoff and pretend that only the UV cutoff exists), but is limited to stronger fields which have enough energy to produce pairs (i.e., fields corresponding to collisions at total energies exceeding 1.022 MeV).* Schwinger's formula for the threshold electric field strength needed for pair production is: $\mathbf{E} = m^2c^3/(\hbar q) = 1.3 \times 10^{18}$ volts/metre. *Below this strength, i.e. at all distances beyond 33 femtometers from an electron, there is effectively no pair production, i.e. no vacuum polarization, and no running of* α_E. The minimum energy for a running coupling is the "IR (infrared) cutoff." The distance this collision energy is equal to is the distance of closest approach in scattering. E.g., when electrons collide with a given kinetic energy, they approach a minimum distance when their kinetic energy is completely converted into electromagnetic field potential energy, $\frac{1}{2}mv^2/(1 - v^2/c^2)^{1/2} = q^2/(4\pi\varepsilon_0 R)$, which then causes them to rebound, like a billiary ball collision (ignoring energy loss due to *inelastic* scatter, like gamma ray emissions.).

In the running coupling equation, electron-positron pair production polarization is not the only contribution to the shielding of the electron's core electric charge. Electron-positron pair production kicks in for collision energies at 1.022 MeV, which is the energy needed for create an electron-positron pair (they each have a rest mass equivalent of 0.511 MeV). But above 105 MeV, muon-antimuon pairs also occur, adding a further $\alpha_{bare}{}^2 \log(E/E_{bare})^2/(12\pi^2)$ term, and mesons and baryons also add in at higher energy.

Parikh-Wilczek's pair production model: it is Hawking radiation tunnelling against gravity out of black holes

The field attenuation shielding due to a single vacuum polarized pair can be represented by a simple exponential Gamow quantum tunnelling law, using the energy-time uncertainty principle in the exponent, representing the energy-time relationship for the virtual fermion pairs which shield the onshell (bare core) electric charge by the process of being briefly polarized prior to annihilation: $e^{-tE/\hbar} = e^{-\sigma/A}$ where σ is the effective shielding cross-section per pair of polarized virtual fermions (the shielding effect by vacuum polarization), and A is geometric area within which is the pair of shielding area σ is located. As the energy increases, the polarization and shielding effect per pair increases, because the electric field causing the polarization gets stronger. M. K. Parikh and Frank Wilczek make the suggestion in their paper, "Hawking radiation as tunnelling," *Physical Review Letters,* v85, 2000, p. 5042 (hep-th/9907001) that *pair production phenomena can be represented by Hawking radiation quantum tunnelling through fluctuating fields, i.e. randomly discrete graviton interactions,* so that *particles which statistically don't happen to be stopped by a graviton* are said to "tunnel out" overcoming a *classically* impossible barrier. Hawking's theory of the black hole ignores Schwinger's 1951 paper on pair production; Hawking wrongly follows *status quo* consensus in implicitly assuming that a black hole doesn't need electric charge in order to radiate. But unless Schwinger's $m^2c^3/(\hbar q) = 1.3 \times 10^{18}$ volts/metre is exceeded at the black hole event horizon, there can be no no pair production there, and no Hawking radiation. There is no gravitational field pair production, because quantum gravity has only one verified sign of gravitational charge. It is thus impossible for black holes to radiate Hawking radiation *unless they have enough net electric charge to establish an electric field strength exceeding Schwinger's* $m^2c^3/(\hbar q) = 1.3 \times 10^{18}$ volts/metre *at their event horizon, which normally requires the black hole to be a fermion.* The electric charge of a black hole then biases the Hawking radiation; *instead of neutral annihilation gamma rays as Hawking predicted, only one sign of charge is able to escape from the event horizon of a strongly charged black hole (this is the same charge sign as the onshell core).* An electron emits Hawking radiation with a net negative charge sign, because the positive charges is biased to fall in to the core. The quantum gravity mass mechanism gives mass to fermions *indirectly* by "miring" their cores in Z boson (pair prduction-originated) neutral currents. *Hawking radiation is therefore the fundamental basis of SU(2) electrodynamics.*

Standard Model architect Sheldon Glashow explained in his 1979 Nobel Prize Lecture how in 1956 as the research student of Julian Schwinger, he had tried to construct an SU(2) electroweak theory by making the charged SU(2) vector bosons massive and keeping the neutral vector boson massless, but ran into trouble making the massive vector bosons left-handed and allowing for strange quark effects (quarks had not yet been discovered, but mesons with 2nd generation strangeness-conserving quarks had been discovered):

"The charged massive vector intermediary and the massless photon were to be the gauge mesons. … We [Schwinger and Glashow in 1956] used the original SU(2) gauge interaction of Yang and Mills. Things had to be arranged so that the charged current, but not the neutral (electromagnetic) current, would violate parity and strangeness. Such a theory is technically possible to construct, but it is both ugly and experimentally false [H. Georgi and S. L. Glashow, *Physical Review Letters,* 28, 1494 (1972)]. We know now that neutral currents do exist and that the electroweak gauge group must be larger than SU(2). … We come to my own work done in Copenhagen in 1960, and done independently by Salam and Ward. … I was led to SU(2) × U(1) by analogy with the appropriate isospin-hypercharge group which characterizes strong interactions. In this model there were two electrically neutral intermediaries: the massless photon and a massive neutral vector meson which I called B but which is now known as Z. The weak mixing angle determined to what linear combination of SU(2) × U(1) generators B would correspond."

This is a classic scientific example of *premature falsification* of SU(2) in general as the electroweak theory: *Glashow and Schwinger tried one specific, incorrect and simplistic representation of SU(2), disproved it, then assumed that SU(2) cannot and does not model electrodynamics.* As Paul Feyerabend explains in his 1975 book *Against Method:* "Naive falsificationism takes it for granted that the laws of nature are manifest and not hidden beneath disturbances of considerable magnitude." Electroweak theory is *subtly* wrong. The electroweak gauge group is indeed larger than SU(2) since it requiring Glashow mixing with a U(1) "hypercharge" group, but the role of hypercharge is misunderstood, *due to mainstream ignorance of magnetic field helicity in electromagnetism, which is a biased-handedness, like weak forces.*

Instead of U(1) hypercharge being the basic symmetry behind electromagnetism, and SU(2) being merely weak isospin symmetry. SU(2) charges are both isospin and electromagnetic, the chiral handedness of SU(2) electromagnetism appearing as the magnetic field curl, while U(1) hypercharge is quantum gravity, which gives mass (gravitational charge) to the isospin charges in the mixing process and makes isospin charge transferrable only between left-handed helicity particles. In *right-handed spinors,* hypercharge is twice the electric charge because of energy conservation: *hypercharge causes gravitation, which causes the expansion of the universe, thus producing electromagnetism.* In *left-handed spinors,* isospin and electric charge are simply connected, apparent differences being due to energy conservation in the electromagnetic field's charge polarization mechanism. The correct SU(2) doublet mixes up the conventional historical distinctions between "matter" and "antimatter," due to the fact that "matter" and "antimatter" were defined by low-energy

	Particle	Isotopic spin charge	*n*, for electric charge = *n*/3	Mass (approximate)
SU(2) doublet	$\bar{v}_e$	-1/2	0	$-m_w\alpha^2 n^{1+n}$
	d	-1/2	-1	$-m_w\alpha^2 n^{1+n}$
	$\bar{u}$	-1/2	-2	$-m_w\alpha^2 n^{1+n}$
	e	-1/2	-3	$-m_w\alpha^2 n^{1+n}$
	v_e	+1/2	0	$-m_w\alpha^2 n^{1-n}$
	$\bar{d}$	+1/2	+1	$-m_w\alpha^2 n^{1-n}$
	u	+1/2	+2	$-m_w\alpha^2 n^{1-n}$
	$\bar{e}$	+1/2	+3	$-m_w\alpha^2 n^{1-n}$
SU(2) triplet	W_+	+1	+1	m_w
	W_0	0	0	$m_w/\cos\theta_W$
	W_-	-1	-1	m_w

Fig. 30: The correct SU(2) doublet for left-handed helicity particles (above). Notice the mix-up between "matter" and "antimatter," which is arbitrary (an historical accident, like Franklin's arbitrary current flow from positive to negative). Mechanisms explain the electric charges and why right-handed charges have no isospin.

Charge:	Isotopic	Hyper	Electric
d_L	-1/2	+1/3	-1/3
e_L	-1/2	-1	-1
$(v_e)_L$	+1/2	-1	0
u_L	+1/2	-1/3	+2/3
d_R	0	-2/3	-1/3
e_R	0	-2	-1
$(v_e)_R$	0	0	0
u_R	0	+4/3	+2/3

(Weak isotopic charge) = (electric charge) – ½ (hypercharge) pair production. At high energy, the positron is not the only or even most likely form of antimatter for the electron. In other words, mixing in pair production processes at high energy causes what appears to be the asymmetry between "matter" and "antimatter" seen in today's low energy universe. This requires a discussion of the SU(2) weak interaction mathematical model and SLAC experiments on the weak mixing angle using longitudinally-polarized (helical) electrons accelerated to energy exceeding M_Z = 91 GeV, and impacted onto positron targets to produce Z bosons by the annihilation.

"What Mills and I were doing in 1954 was generalizing Maxwell's theory. We knew of no geometrical meaning of Maxwell's theory and were not looking in this direction. Connection [*between gauge theory potential and geometric field curvature*] is a geometrical concept which I only learned around 1970. ... if a physicist learns too much of mathematics, he or she is likely to be seduced by the value judgement of mathematics, and may lose his or her physical intuition. I have likened the relation between physics and mathematics to a pair of leaves. They share a small common part at the base, but mostly they are separate."

- C. N. Yang, interviewed by D. Z. Zhang, "C. N. Yang and Contemporary Mathematics," *The Mathematical Intelligencer*, v. 15/4 (1993), p. 13.

The great problem with the Yang-Mills theory when proposed in 1954 ("Conservation of Isotopic Spin and isotopic Gauge Invariance," *Physical Review,* v. 98, p. 191) was highlighted aggressively by Wolfgang Pauli, who interrupted a presentation by Yang to repeatedly ask what the mass term for SU(2) field quanta lagrangian was. Pauli had been investigating such theories, in a mathematical way, and had ignored the possibility of massless SU(2) field quanta exchange, by analogy to electricity propagating as a logic step in a two-conductor transmission line, with the magnetic curls of each charge sign cancelling each other's infinite self-inductance (backreaction). Nobody had the physical intuition in mutual inductance to grasp electromagnetism as an SU(2) massless charged gauge boson theory, not U(1).

So the Yang-Mills theory was held up until a way was found to make the field quanta massive at low energy in order to model weak isospin SU(2) interactions, while allowing renormalization by making the field quanta lose their rest mass at high energy, eliminating unphysical (infinite) field quanta momentum at short distances. The solution eventually found in the 1960s is the "Higgs field," an epicycle which does the job. The real solution is not a Higgs field, but a running on the mixing angle of SU(2) electroweak dynamics with U(1) quantum gravity (hypercharge), which gives U(1) charge (gravitational and inertial mass) to part of the (left-handed) SU(2) field at low energy, but mixes less as energy is increased (due to the running of the mixing angle with energy). This running of the weak mixing angle is thus the replacement for the Higgs mechanism. However, mainstream thinking is locked with dogmatic rigor mortis into the Goldstone theorem, where Goldstone bosons are produced whenever a symmetry is spontaneously broken, and you cannot get anybody to listen to sense. They "understand" spontaneous symmetry breaking by analogy to phenomena like the loss of magnetism when a magnet is heated (allowing spinning electrons to take up random orientations), and use this kind of analogy. They believe passionatedly that because they have one model for a phenomenon, that must be the *only* model possible, so all other ideas are deemed to be wrong and is is not even necessary to "waste time" even reading such "rubbish."

Left-handed and "right-handed" electrons: SLAC data

In 1976, it was discovered that longitudinally polarized (helical) electrons are emitted when gallium arsenide crystals are subjected to circularly polarized laser light with a wavelength of 715 nm (D. T. Pierce and F. Meier, *Phys. Rev.,* B13, p. 5484). This is ignored in most popular accounts of helicity in the modern physics teaching literature, which insists that only "massless" neutrinos have definite helicity, and claims that massive particles have an "indeterminate" helicity wavefunction which is superposition of two states which only "collapses" when a measurement is made on the system (analogous Bell inequality 1st quantization philosophy in Alain Aspect's "quantum entanglement" experiments on polarized photons). As we have explained, there is no single, indeterminate wavefunction; but a path integral over many wavefunction amplitudes for all the paths contributing for every onshell particle. The EPR experiment and Bell's inequality are non-relativistic, single-wavefunction 1st quantization philosophy, which are wrong. The correlation of wavefunctions is confirmation of Feynman's path integral, where there is no single wavefunction to collapse, but simple multipath interference causing statistical indeterminancy.

The gallium arsenide crystal method of producing helical electrons was then applied as input to SLAC's 3 km long linear collider in experiments begun in 1992, as described in Robert Elia's paper, "First Measurement of the Left-Right Asymmetry in Z-boson Production," SLAC-PUB-6169, July 1993. By measuring the production of Z-bosons when helical left-handed electrons annihilated with positrons at >91 GeV, they determined the Glashow/Weinberg mixing angle that gives mass to the SU(2) weak bosons. There are some important technical limitations, here, however. The circularly polarized laser light is supposed to transfer spin helicity to the electrons, i.e. the conservation of angular momentum. However, the way the experiment works is that the maximum amount of longitudinal polarization is 50%, and depolarization problems limited the actual figure to 28%, and what the experimenters were actually doing was a *comparison of Z-boson production by longitudinally-polarized electrons to Z-boson production by unpolarized electrons.* They were not sending out left-handed and right-handed helicity electrons into positron targets and comparing the Z-boson production rates. When they changed the laser light helicity to reverse the handedness of the electrons, they had no way of knowing whether any r*ight-handed electrons were produced, or whether the output was then merely being depleted in left-handed electrons, so they were comparing a depletion in left-handed electrons relative to an unpolarized beam, to a beam with an enrichment in left-handed helical electrons.* The supposedly "right handed"-biased electron beam could be just *depleted* in left-handed electrons, as compared to the left-handed beam. When they produced a beam of "left-handed" helicity electrons, it was *mainly an unpolarized beam with a moderate enhancement of left-handed helicity*, but when they reverse the circularly polarized light helicity, the so-called "right-handed" helicity beam is not necessarily enriched in right-handed helicity electrons, but could merely be *depleted in left-handed electrons,* since most of the electrons have no longitudinal polarization at all, thus no helicity, either way.

In this case, the experiment would give a Z-boson production rate for left and "right handed" electrons that differs as expected by electroweak theory, but involves no right-handed helicity electrons. The experiment may enhance production of left-handed helicity electrons for one direction of circular polarized light striking the crystal, and reduce the production of left-handed helicity electrons when the direction of the circular polarized light is reversed. The results from this would be identical to the measured data, *appearing* to confirm Yakov Zel'dovich 1959 prediction.

The point we are making is that it is possible to take an incorrect theory, experimentally check it and "confirm the prediction," and then deduce that the theory "must be correct," when the indirect experiment has had a prejudiced interpretation error, like "confirming epicycle predictions." The only way the handedness of the electrons is being measured in the experiment is from the *statistical enhancement of Z-boson production in weak interactions above 91 GeV energy. So there is a possibility of an error in the interpretation of the statistical results.* The experiment has three, not two, kinds of electrons: unpolarized electrons, left-handed electrons, and *supposedly* right-handed electrons, although in this case the circularly polarized light striking the crystal may be producing *a statistical depletion in left-handed helicity electrons,* rather than an *excess* of right-handed helicity electrons, as assumed. In all these experiments, over 50% of the beam is in *non*-longitudinally polarized spin directions, which are not-helical at all.

So you are not comparing left and right handed electron helicity for Z boson production; instead you are comparing unpolarized electron beams with little statistical longitudinal helicity to electron beams with either depleted or enhanced amounts of left-handed helicity. You then falsely interpret the results as being a clean cut comparison between left and right handed helicity to "simplify" the presentation of the experimental results and to "fit them in" nicely with theory.

This discussion of the alleged "evidence" for right-handed electrons in SLAC experiments on the weak mixing angle is not designed to be a disproof of right-handed electrons. We are merely pointing out that the experiment compared data for a statistical enhancement of left-handed helicity electron weak interactions, with data for a statistical depletion of left-handed helicity electron weak interactions. We are not convinced that there is strong evidence for any right-handed helicity electrons in this comparison. What the experiment does may be instead just a comparison between unpolarized electron beams and beams with some enrichment or depletion in left-handed helical polarization, a far cry from evidence for right-handed helicity electrons.

The reasons why this possibility has not been investigated appears to be the incorrect prejudice that electrodynamics is a non-chiral U(1) Abelian theory, and a dogmatic effort to ignore the chiral handedness of the magnetic field curl direction around a current. Right-handed helicity electrons may exist, in the sense that right-handed neutrinos are needed to allow neutrinos to change flavour and to have mass as observed. However, mainstream "data" may be prejudiced.

The greatest trick of politics is to *pretend that there are only two options:* the Michelson-Morley experiment was a test of two alternatives only, (1) light is carried by a field at an absolute non-relative velocity, and (2) light is not carried by a field at an absolute velocity. FitzGerald's and Lorentz's *third* alternative, (3) *light is carried by a field at an absolute velocity, but the Michelson-Morley instrument contracted in the direction of its absolute motion in just such a way as to cancel out the differences in light velocities in different directions,* is a hard fact still ignored or ridiculed with no objectivity whatsoever by popular media. In the same way, politics is bipolar. Choices must be between *two* possibilities only, to be fashionable popular groupthink. You must favour *one alternative or the other,* not a third option.

Wolfgang Pauli was so sure that his weakly-interacting neutrinos were undetectable that he gave a case of champagne to Clyde Cowan and Fred Reines who detected electron antineutrinos from the Savannah River nuclear reactor in 1956. They had originally planned to use a nuclear bomb test in the Nevada desert, to ensure a high enough fluence of electron antineutrinos to be sure of detecting some. They are hard to detect because they have a very small mass (gravitational charge) and only have weak isospin charge. They do carry a lot of energy. On average two-thirds of the energy of beta radioactive decay is in the form of electron antineutrinos, particles with fermionic (half integer) spin. The "missing energy" in beta decay led Pauli to propose the neutrino in 1930. Feynman explains in his book *Character of Physical Law* (Penguin, 1992, pp. 75-76) that indeterminancy philosopher Niels Bohr proposed indeterminancy in the energy conservation law as an alternative explanation of that missing beta decay energy: "It might have been that the law of energy conservation was not right; in fact it was proposed by Bohr for a while that perhaps the conservation law worked only statistically, on the average. But it turns out now that the other possibility is the correct one, that the fact that the energy does not check out is because there is something else coming out, something which we now call an anti-neutrino. The anti-neutrino which comes out takes up the energy. ... This example illustrates a point. How is it possible that we can extend our laws nto regions we are not sure about? Why are we so confident that, because we have checked the energy conservation here, when we get a new phenomenon we can say it has to satisfy the law of conservation of energy? Every once in a while you read in the paper that physicists have discovered that one of their favourite laws is wrong. Is it then a mistake to say that a law is true in a region where you have not yet looked? ... Of course this means that science is uncertain; the moment that you make a proposition about a region of experience that you have not directly seen then you must be uncertain. ... When it was discovered that the Newtonian idea was false everyone kept saying what a terrible thing it was that physicists had found out that they were wrong. Why did they think they were right?"

Newton was lauded initially for *just* reasons. His centripetal acceleration law $a = v^2/R$ allowed the centripetal acceleration of the Moon to be calculated (the Moon's distance and speed of orbit around the earth were known; a quarter of a million miles and a month), and compared to the acceleration of an apple on the earth's surface. Newton found that the Moon's centripetal acceleration was smaller than the apple's Galilean acceleration by a factor of $(R_{\text{earth radius}}/R_{\text{Moon distance}})^2$, *verifying* his inverse-square law of gravity. He couldn't verify that *gravity* is proportional to *mass* (his 2nd law of motion merely *defines* "force"), and it was first checked by Cavendish much later (Laplace was first to write Newton's law in algebra, with gravitational coupling G).

Newton also gave the correct explanation for the earth's two daily high tides. The Moon roughly orbits the earth's equator, and water on the side of the earth nearest the Moon is closer to the Moon that the water on the other side of the earth, so it is "pulled" upwards slightly, reducing the downward gravitational acceleration and thus causing a high tide on the side facing the Moon. The water on the other side of the earth has a both a centripetal bulge from the earth's spin and a weaker pull towards the Moon than the earth's core and the water elsewhere around the earth, because the water on the far side is furthest from the Moon so the inverse-square law means a smaller force towards the Moon. So there is a high tide on the side of the earth furthest from the Moon, as well as on the side closest to the Moon. Newton also showed that the inverse-square law applies to a uniform spherical mass (just as to a point source of gravity) using an ingenious geometric shell argument. He also formulated the empirical laws of motion (Descartes and others had earlier proposed semi-correct laws of motion, so Newton was just correcting errors, not being completely innovative and original). The importance of Newton's work was not in "explaining" gravitation or closing down physics for ever, but in checkably solving problems. The same applies to Einstein's theories, although in all cases the popular media deliberately obfuscates the mathematics, or omits to state the theory is mathematical, and makes up some claim that Newton or Einstein were great physicists because they closed down physics by presenting a final mechanism of the laws of nature. This is like romantic fiction; a complete myth. It was actually the opposite. By formulating physics in a checkable, falsifiable mathematical manner, these people allowed the subject to *escape* from the vague vacuum vortices of Descartes and the gear box aether of Maxwell. The danger of the popular media is that eventually a generation of physicists evolves which believes hype, and successfully censors physics innovations to be consistent with dogmatic groupthink prejudices, not with nature.

Left and "right-handed" onshell and offshell neutrinos

	Particle	Isotopic spin charge	*n*, for electric charge = *n*/3	Mass (approximate)
SU(2) doublet	$\bar{\nu}_e$	-1/2	0	$-m_W\alpha^2 n^{1+n}$
	d	-1/2	-1	$-m_W\alpha^2 n^{1+n}$
	$\bar{u}$	-1/2	-2	$-m_W\alpha^2 n^{1+n}$
	e	-1/2	-3	$-m_W\alpha^2 n^{1+n}$
	ν_e	+1/2	0	$-m_W\alpha^2 n^{1-n}$
	$\bar{d}$	+1/2	+1	$-m_W\alpha^2 n^{1-n}$
	u	+1/2	+2	$-m_W\alpha^2 n^{1-n}$
	$\bar{e}$	+1/2	+3	$-m_W\alpha^2 n^{1-n}$
SU(2) triplet	W_+	+1	+1	m_W
	W_0	0	0	$m_W/\cos\theta_W$
	W_-	-1	-1	m_W

Fig. 31: the correct SU(2) electroweak symmetry for one generation of particles after mixing with U(1) quantum gravity (not hypercharge), containing a doublet of fermions and a triplet of bosons. Notice the so-called "antimatter" (designated by an overbar), which was by historical accident misassigned in a disastrous partitioning of "matter" and "antimatter". The Standard Model's U(1) "hypercharge" epicycle covered-up this mismatch of matter-antimatter allocations, masking the simple SU(2) isospin charge and electric charge relationship in the table above. Isospin charge and electric charge are both generated by SU(2), with *differences due to the fact that mixing with U(1) quantum gravity gives mass, affecting their fields*. The -1/2 isotopic spin fermions have electric charges of 0, -1, -2, and -3 (in e/3 units), since vacuum polarization converts of electromagnetic energy into short-range fields, reducing the observed electric charge. The historical confusion which missed this correct SU(2) electroweak symmetry stems from the misunderstanding of electromagnetism, where the angular momentum mechanism for magnetic field quanta is still ignored, so Pauli groundlessly opposed Weyl's 1929 chiral helicity interpretation of the Dirac spinor. Pauli's alleged a "conservation of parity" in nature, despite the fact that *all electrons ever observed have a magnetic field that curls in a fixed direction of helity, thus implying a left-handed spinor direction, due to the angular momentum of the magnetic field quanta*. Bohr's efforts stopped work on physical mechanisms in quantum field theory. Dirac first tried to explain the electron's antiparticle as already existing in a disguised form as protons, but this was a premature (pre-quark) idea and was put down by Oppenheimer in 1930. The positron was then "confirmed" by Carl Anderson's 1932 experiment, but his study was only valid for very low energy, and proof it is invalid at high energy e.g. the big bang is that positrons are *not* common particles.

The helicity of photons is called circular polarization. But because photons and their "antiparticles" are both electrically neutral they are normally not distinguished, so the circular polarization of a "photon" can be either left-handed or right-handed, which appears to justify the "conservation of parity" for electromagnetism. However, if the right-handed "photon" is actually an "antiphoton," then parity is not being conserved, because the mirror image of the photon with left-handed helicity then an antiparticle, rather than just the same particle with opposite helicity.

Because neutrinos have mass, neutrinos must not be entirely left-handed. There is a contribution from right-handed neutrinos which allow them to change flavour as observed. Because right-handed neutrinos do not undergo weak interactions or any other Standard Model interactions, it is clear that they only undergo gravitational interactions. Right-handed neutrinos are the dark matter of the universe. However, as far as SU(2) electroweak theory is concerned, right-handed neutrinos have no electric or isospin charge.

In 1958, Goldhaber, Grodzins and Sunyar at Brookhaven National Laboratory showed that electron neutrinos appear to have left handed helicity. They used europium-152, which undergoes "electron capture," with the nucleus capturing an electron (inverse beta decay), producing samarium-152, and a neutrino and gamma ray were emitted back-to-back with identical handedness (to conserve angular momentum). They therefore determined the handedness of the neutrino by measuring the helicity of the gamma ray in this situation, which showed that neutrinos are left-handed. Earlier experiments had also shown that parity is not conserved in beta decay, a weak force interaction. However, the solar neutrino measurements which showed that only a third of the electron neutrinos arrived, compared to the emission from nuclear reactions in the sun, proves that neutrinos mix flavour during their 8.3 minutes journey from the sun to the earth, arriving in electron, muon and tauon "flavours."

This neutrino mixing is not possible if neutrinos are purely left-handed. Some long range experiments have been done on earth, such as the K2K experiment in Japan where muon neutrinos produced at the KEK accelerator were fired at the SuperKamiokande detector 250 km away, and similar setups from CERN and Italy, and from Fermilab to Minnesota. These experiments confirmed the solar neutrino mixing data; neutrinos do change flavour as they propagate, becoming gradually mixed up between the three different flavours. Because neutrinos only have weak charge, and do not undergo electromagnetic or strong interactions, they only interact weakly. This implies that in order to change flavour at the observed rate, they must interact by having a small mass. It is normally assumed that they interact with a "Higgs boson," to acquire mass, but since they have a weak charge, they will also interact with electrically neutral Z bosons, i.e. neutral currents in the vacuum. These weak interactions will convey mass and gravitational charge to the neutrinos.

A popular idea is that *Dirac neutrinos* which change handedness when they gain mass by interacting with spin-0 "Higgs bosons," and thus spend half their time left-handed and half their time right-handed. The fact that only left-handed neutrinos are observed is attributed to an insignificant interaction rate of right-handed Dirac neutrinos with the supposed "Higgs bosons" (or Z bosons). *Majorana neutrinos* instead sensibly abandon dogmatic matter-antimatter symmetry and use an intrinsically massive and short-lived right-hand component, so their time-averaged mass is small, as observed.

REFLECTIONS ON THE FATE OF SPACETIME

String theory carries the seeds of a basic change in our ideas about spacetime and in other fundamental notions of physics.

Edward Witten

Our basic ideas about physics went through several upheavals early this century. Quantum mechanics taught us that the classical notions of the position and velocity of a particle were only approximations of the truth. With general relativity, spacetime became a dynamical variable, curving in response to mass and energy. Contemporary developments in theoretical phys-

initial state can evolve into a given final state.

This beautiful recipe—formulated in the early days of quantum field theory—brought marvelous success and efficient, precise computations. Yet this recipe also exhibits certain of the present-day troubles in physics. One important property of a Feynman graph is that the

Moreover, these theories have (or this one theory has) the remarkable property of *predicting gravity*—that is, of requiring the existence of a massless spin-2 particle whose couplings at long distances are those of general relativity. (There are also calculable, generally covariant corrections that are unfortunately unmeasureably small under ordinary conditions.) This result is in striking contrast to the situation in conventional quantum field theory, where gravity is impossible because of the singularities of the Feynman graphs.

Fig. 32 (*above*): Edward Witten's article "Reflections on the fate of spacetime," *Physics Today*, April 1996, pp. 24-30, states on p. 25 that the "theories" covered by his M-theory unification "have (or this one has) the remarkable property of *predicting gravity* - that is, of requiring the existence of a massless spin-2 particle whose couplings at long distances are those of general relativity," but he fails to offer any *evidence* for his spin-2 graviton hype, either in theoretical proof or in observational data. This is still cited by "peer"-reviewers to censor out hard facts.

"This line of thought has hardened into a new orthodoxy ... There is not even a serious proposal for what the dynamics of the fundamental 'M-theory' is supposed to be ... The sole argument generally given to justify this picture of the world is that perturbative string theories have a massless spin two mode and thus *could* provide an explanation of gravity, *if* one ever managed to find an underlying theory for which perturbative string theory is the perturbative expansion. This whole situation is reminiscent of what happened in particle theory during the 1960s, when quantum field theory was largely abandoned in favor of what was a precursor of string theory. The discovery of asymptotic freedom in 1973 brought an end to that version of the string enterprise, and it seems likely that history will repeat itself when sooner or later some way will be found to understand the gravitational degrees of freedom within quantum field theory. ... there is certainly nothing like a no-go theorem indicating that it is impossible to find a quantum field theory that has a sensible short distance limit and whose effective action for the metric degrees of freedom is dominated by the Einstein action in the low energy limit."

- Peter Woit, *Quantum Field Theory and Representation Theory: A Sketch*, arXiv:hep-th/0206135v1, 2002, pp. 51-52.

Weinberg mixing, CKM quark mixing, neutrino mixing

The Glashow-Weinberg mixing angle, θ_w (first discovered by Glashow but of course symbolically named after the great man Weinberg), appears to run with energy, from

$\sin^2\theta_w = 0.23120 \pm 0.00015$ at an energy of 91.2 GeV,

using the minimal subtraction renormalization scheme[35], to

$\sin^2\theta_w = 0.2397 \pm 0.0013$ at an energy of 160 GeV,

using parity violation in Moller scattering[36] (the collision of left handed electrons with positrons to make Z bosons, as described in detail earlier). The difference in the weak mixing angle between 91.2 and 160 GeV is very much larger than the error bars in the data, so unless there is an error in the error bars, it is strong evidence that the mixing angle is not a fixed constant, but runs with energy.

The running of mixing angles is the key to the theory of this paper. If we can make the mixing of quantum gravity U(1) with SU(2) run appropriately, we can make the SU(2) vector bosons massless at very high energy, replacing the Higgs mechanism for the renormalization of SU(2), because the charge of U(1) quantum gravity is mass. The whole problem of renormalization is getting the SU(2) field quanta massless at very high energy, averting the Lorentz mass transformation from making the field quanta have unphysically large momenta. The UV cutoff at very high energy stops field quanta having infinite momenta, but they have enough momenta to prevent gauge invariance working unless they lose their rest mass well before the UV cutoff is reached. 't Hooft's proof of the renormalizability of Higgs mass mechanism theories applies equally well to any theory which makes the SU(2) field quanta massless at high energy. It is not specific to the Higgs mechanism in the sense that once the field quanta are made massless, Yang-Mills theory becomes renormalizable, just like U(1) Abelian theory.

We *replace* the brilliant 't Hooft's proof of the renormalizability of Yang-Mills field theories with *massless* field quanta by the *mechanism* we gave earlier in this paper for the charge-transfer term of the Yang-Mills equations to drop out for massless charged field quanta due to their infinite magnetic self-inductance. Since no *net* charge transfer is possible when the field quanta become *massless,* the charge-transfer term of the Yang-Mills equations becomes effectively zero, reducing the Yang-Mills equations to Maxwell's equations as an effective theory. Since we know from QED that Maxwell's equations for massless field quanta form the basis for a renormalizable quantum field theory, it follows that we can prove that SU(2) Yang-Mills theory with a mechanism for making the field quanta massless at high energy automatically makes the theory fully renormalizable.

't Hooft's makes the statement on his personal website[37]: "... I found in 1970 how to renormalize the theory, and, more importantly, we identified the theories for which this works, and what conditions they must fulfil. One must, for instance, have a so-called Higgs-particle." This is incorrect; all that gauge theories with charged massive vector bosons require for renormalization is not Higgs particles *per se*, but some way of *dropping the mass of the gauge bosons at high energies where Feynman diagrams with multiple loops containing very high energy massive propagators interfere with renormalization.* What 't Hooft should write is that the Higgs mechanism was then the only known way of making the SU(2) field quanta massless as required. But we make SU(2) field quanta massless by running with energy the mixing angle between SU(2) and mass i.e. quantum gravity U(1). Since SU(2) field quanta acquire mass from mixing with U(1) quantum gravity, rather than a Higgs field, we obtain definite falsifiable predictions.

The weak hypercharge of U(1) quantum gravity for *left-handed* (weak-participating) leptons is $Y = -1$, and they have a weak isospin charge of $I = \pm \frac{1}{2}$, so that the ratio of weak isospin charge to hypercharge for these particles is $\pm \frac{1}{2}$. (Forget about *right-handed weak hypercharges*, since right-handed particles *don't participate in the weak interaction,* so they are just distracting epicycles as seen from that perspective.) From equation 10.21 ($\tan \theta_w = g_w/g_B$) in David McMahon's 2008 *QFT Demystified,* this $\frac{1}{2}$ ratio of isospin charge to hypercharge determines the isospin and hypercharge couplings, g_w and g_B, respectively, *if charge is proportion to coupling:*

$$\tan \theta_w = g_w/g_B = \tfrac{1}{2}$$

hence:

$$\sin^2\theta_w = \tfrac{1}{5}$$

A detailed justification for this calculation is called for, so it won't be lost, dismissed or ignored in the literature. We have not just written down $\sin^2\theta_w = \frac{1}{5}$ but have *calculated* the factor 1/5, based on the model we are using. It really turns out that McMahon's formula 10.21, $\tan \theta_w = g_w/g_B$, set equal to 1/2 (since the isospin is half the hypercharge), when calculated gives the prediction that $\sin^2\theta_w = \frac{1}{5}$. *The factor 1/2 turns into 1/5, like turning lead into gold, not a case of abject numerology.*

We have stated the foundations clearly, which follow from the vacuum polarization mechanism required for correlating quark and lepton masses and explaining fractional electric charges/fractional hypercharges. Now the measured values of $\sin^2\theta_w$ are slightly greater than 1/5, but they run with energy, and our calculation here does not included this running with energy. The result $\sin^2\theta_w = \frac{1}{5}$ is a bare core asymptotic value, not the value including the running with energy due to vacuum polarization shielding. It is the complexity of this running which permits renormalization.

"When a historian of science pressed him on the question of unification in his Caltech office, he resisted. 'Your career spans the period of the construction of the standard model,' the interviewer said. 'The standard model,' Feynman repeated dubiously... The interviewer was having trouble getting his question on to the table. 'What do you call SU(3) × SU(2) × U(1)?' 'Three theories,' Feynman said. 'Strong interactions, weak interactions, and the electromagnetic. ... The theories are linked because they seem to have some similar characteristics. ... Where does it go together? Only if you add some stuff we don't know. There isn't any theory today that has SU(3) × SU(2) × U(1) - whatever the hell it is - that we know is right, that has any experimental check. ..."

- Gleick's biography of Feynman.

The electrically neutral Z weak boson has a higher mass, about 91 GeV, than the electrically charged W weak bosons because of the weak mixing angle:

$$\cos \theta_W = M_W/M_Z,$$

our formula $\sin^2\theta_W = \frac{1}{5}$ gives $\cos \theta_W = M_W/M_Z = 0.8944$, close to the observed ratio of 80/91 = 0.879.

The standard formula for the W boson mass involves the Fermi coupling G_{Fermi} and the running α electromagnetic coupling, which is only asymptotically 1/137.036... at energies below about 1 MeV, and increases to about 1/128.5 at the weak boson mass scale of about 80-91 GeV:

$$M_W = [\pi\alpha/(2^{1/2}G_{\text{Fermi}})]^{1/2} / \sin\theta_W.$$

In Enrico Fermi's original 1934 theory of beta radioactive decay, based on Pauli's neutrino explanation for the then unobserved 2/3rds of the energy released in beta decay, a neutron and a neutrino collide and change flavours, producing a proton and an electron (beta particle). This *neutrino* input (as a scattering reaction) is equivalent to the *release* of an *antineutrino* in the beta decay interaction, as can be clearly demonstrated with Feynman diagram rules. The 1934 Fermi theory of beta decay is therefore equivalent to a "flavour changing" point scattering interaction.

("Flavour" should be taken as evidence for the trivial nature of the physics involved, not as a daunting evidence that physics is very hard, abstruse psychedelics. In trying to discuss modern physics with people working in classical electromagnetism, the use of the absurd term "flavour" shuts down conversations. The concept of "flavour" came from an original idea for calling quark flavours "chocolate, vanilla and strawberry." Physicists distracted by food-thinking then renamed the "flavours" more abstractly, but the "flavour" description remained in use; an irrational anachronism. Feynman also argued that the legacy of many different energy units in physics is evidence of irrational physics fashions. For people outside physics, "stress" and "strain" in materials mechanics are similar examples of psychedelics; commonplace words take on specific mathematical definitions. Even the word "force" as defined by Newton's 2nd law *differs from commonplace use,* which defines "force" as an impact. If you "force" a nail into wood or "force" a door open, you don't apply a steady force, but an *impulse,* a force integrated over time, $\int F dt = \int (dp/dt) dt = \int dp \sim p$. *Thus, you use momentum, p, not force, F.* You *swing* a hammer to hit a nail with time-acquired momentum, thus *integrating force over time by swinging your arm.* This is the intuitive mechanism used by Dr Theodore Taylor to cut the size of nuclear weapons. By introducing a *void* between the chemical explosive implosion system's metal pusher and the bomb core, the metal pusher was able to gather momentum from the force applied by the chemical explosion around it, before reaching the core with optimal momentum. The first implosion weapon in 1945 neglected this commonsense physics, and tried to compress the core in a way analogous to trying to push a nail into wood using a hammer and *steady force,* without swinging the hammer to acquire momentum first. It is significant that some of the "world's great physicists" designed that first weapon, *ignoring the very basic physics of hammering nails, thereby having to use tons of chemical explosives; a needlessly bulky weapon.*)

The 1967 electroweak theory introduces a massive weak boson as an off-shell "propagator" in the Fermi theory, so that Fermi's constant becomes

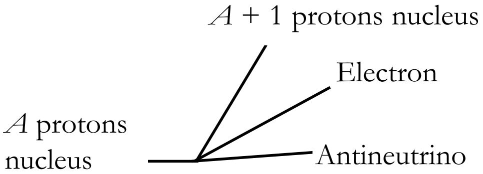
$$G_{\text{Fermi}} = 2^{1/2}g^2/[8(q^2 + M_W^2)],$$

where the W boson mass M_W determines the weakness of the weak force relative to the electromagnetic force, and q is momentum. The mass of the weak bosons is the reason why the weak force is weaker than the electromagnetic force, which has massless bosons. A massive propagator is slower and has a shorter lifetime under the exclusion principle, $t = \hbar/E = \hbar/(mc^2)$, so it has a shorter range $R \sim ct = \hbar/(mc)$, reducing the interaction rate and the force conveyed.

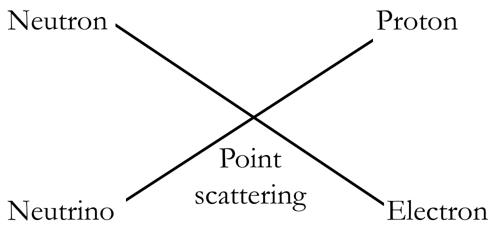
We therefore agree with the standard electroweak unification in the sense that weak and electromagnetic interactions come from a mixing of U(1) and SU(2), but we differ in how this comes about, and we use the mixing to avoid the Higgs mechanism for mass. By making U(1) hypercharge the basis of quantum gravity, its mixing with SU(2) makes the SU(2) bosons massive for left-handed weak interactions, while allowing SU(2) electromagnetism with massless bosons which have not acquired mass from the U(1) mixing.

The propagator (Fourier transform) of the Coulomb potential $\propto \alpha_{EM}/r$ is α_{EM}/q^2, where q is the boson momentum, $q = p/c$. A Yukawa potential results for a massive weak boson[38], $\alpha_{\text{weak}}e^{-r/R}/r = \alpha_{\text{weak}}e^{-Mr}/r$, where $M = M_W c/\hbar$, yielding propagator: $\alpha_{\text{weak}}/(q^2 + M^2)$. At *low* energies, $M^2 >> q^2$, so the transform $\alpha_{\text{weak}}/(q^2 + M^2)$ reduces to effectively α_{weak}/M^2, thus "unification" if $\alpha_{EM}/q^2 = \alpha_{\text{weak}}/M^2$.

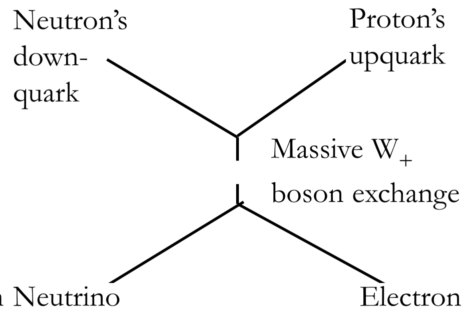
Radioactive "beta decay" (weak interaction) as first formulated by Wolfgang Pauli in 1930 (note that an antineutrino output is equivalent to a neutrino in the event input):



Fermi's 1934 reformulation of beta decay as an isospin-changing neutron-neutrino point-scattering event:



1967 electroweak theory:



Tree-level generic Moller scattering Feynman diagram, which by "crossing-symmetry" has the same cross-section as Bhabha's $p + e$ attraction (these rules apply also to looped diagrams with more vertices):

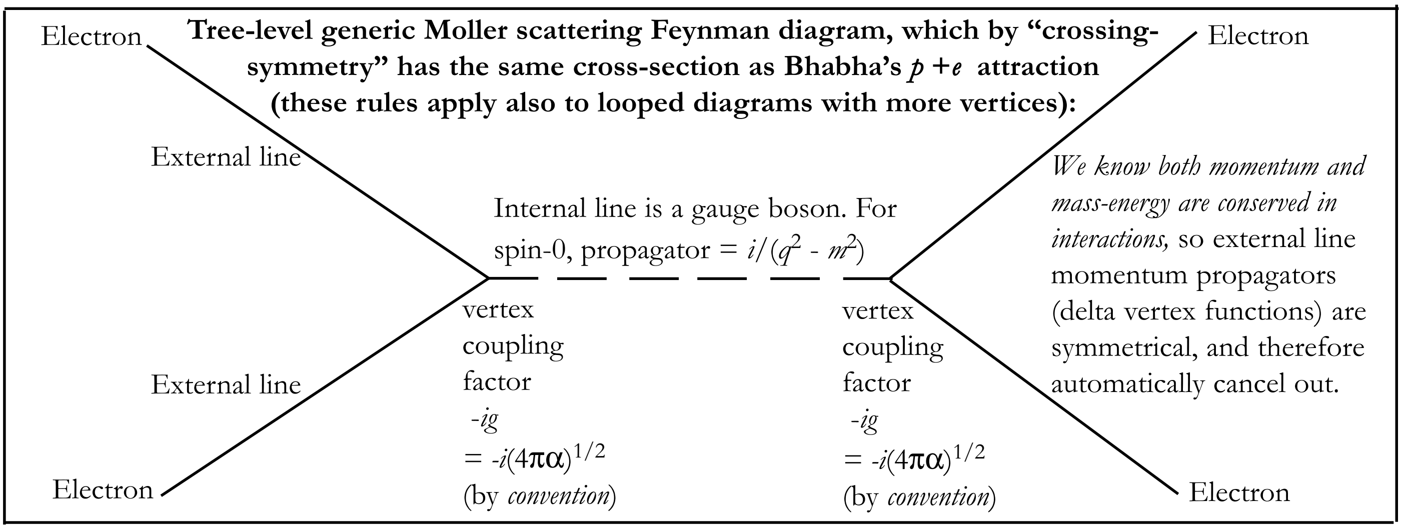


Fig. 33: Coulomb's law of repulsion between two similar charged electrons corresponds to this very simple 2-vertex Feynman diagram, thus the simplest quantum field theory Feynman diagram corresponds to classical electrodynamics.

Feynman's rules for calculating the amplitude any Feynman diagram (including more complex diagrams with pair-production loops, multiple crossing propagators, etc.) were derived from normalizing the Feynman path integral with the empirical "S-matrix grey box" scattering calculation rules. The overall amplitude of a Feynman diagram is equal to momentum integral of the product of all vertex coupling factors and *internal line* momentum propagators (the dashed line above is the internal momentum propagator, i.e. the gauge boson), ensuring that momentum and mass-energy are conserved. In the example above, the product of the two vertices interaction couplings is $[-i(4\pi\alpha)^{1/2}][-i(4\pi\alpha)^{1/2}] = -4\pi\alpha$. Spin angular momentum is behind for SU(2) spin effects like magnetic repulsion and left-handed helicity in weak interactions, but just considering electric forces or gravitational forces, we can effectively treat their force-causing *linear momentum exchanges* using a spin-0 propagator, equal to $i/(q^2 - m^2)$, where $m = 0$ for a massless *real* photon. The total amplitude factor for the diagram above (assuming propagator spin-0) is: $\psi = \int[-4\pi\alpha(2\pi)^4 i/(q^2 - m^2)]\, d^4q$, where an geometric vertex delta function factor of $(2\pi)^4$ is inserted because the integral is over four-dimensional spacetime momentum, d^4q. (Because the four external lines are symmetrical, their propagators conserve momentum and thus cancel out.)

The relative probability or relative cross-section for this process is directly proportional to $|\psi|^2 = |\int[-4\pi\alpha(2\pi)^4 i/(q^2 - m^2)]\, d^4q|^2$ which is Max Born's relationship between wavefunction amplitude and probability or cross-section. (This is also seen generally in wave phenomena, e.g. in the fact that the square of the electric field strength amplitude is proportional to the energy density of that electric field, so the square of an amplitude is generally an energy density, thus is proportional to the number of particles per unit volume.) The relative half-life for beta radioactive decay is thus proportional to $1/|\psi|^2$, while the absolute probability of this process is equal to $|\psi|^2$ for *this* process divided into the path-integral for *all* processes, i.e. all Feynman diagrams. Obviously, you cannot actually use this to calculate the half-life of cobalt-60 theoretically because of the complexity of the many interactions going on in a large nucleus, with three onshell quarks per nucleon and a large number of *offshell* quarks and leptons contributing an infinite number of potential interactions. You can only make a useful path integral calculation for relatively simple situations.

Moller scattering is relatively simple because it is between just two onshell electrons, and the simplest Feynman diagram (that shown above) has the greatest influence. The more complex Feynman diagrams only contribute very small corrections to the Moller scattering two-vertex amplitude. The path integral cross-section is proportional to $|\int e^{iS/\hbar} Dx|^2 = |\psi_1 + \psi_2 + \psi_3 + \psi_4 + \ldots|^2$, so we can use Feynman's rules for calculating the amplitude ψ of any given Feynman diagram to produce a "perturbative expansion" equivalent to the path integral (which would be very difficult to do analytically using calculus, to put it *mildly*, despite all the fashionable arm-waving propaganda about the help from calculus in physics).

Note that the force coupling picks up an additional power for each additional pair of vertices involved, so for two verticles the amplitude is proportional to $\{\text{coupling}\}^2$, for four verticles (Feynman diagrams with one pair-production/annihilation "loop" in the propagator, for instance), it is proportional to $\{\text{coupling}\}^3$, and so on. Because of the *mainstream assumption* that the coupling is proportional the *square-root* of α, as discussed earlier in the context of Penrose's book, the simplicity of this fact is obfuscated in quantum field theory textbooks. Therefore, if the coupling is a *small fraction*, all the more complex Feynman diagrams which have very large powers of the coupling, will automatically have *fairly insignificant contributions*, so the "path integral" is *largely determined just by the integration of a simple two-vertex diagram (first diagram wavefunction amplitude), giving a classical law, unless there are geometrical factors causing path phases to cancel out where near the Planck action, examples being the double slit experiment, or the small size of the electron orbit in an atom.*

In such cases, $|\int e^{iS/\hbar} Dx|^2 = \int[\cos(S/\hbar) + i\sin(S/\hbar)]Dx|^2$, but we can drop the complex $i\sin(S/\hbar)$ term because the *direction* of the resultant arrow for all paths on an Argand diagram equals the *direction of the real axis (the principle of least action)*. Interferences only vary the *length* of the resultant, not its *direction*.

The CKM matrix and neutrino mixing is closely linked to beta decay, because it is during beta decay of a quark that there may be a probability for a quark to change flavour (transitions between different generations of quarks). It is significant that the analogous mixing for leptons has not been discovered to occur between the different generations of electrically charged electron, muon, and tauon, but mixing has been discovered to occur between the different generations of their respective *neutrinos*. So we have two mixing matrices: the CKM matrix for quarks, and recent data for leptons (neutrinos).

Any mixing angles for quark to lepton transitions are unobservably small at the energies available in existing particle physics experiments, for quarks have not been observed to become leptons, within the current paradigm of analysis of pair production. However, we find an anomaly in this analysis, which is very important for unprejudiced understanding:

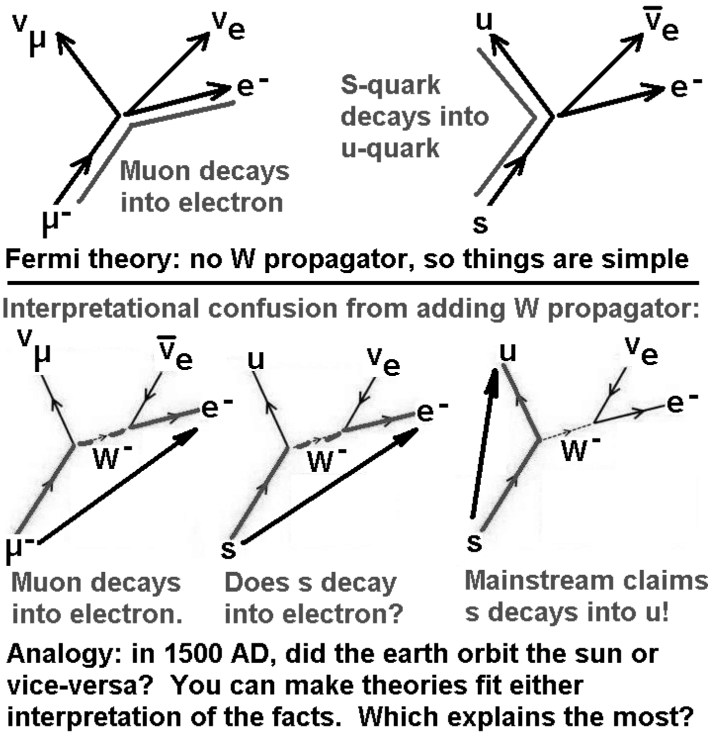


Fig. 34: in Fermi's point scattering interpretation of weak interactions, everything is fine and there is no anomaly. A muon can decay into an electron, and an s-quark can decay into a u-quark. Everything is fine. But when in 1967 electroweak theory inserted a W propagator, *this neat symmetry was defied for a comparison of quark and lepton decays*. Our symmetry anomaly of electroweak theory is this: if we define beta decay as being a "decay of a muon into an electron," then this only occurs *via the path containing the W boson. But if we use the same W-boson path to define what an s-quark decays into, we get an electron, because that is the analogy to the a muon decaying into an electron via a W-boson decay path.* The mainstream dogma is inconsistent, "seeing" muons decaying into electrons *via the W boson,* but ignoring this process in s-quark decays, where it changes the goalposts and then "sees" the s-quark decaying directly into a u-quark, not via the path of a decaying W boson. If you are rational, you need to use the same beta decay analysis rule for all beta decays, quarks and leptons. So either you must say that:

"a quark decays into a quark plus a W-boson, and a muon decays into a neutrino plus a W-boson,"

or you must say:

"a quark is converted into an electron via a W-boson decay, just as a muon is converted into an electron via a W-boson decay,"

but you are inconsistent if you claim (as the dogmatic mainstream does):

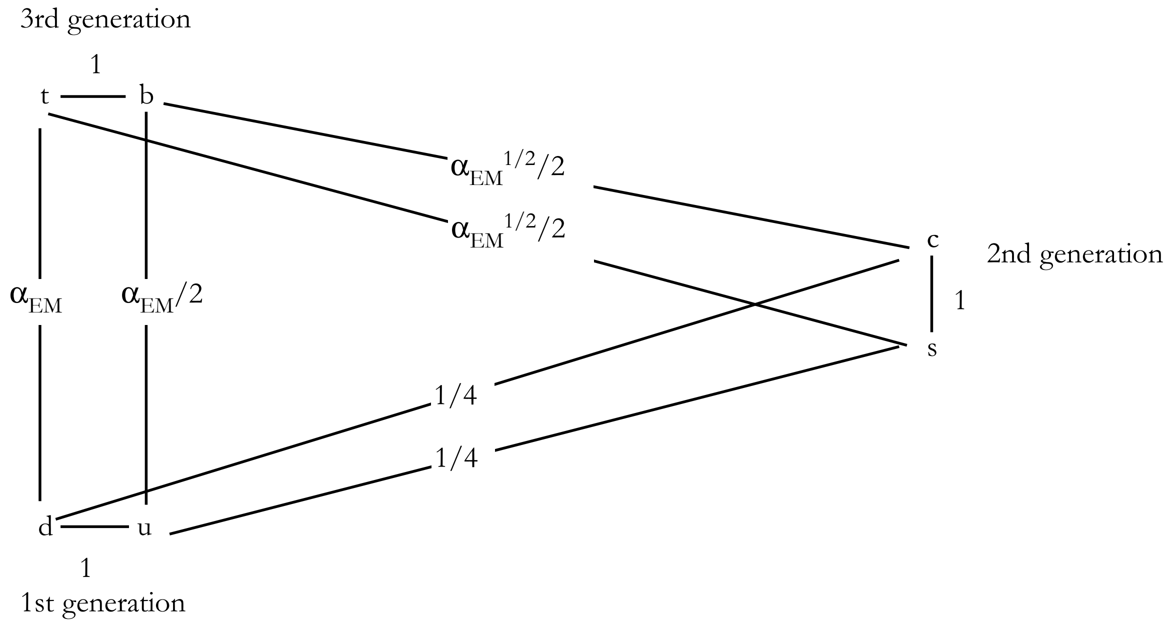
"a quark decays directly into another quark, emitting a W-boson in the process, but a muon doesn't analogously decay directly into a neutrino (emitting a W-boson in the process), but instead a muon follows the W-boson path and becomes an electron."

It doesn't matter how many billions of brilliant physicists or mathematicians are brainwashed or deluded with *status quo,* if it is a systematic interpretation error, it still needs correcting. Nor is it immediately clear from authority-figures which explanation is "correct," and by analogy relativism in the solar system, you can argue that neither the earth rotates daily, not does the sun orbit the earth daily (but there is evidence from the handedness of hurricanes and the precession of Foucault pendulums that the earth really does rotate, so there isn't any "Copernican relativism principle" proof).

What we are arguing here is not for either of the two systematic interpretations to become a dogma, but instead for the inconsistency and its implications for the interpretation of the CKM matrix parameters to be recognised. What we are saying is that beta decays *can* be interpreted as lepton to quark decays, if a muon really does decay via a W boson into an electron. I.e., if a muon *is* really a massive radioactive isomer of an electron, then we are forced for consistency of beta decay analysis, to accept that the equivalent decay route of a quark produces an electron.

Dogma of course states that quarks do not decay into electrons, which as far as our analysis is concerned, is simply an insistence that the Emperor's New Clothes are self-evident. So what we are getting at is that the CKM matrix has been mixed up by a faulty (inconsistent) analysis of how to interpret beta decay, and if only this error were made consistent, things would become much clearer, by analogy to the role of the faulty Ptolemaic theory (that the sun orbits the earth daily) had in messing up the analysis of observational data. If you try to interpret data using a false theory, you end up with with a set of abstruse "epicycle parameters" that look mysterious, and then you sit back and wait for a final theory which can "explain the epicycles." It never arrives, because there are no epicycles. What arrived eventually was Kepler's 3 simple laws of elliptical solar system orbits.

$$\begin{bmatrix}|V_{ud}| & |V_{us}| & |V_{ub}| \\ |V_{cd}| & |V_{cs}| & |V_{cb}| \\ |V_{td}| & |V_{ts}| & |V_{tb}|\end{bmatrix} = \begin{bmatrix}0.97428 & 0.2253 & 0.00347 \\ 0.2252 & 0.97345 & 0.0410 \\ 0.00862 & 0.0403 & 0.999152\end{bmatrix} \sim \begin{bmatrix}1 & 1/4 & \alpha/2 \\ 1/4 & 1 & \alpha^{1/2}/2 \\ \alpha & \alpha^{1/2}/2 & 1\end{bmatrix}$$



Factor of 1/2 difference suggests a single helical handedness for "b-u", compared to both helicities for "t-d"

Fig. 35: our simple CKM matrix symmetry pattern. The numbers are relative amplitudes for the specific path; the relative probabilities are proportional to the squares of these amplitudes ("unitarity" constrains the sum of the squares for all possible decay path amplitudes to equal 1, as in the normalization of probabilities in quantum mechanics generally; one event happens once, so the sum of all path probabilities is equal to 1). A top quark can undergo beta decay to form a bottom, a strange or a down quark; the relative amplitudes for these 3 paths being about 0.999, 0.04 and 0.009, respectively, so the relative probabilities are about 0.999^2, 0.04^2, and 0.009^2, and the decay "branching fractions" are ~1, 0.002, and 0.00008, respectively. Notice that alpha or ~1/137 is not a fixed parameter at quark energies, but "runs" (increasing with energy), so this correlation is approximate. We are trying to merely get a general feel for the symmetry pattern of the physical processes by seeing what the *first-order* mixing amplitude factors look like in terms of the IR cutoff alpha value. Studies of the detailed mechanism explains the fine structure differences. In the case of chemistry, there were long-persisting "anomalies" such as the 35.5 mass number of chlorine, and many other non-integer masses, which had to await detailed experimental and theoretical data (isotopes and binding-energy mass defect mechanisms).

Therefore, the beta decay branching fractions for quarks are obfuscated by the "mixing angle" epicycle-like assumptions in the Cabibbo-Kobayashi-Maskawa (CKM) matrix formulation, while the mixing of leptons (neutrino mixing data) are obfuscated by a different set of parameters, namely the *masses* attributed theoretically to the neutrinos to correspond to their mixing. What we need for understanding the physics is a *common measure of the mixing ratios of quarks and leptons, not their dogmatically different conventional units of CKM angles for quark mixing and masses for neutrino mixing,* which obviously obfuscates any similarity or pattern in the two sets of mixing parameters (quark mixing and lepton mixing). (E.g., if you compare *clothing sizes* in Japan and America, you first need to ensure you are using the *same system of units for both cases,* not comparing data in *metric units with imperial units*.)

What we are really interested in is expressing mixing in terms of the transition amplitude, measured in multiples of the real coupling parameter, α_{EM}, allowing for the fact that α_{EM} runs with energy from the low energy asymptote of about 1/137.036 below about 1 MeV to about 1/128.5 at 91 GeV, and higher at greater energies. Since the Glasshow/Weinberg electroweak mixing angle runs with energy, we may expect by analogy that the mixing angles for quark mixing and neutrino mixing also run with energy. In this case, it might be modelling epicycles to try to discover a relationship between existing experimental values. In the case of neutrino mixing, we already know that the amount of flavour mixing is distance dependent: the closer you are to a neutrino source, the smaller the percentage which have changed flavours. In Lederman's original laboratory experiments, he found that muon neutrinos striking neutrons *produced muons in 51 different events, but never produced electrons,* suggesting no neutrino mixing. But for the solar neutrinos coming from 93 million miles distance in 8.3 minutes, the mixing is extreme and 67% of the electron neutrinos are able to change flavour into muon neutrinos and tauon neutrinos. For earth bound measurements closer to a nuclear reactor, the mixing is far less. Therefore, the mixing parameter is distance-dependent in the case of neutrinos. The large amount of solar neutrino mixing of vacuum is at odds with normal thinking about the small cross-section of the neutrino for any interaction with matter. Clearly, although the neutrino very rarely interacts with onshell *matter,* it must be interacting at a relatively high rate with an *offshell* field in the vacuum, in order to undergo so much flavour mixing.

A reformulation of the phase amplitude factor from complex configuration space to Euclidean space, overcoming the problem that Haag's theorem forbids an interaction picture in quantum field theory within Hilbert space

Quantum field theory is presently formulated in a complex configuration space, such as Hilbert or Foch space. Haag's theorem states that there is a lack of consistency between the free field and the renormalized (i.e. vacuum polarization-compensated) vacuum states in Hilbert space, because the isomorphism that maps the free-field Hilbert space on to the renormalized-field Hilbert space is ambiguous.

Haag's theorem has led Oakley[39] to suggest the drastic step of removing the interaction picture, throwing out the baby with the bath water. We overcome Haag's theorem by retaining the interaction picture and reformulating the phase factor of the path integral using Euler's formula for the phase amplitude factor, $e^{iS/\hbar} = \cos(S/\hbar) + i \sin(S/\hbar)$ where S is the action. As this formula shows, the phase factor $e^{iS/\hbar}$ is a simple periodic function when plotted on an Argand diagram. Paths represented by small actions ($S \approx 0$) lead to phase factors of $e^{iS/\hbar} \approx e^0 = 1$, while the oscillatory value of e^{iS} for other paths with greater actions cancel one another, allowing the sum of phase factors for all paths to be maximised where the action is least. A precise duality exists for path integral purposes between the complex phase factor $e^{iS/\hbar}$ and the factor $\cos S$, the only difference being the loss of vector information: the *direction* of the resultant amplitude in a path integral is lost by use of the substitution $e^{iS/\hbar} \rightarrow \cos(S/\hbar)$, since this substitution changes the path integral from summing vectors (of equal length but varying direction on the Argand diagram), to the summation of scalars (amplitudes without direction, i.e. the output from $\cos S$) which vary in value between plus and minus one to allow cancellation of cyclical contributions from large actions. However, this vector information is an unnecessary and superfluous epicycle for *genuine existing uses of the path integral* because although the *length of the resultant arrow is variable*, its direction is not variable and must be in the direction of the real axis (the *direction* corresponding to zero action and thus to *least action*), so that a real amplitude and a *real probability result from the path integral.*

So that the substitution $e^{iS/\hbar} \rightarrow \cos S$ is the effective and necessary solution to the problem for Hilbert space in Haag's theorem, allowing the path integral to be formulated in Euclidean space, instead of a complex space. As Woit points out, the path integral is ill-defined in Minkowski spacetime in any case, so is usually evaluated in Euclidean space. The Wick rotation is used precisely for this purpose. There is an almost eternal preoccupation with the occult in mathematical physics, leading to tragedy. From the Pythagorean cult of number, to Plato's arm-waving "theory" that atoms are unsplittable regular geometric solids, to Newton's concept of "laws" without mechanism, opportunities to make progress in understanding the world have always been stamped out by the number mystics obsessed with the occult, with extra spatial (not time) dimensions from the 5-dimensional Kaluza-Klein vacuous "unification" of electromagnetism and gravity to SU(5) grand unification (which falsely predicted that the proton decays), technicolour, 26 dimensional bosonic string theory, and finally Ed's 10/11 dimensional M-theory.

What Newton could and should have done with Fatio's gravity mechanism circa 1790 A.D., when Newton could (if he knew G which of course he didn't really know or even name, since he used Euclidean-type geometric analysis to prove everything in Principia, and that symbol it came from Laplace long after), have predicted the acceleration of the universe from applying his 2nd and 3rd laws of motion plus other Newtonian physics insights to improve and rigorously evaluate the gravity mechanism. Of course, we're still stuck in a historical loop where any mention of the facts is dismissed by saying Maxwell and Kelvin disproved a gravity mechanism by proving that onshell matter like gas would slow down planets and heat them up, etc. Clearly this is not applicable to experimentally validated Casimir off-shell bosonic radiations, for example, and in any case quantum field theory's well validated interaction picture version of quantum mechanics (with wavefunctions for paths having amplitudes $e^{iS/\hbar}$, representing different interaction paths) suggests that fundamental interactions are mediated by off-shell field quanta.

The Maxwell/Kevlin and other "disproofs" of graviton exchange are wrong because they implicitly assume gravitons are onshell, an assumption which, if true, would also destroy other theories. It's not true. E.g. he Casimir zero point electromagnetic radiation which pushes metal plates together does not cause the earth to slow down in its orbit or speed up.

The use of a disproved and fatally flawed classical "no-go" theorem to "disprove" a new theory is exactly what holds up physics for centuries. E.g., Rutherford objected at first to Bohr's atom on the basis that the electron orbiting the nucleus would have centripetal acceleration, causing it to radiate continuously and disappear within a fraction of a second. We now know that the electron doesn't have that kind of classical Coulomb-law attraction to the nucleus, because the field isn't classical but is quantum, i.e. discrete field quanta interactions occur. This is validated by "quantum tunnelling", where you can statistically get a particle to pass through a classically-forbidden "Coulomb barrier" by chance: instead of a constant "barrier" there is a stream of randomly timed field quanta (like bullets in this respect) and there is always some chance of getting through by fluke.

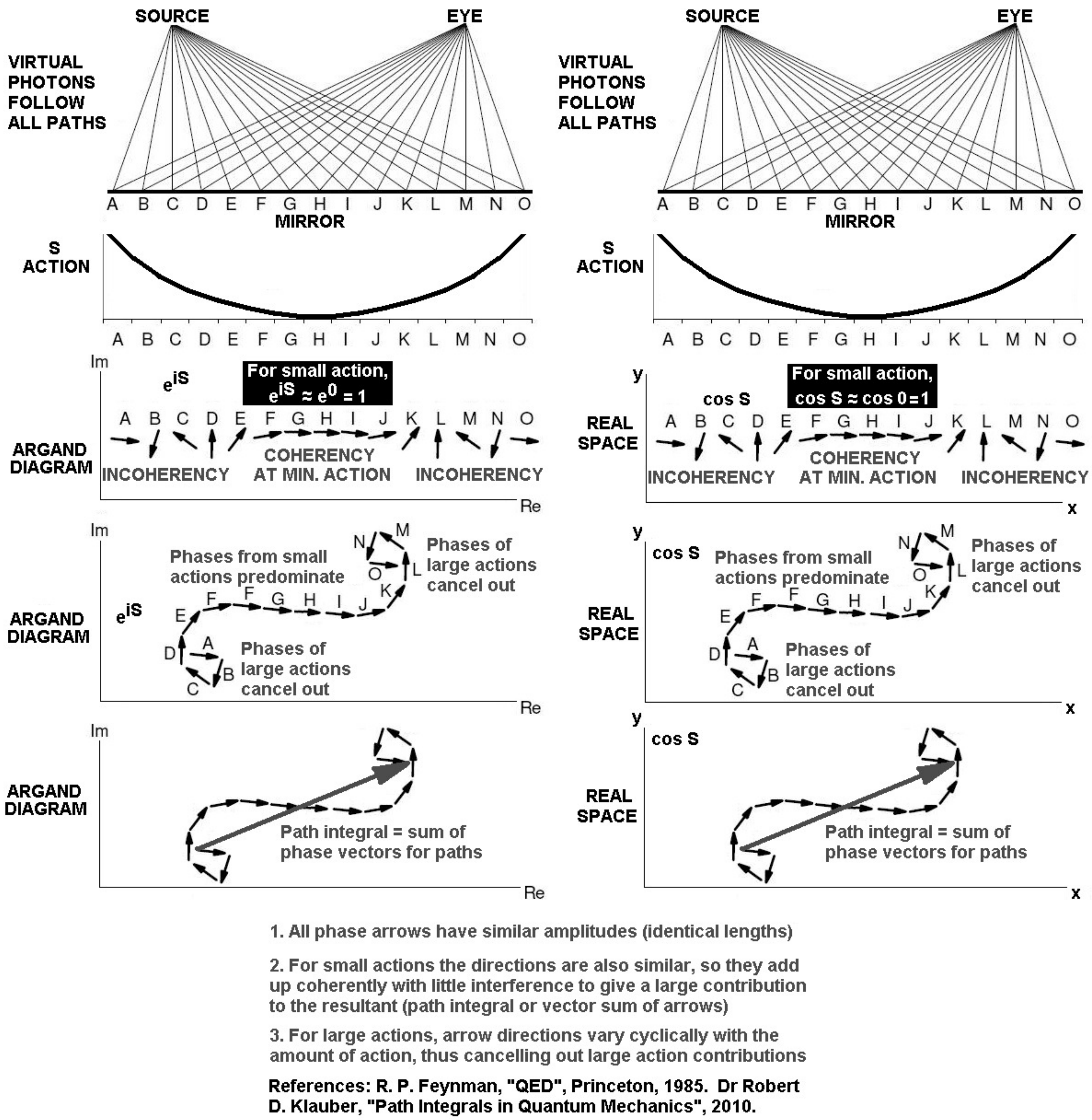
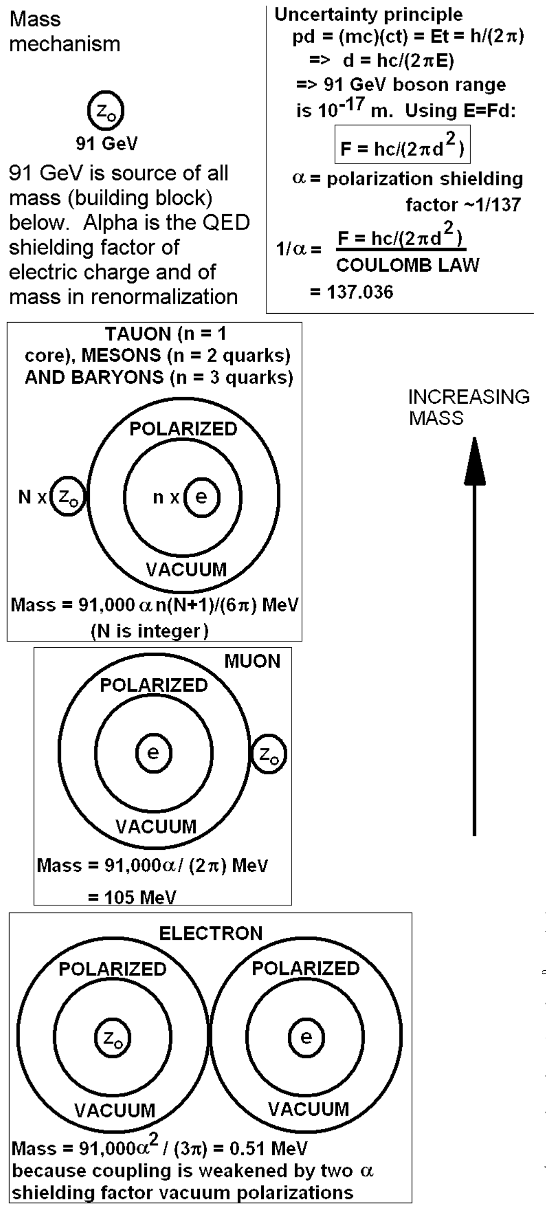


Fig. 36: the imaginary plane is not just imaginary but unnecessary because replacing exp(iS), for S in units of h-bar, with Euler's real component of it, cos(iS), does all the work we need it to do in the real physics of the path integral (see Feynman's 1985 book *QED* for this physics done with arrows on graphs, without any equations): all you're calculating from path integrals are *scalars* for least action magnitudes (resultant arrow lengths, *not* resultant arrow *directions;* since as said the resultant arrow direction is horizontal, in the real plane, or, you don't get a cross-section of 10i barns!). As Feynman says (v3, p16-12), Schroedinger's equation came from the mind of Schroedinger (actually due to Weyl's idea), not from experiment. Why not replace exp(iS) with cos(iS) for phase amplitudes? It gets rid of complex Fock and Hilbert spaces and Haag's interaction picture problem which is due to renormalization problems in this complex space, and it makes path integrals simple and understandable! When using exp(iS) you're adding in effect a series of unit length arrows with variable directions on an Argand diagram to form the path integral. This gives, as stated, two apparent resultant arrow properties: direction and length. A mainstream QFT mathematician's way of thinking on this is therefore that this must be a vector in complex space, with direction and magnitude. But it's not physically a vector because the path integral must always have *direction* on the real plane due to the physical principle that the path integral follows the direction of the path of least action. The confusion of the mainstream QFT mathematician is to confuse a vector with a scalar here. A "vector" which *always has the same direction is physically equivalent to a scalar*. You can plot, for example, a "two dimensional" graph of money in your bank balance versus time: the line will be a zig-zag as withdrawals and deposits occur discretely, and you can draw a resultant arrow between starting balance and final balance, and the arrow will appear to be a vector. However, in practice it is adequate to treat money as a scalar, not a vector. Believing that the universe is intrinsically mathematical in a complicated way is not a good way to learn about nature, it is biased. Instead of having unit arrows of varying direction and unit length due to a complex phase factor exp(iS), we have a real world phase factor of cos(iS) where each contribution (path) in the path integral (sum of paths) has fixed direction but variable length. This makes it a scalar, removing Foch space and Hilbert space, and reducing physics to the simplicity of a real path integral analogous to the random (Monte Carlo) statistical summing of Brownian motion impacts, or better, long-wave 1950s and 1960s radio multipath (sky wave) interference. Thus wavefunctions are measurable using radio sets.



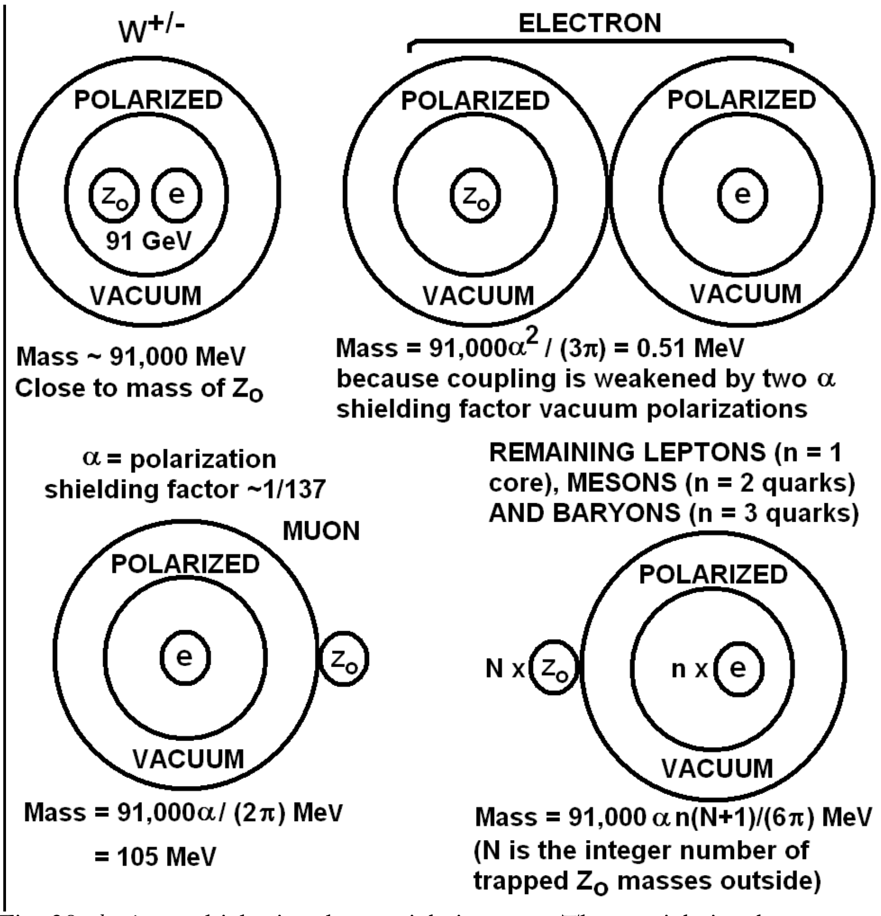


Fig. 38: *lattice QCD has to use some particle masses as input, to calculate other masses as output.* We instead use the mass mechanism of neutral Z currents, where offshell fermion pair production field quanta around the core of a fundamental particle absorb some of the electric field energy and move apart, attenuating the electric field in the process (hence causing the running of the electromagnetic coupling with distance and energy), and thus take longer to annihilate than given for purely offshell field quanta. The absorbed extra energy increases the virtual fermion pair survival time towards that of onshell particles, so the Pauli exclusion principle begins to apply to those virtual fermions, *structuring the vacuum virtual fermions into electronic "shells," giving a simple pattern of discrete masses. This model justifies the vacuum shell structure model since rematively stable long-lived particle masses (life >10^{-23} second) correspond to parameters equivalent to stable (filled) shells.*

Hadron masses can be correlated in a kind of periodic table summarized by the expression $M= mn$(N + 1)/(2*alpha) = $35n(N + 1)$ MeV, where m is the mass of an electron, alpha = 1/137.036, n is the number of particles in the isolatable particle (n = 2 quarks for mesons, and n = 3 quarks for baryons), and N is the number of massive field quanta (Z bosons formed by annihilation of charged virtual fermions) which give the particle its mass. The particle is a lepton or a pair or triplet of quarks surrounded by shells of massive field quanta which couple to the charges and give them mass, then the number of massive particles which have a highly stable structure might be expected to correspond to well-known "magic numbers" of closed nucleon shells in nuclear physics: N = 1, 2, 8 and 50 have relative stability.

For leptons, n=1 and N=2 gives: 35n(N + 1) = 105 MeV (muon).

Also for leptons, n=1 and N=50 gives 35n(N + 1) = 1785 MeV (tauon).

For quarks, n=2 quarks per meson and N=1 gives: 35n(N + 1) = 140 MeV (pion).

Again for quarks, n=3 quarks per baryon and N=8 gives: 35n(N + 1) = 945 MeV (nucleon).

Obviously there are running coupling factor and "isotope/isomer" effects also involved in determining masses. For example, as with the periodic tables of the elements you might get effects like isotopes, whereby different numbers of uncharged massive particles can give mass to a particular species, so that certain masses aren't integers. (Chlorine's 35.5 mass did not fit well into Dalton's integer atomic weight theory.)

With this quantum gravity mass law and the "selection principle" of nuclear shell structure "magic numbers" like N = 1, 2, 8 and 50, we can predict a "periodic table" of hadron and electron masses, including currently "missing particles" thay may later be detected and identified by experiments.

"The notion that a scientific idea cannot be considered intellectually respectable until it has first appeared in a 'peer' reviewed journal did not become widespread until after World War II. ... the refereeing process works primarily to enforce orthodoxy. ... 'peer' review is NOT peer review."

– Frank J. Tipler, *Refereed Journals: Do They Insure Quality or Enforce Orthodoxy?*

"[Einstein's] final manuscript was prepared and sent to the *Physical Review*. It was returned to him accompanied by a lengthy referee report in which clarifications were requested. Einstein was enraged and wrote to the editor [27 July 1936] that he objected to his paper being shown to colleagues before publication … Einstein … never published in the *Physical Review* again."

– Abraham Pais, *Subtle is the Lord, the Science and the Life of Albert Einstein,* Oxford University Press, Oxford, 1982, p. 495.

"Centralization of information and decision-making at the top has been destructive to most organizations. The Greeks ... called it hubris. ... decisions must be pushed down to the lowest level at which they can be sensibly made."

– Gregory H. Canavan, *The Leadership of Philosopher Kings,* Los Alamos National Laboratory, report LA-12198-MS, December 1992.

COMPARISON OF OBSERVED WITH PREDICTED MASSES OF ELEMENTARY PARTICLES*

N (number of black hole, gravitationally trapped Z-bosons associated with each core)	n (number of fundamental particles per observable particle core)		
	1	2 (i.e., 2 quarks)	3 (i.e., 3 quarks)
	Leptons	Mesons	Baryons
1	*Electron (stable, 0.511 Mev measured):* $M_z\alpha^2/(1.5*2\pi) = 0.51$ MeV	*Pions (139.57, 134.96 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 140$ MeV	'… I do feel strongly that this [string theory] is nonsense! … I think all this superstring stuff is crazy and is in the wrong direction. … I don't like it that they're not calculating anything. … why are the masses of the various particles such as quarks what they are? All these numbers … have no explanations in these string theories - absolutely none! …' – Richard P. Feynman in Davies & Brown, *Superstrings* 1988, at pages 194-195
2* *Magic number of nuclear physics => High stability	*Muon (Most stable particle after neutron, 105.66 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 105$ Mev		
6		*Kaons (493.67, 497.67 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 490$ Mev	
7		*Eta (548.8 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 560$ Mev	
8* *Magic number of nuclear physics => High stability			*Nucleons (VERY STABLE, 938.28, 939.57 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) \sim 945$ Mev
10			*Lambda & Sigmas (1115.6, 1189.36, 1192.46, 1197.34 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 1155$ Mev
12			*Xi (1314.9, 1321.3 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 1365$ Mev
15			*Omega (1672.5 Mev measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 1680$ Mev
50* *Magic number of nuclear physics => High stability	*Tauon (1784.2 MeV measured):* $M_en(N+1)/(2\alpha) = 35n(N+1) = 1785$ Mev		

*Only particles with lifetimes above 10^{-23} s are included above. The blank spaces predict other particles. The integer formula is very close, as statistical tests show. (Notice that the periodic table of chemistry did not explain discrepancies from integer masses until mass defect due to binding energy, isotopic composition, and other factors were discovered long after the periodic table was widely accepted. Doubtless there is analogous 'noise' in the measurements due to field interactions.)

Figure 39 (above): comparison of the mass model to experimental data. The formula has specific particles "automatically picked out" by the "selection principle" of closed shells in the vacuum, analogous to "magic numbers" (closed nuclear shells).

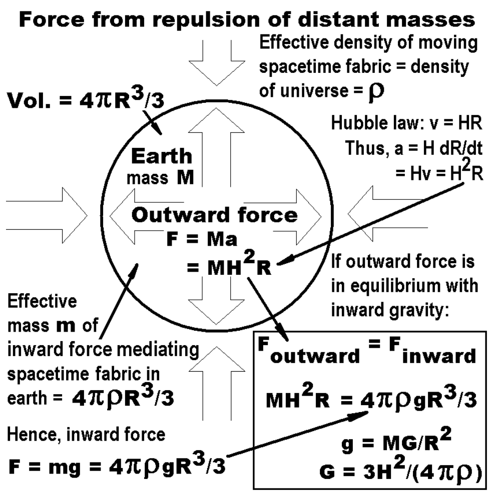


Figure 40 (left): a nascent duality to the quantum gravity mechanism, this "rough scaffolding" gives *exactly the same quantitative prediction, without requiring as input the size of the cross-section for gravitational interactions*. Archimedes' *Method* constructs *scaffolding for geometric theorem proofs* by literally using equilibrium-balancing weighing scales to compare *effective "masses,"* i.e. fixed-density geometric volumes represent geometric shapes at scaled distances from a fulcrum. Treating geometric volumes as constant density weights is vital. We treated the *geometry of space* using Archimedes' force-balancing *Method*. We added up contributions from spherical "shells" to approximate the Earth, using a dynamic superfluid space fabric. A dragless incompressible superfluid space represents the T_{mn} field, so when objects move, gravity results as a space-reaction effect. To see this, represent the Hubble law by submarines moving in a superfluid, then the *volume continuously vacated* while the submarines move outward is continually being "filled in" by an *inflow* of the fluid, *with identical volume and velocity to the receding matter.* The black hole cross-section is then an *output* from the calculation, via the *G* prediction formula. Hubble's galaxy recession law $v = HR$ is ubiquitously interpreted as a "space" (not *spacetime*) effect, ignoring "spacetime" where *observed* distance *R* is a *function of time past t*, since $R = ct$. Since $v = dR/dt$, $dt = dR/v$, so acceleration $a = dv/dt = dv/(dR/v) = v\,dv/dR = v\,d(RH)/dR = vH = RH^2 \sim Hc$. Spacetime *requires an interpretion of Hubble's law as a velocity varying with time past,* i.e. effective *acceleration*, $a = dv/dt = d(RH)/dt = H\,dR/dt = Hv = H^2R$. Or $a = dv/dt = d(HR)/d(R/c) = Hc$. Matter receding then has an effective outward force by Newton's 2nd law: $F_{outward} = Ma = MH^2R$. Newton in 1692 wrote in his printed *Principia* that Fatio's 1690 graviton exchange (reflection) theory was "the unique hypothesis by which gravity can be explained," but Newton nevertheless failed to predict Lorentz contraction or the cosmological acceleration.

"Scepticism is ... directed against the view of the opposition and against minor ramifications of one's own basic ideas, never against the basic ideas themselves. Attacking the basic ideas evokes taboo reactions … scientists only rarely solve their problems, they make lots of mistakes ... one collects 'facts' and prejudices, one discusses the matter, and one finally votes. But while a democracy makes some effort to *explain* the process so that everyone can understand it, scientists either *conceal* it, or *bend* it ... No scientist will admit that voting plays a role in his subject. Facts, logic, and methodology alone decide – this is what the fairy-tale tells us. … This is how scientists have deceived themselves and everyone else ... It is the *vote of everyone concerned* that decides fundamental issues ... and not the authority of big-shots hiding behind a non-existing methodology. ... Science itself uses the method of ballot, discussion, vote, though without a clear grasp of its mechanism, and in a heavily biased way." – Professor Paul Feyerabend, *Against Method,* 1975, final chapter.

"… it is once for all clear from the very appearances that the earth is in the middle of the world and all weights move towards it. ... Now some people, although they have nothing to oppose to these arguments, agree on something, as they think, more plausible. … the earth as turning on the same axis from west to east very nearly one revolution a day … never would a cloud be seen to move toward the east nor anything else that flew or was thrown into the air. For the earth would always outstrip them in its eastward motion, so that all other bodies would seem to be left behind and to move towards the west." – Claudius Ptolemy (100-178 AD), *Almagest, Book I, part 7, That the Earth does not in any way move locally.* Translated by R. C. Taliaferro, *Great Books of the Western World,* volume 16, 1952, pp. 11-12.

"Ptolemy and the Peripatetics think that nature must be thrown into confusion, and the whole structure and configuration of our globe destroyed by the Earth's so rapid rotation … what structure of iron can be imagined so strong, so tough, that it would not be wrecked and shattered to pieces by such a mad and unimaginable velocity? … all atmosphere … rotate with the globe: the space above … is a vacuum; in passing through vacuum even the lightest bodies and those of least coherence are neither hindered nor broken up. Hence the entire terrestrial globe, with all its appurtenances, revolves placidly and meets no resistance." – Dr William Gilbert (1540-1603), *On the Loadstone and Magnetic Bodies and on the Great Magnet the Earth,* 1600, book 6, chapter 3. (Translation: P. Fleury Mottelay, John Wiley and Sons.)

"It is indeed a most absurd fiction to explain natural phenomena by false causes."
- Kepler, quoted by G. Abetti, *History of Astronomy*, London, 1974, p. 74.

In 2006, the book *Not Even Wrong* Peter Woit were published, arguing that superstring is hardening into a dogmatic epicycle-consensus. Right on cue, Ed, the "discoverer" of stringy "M-theory," just happened to write a letter to *Nature* (vol. 444, p. 265, 16 November 2006), headlined:

"**Answering critics can add fuel to controversy.**

"SIR — Your Editorial "To build bridges, or to burn them" and News Feature "In the name of nature" raise important points about criticism of science and how scientists should best respond (*Nature* 443, 481 and 498–501; 2006). The News Feature concerns radical environmentalists and animal-rights activists, but the problem covers a wider area, often involving more enlightened criticism of science from outside the scientific establishment and even, sometimes, from within.

"The critics feel ... that their viewpoints have been unfairly neglected by the establishment. ... They bring into the public arena technical claims that few can properly evaluate. ... We all know examples from our own fields ... Responding to this kind of criticism can be very difficult. It is hard to answer unfair charges of élitism without sounding élitist to non-experts. A direct response may just add fuel to controversies. Critics, who are often prepared to devote immense energies to their efforts, can thrive on the resulting 'he said, she said' situation. [*Here's a reason why you're top genius, Ed: you know that the biggest horror is for objective critics to thrive/survive.*]

"Scientists in this type of situation would do well to heed the advice in Nature's Editorial. Keep doing what you are doing. And when you have the chance, try to patiently explain why what you are doing is interesting and exciting, and may even be useful one day.

"Edward Witten
Institute for Advanced Study, Einstein Drive ..."

This "clever trick" is precisely what politicians do when criticised. Politicians *sigh,* and "patiently explain" to critics "*why what they are doing is interesting and exciting, and may even be useful one day soon.*" It is telling that Ed's high-horse advice to ignore criticisms then patronise critics like ignorant fools, *is exactly the first response of politicians to a crisis.* Self-deluded egotistical propaganda in politics is a *very disrespectful, even rude* response to critics of nonsense hype that is *effectively censoring alternative ideas by filling the media, the journals and the citation index with non-falsifiable, fashionable epicycles.* It is fashion dictatorship: ignore criticisms, stereotype critics as ignorant (or perhaps morons, in true gutter-politics fashion), and (with plenty of high-handed false-modesty) "kindly" dish out a nickels-worth of free advice, a dose of *educational brainwashing in mainstream dogma.* "Better propaganda is needed" = when in a hole, dig deeper. Next letter on that *Nature* page:

"How and why did our public image change from harmless geeks to state- and industry-sponsored evil-doers ... *how do we communicate more effectively what we are doing ... ?*" [Emphasis added to a delusional political dogma: propaganda protects *status quo*.]

What can be misunderstood, will be misunderstood

The problem is not elitist censorship, but the absense of objective censorship. If you criticise the relative *lack* of democracy in a country which decrees that a vote every four years between nearly two identical candidates is "democracy," that does not mean that you are *against democracy in general.* Quite the opposite. Your "critics" will of course try to misunderstand what you say to deliberately make your case look unattractive to bystanders they hope to win over for themselves; your "critics" will try to deliberately misinterpret everything you say to give straw-man targets. This is why there are lawyers paid to present evidence effectively, and to answer lies effectively without the angry emotions desired by the opposition.

Taking this example to quantum gravity, the problem of "critics" has always been political. We see politicians paid to "defend" failed policies, trying to "justify" themselves in interviews by evasion of fact, seaching out strawman arguments/trivia, ignoring the big picture. It is much worse in science, where the facts are so technical that dishonest "big shots" who are skilled at climbing greasy poles into positions of "authority" can act as dictators without the public being aware of the weakness of their "arguments." The media steer clear of technical facts in science, even when the situation is a politically important "controversy," when the media will simply find "authority figures," instead of digging up the facts themselves. The problem here is that "investigative science journalism" doesn't really exist. The nearest journalism can approach this is interviewing a dissenting scientist, using fashionable groupthink authority "credentials."

Be clear what we are saying: we are not saying that journals contain *no* alternative ideas (they are *full of minor alternatives within the existing theoretical framework, or within the existing paradigm*), nor do we claim that major alternatives *never* get a say (Lisi and Smolin get plenty of publicity). What we are stating is that there is *irrational bias* against facts, these exceptions notwithstanding. (These exceptions are in any case much closer to prejudiced mainstream dogmatic speculation-building ideals that this paper, which builds on facts, rather than *ad hoc* non-mechanistic LQG and E_8.) There is *also* irrational "trade union, closed-shop science politics," which takes the short-cut of relying on superficial "tin hats" to distinguish what to take seriously and what to reject. This is closely associated with the dating delusion that personality is important, when of course personality is a check that is *done* after looks. It's no good complaining that about superficial or shallow selection criteria: there is a long list of criteria in dating and scientific paper publication politics, and although relatively superficial criterial feature on the list, deeper criteria also appear further down on the list. Ideally, a paper must be presentable and written by an expert with some "peers" in the discipline who can check the paper (peer-review), but also it must ideally fit in with existing ideas. If it is so radically innovative that it overthrows a great deal of existing dogma, every contradiction between the mainstream unchecked speculations and the new theory is seen by mainstream "peer"-reviewers as a point *against* the new theory.

We gave a persentation in which we answered questions. It was pretty clear from the first question, that the "critics" were asking what they believed to be "rhetorical questions," *questions that they believed no answer existed to, except that the theory was wrong.* When we supplied the answer, adding that the answer was in the paper which had not been read, *the "critics" responded with fury, and emotional anger, not the enlightenment of being given accurate information.* With further rhetorical questions answered, the anger of bigots increased, instead of subsiding. *This is diametrically opposed to response expected from a genuine unbiased discussion: it is the response to interrupting a religious ceremony.* The "questions" purporting to be dismissals of the theory were all *false statements* or claims that *could be equally well directed towards the mainstream theory.* E.g., "if there are field quanta in the vacuum, that would slow down the planets," or ignorance of the fact that a theory which reproduces Newton's law as the low-speed limit for the solar system automatically produces all of the results of Newton's law where Newton's law is applicable, like the Lagrange points.

So "critics" raise drivel about their misunderstanding of the mainstream theory, and dress up their misunderstanding as an attack on the new theory. Trying to patiently answer hundreds of irrelevant and abusive pieces of ignorant rhetotical "criticism" (lies) on "Physics Forums," where the "moderators" were against unfashionable facts (or too ignorant to read the facts), led to a situation that makes it clear how propaganda works. No unbiased questions were ever asked. It was all stupid abuse dressed up as damning rhetorical questions. *The problem is not elitist censorship, but the absense of objective censorship.*

One of "best" comments there was from a student who stated that our theory was wrong because everyone sensible is working on 11-dimensional supergravity theory, adding that if he ever thought our fact-based mechanism was correct and had been wrongly censored out, *he would give up on physics altogether, instead of studying the facts or helping reforming physics.* As Max Planck wrote, *converting dogma-believers is impossible by definition.* If they *believe dogmatically* in the 11-dimensional supergravity bulk cloaked by a 10-dimensional supergravity brane, and they *believe dogmatically* in "multiple universes" from the single-wavefunction (non-relativistic) 1st quantization QM dogma, and they partition all their knowledge of QM and QFT with Bohr's Correspondence/Complementarity Principles, so that there is no *replacement* of 1st quantization by 2nd quantization, then you *cannot convert them using facts.* There is no way to even *communicate* anything with all of these deluded people, who may well include some prominent M-theory critics. *Most physicists working on non-stringy alternatives seem even more deluded than M-theorists.*

"… when innovations creep into their games and constant changes are made in them, the children cease to have a sure standard of what is right … There can be no worse evil … Change … is most dangerous …" - Plato (429-347 B.C.), *The Laws,* Book VII, 360 B.C.

This attitude of Plato towards innovations is explained well by a study of his book *Timaeus,* in which Plato claims that the universe is mathematically described by Euclid's five regular geometric polygons (perfectly inscribed within a sphere): earth atoms are cubic, air is octahedrons, energy is tetrahedrons, water is icosahedrons; the universe is a dodecahedron. Curved spacetime geometry continues such speculation, as is the 10/11-dimensional M-theory of spin-2 gravitons. Plato insistence that innovation and change even in games is *most dangerous*, because they may be *confused,* is very convenient for *status quo*.

"A general State education is a mere contrivance for moulding people to be exactly like one another: and the mould in which it casts them is that which pleases the predominant power in the government, whether this be a monarch, a priesthood, an aristocracy, or the majority of the existing generation; in proportion as it is efficient and successful, it establishes a despotism over the mind …" - John Stuart Mill, *On Liberty,* 1859.

"The very magnitude of the power over men's minds that a highly centralised and government-dominated system of education places in the hands of the authorities ought to make one hesitant before accepting it too readily." - Professor F. A. Hayek, *The Constitution of Liberty,* Routledge and Kegan Paul, London, 1960, p. 379.

"The Correspondence Principle says that every new theory must contain the old theory as a sub-set ... the Correspondence Principle ... would have forced the retention of phlogiston and of caloric ... political systems develop procedures which outlaw the change of those systems." - Ivor Catt, letter to author dated 28 April 1997.

"It should be admitted quite frankly that, at the present time, the mathematical applications of wave mechanics have outrun their interpretation in terms of understandable realities. There is little doubt, in view of their remarkable success in various atomic studies, that the equations of wave mechanics are substantially correct, but their underlying significance is by no means obvious." - Samuel Glasstone, PhD, DSc, *Sourcebook on Atomic Energy,* Van Nostrand, New York, 3rd ed., 1967, p. 82.

"... the Victorian scientist thought it necessary to 'explain' light as a wave motion in the mechanical ether which he was for ever trying to construct out of jellies ... the scientist of today, fortunately for his sanity, has given up the attempt and is well satisfied if he can obtain a mathematical formula which will predict what light will do under specified conditions." - Sir James Jeans, DSc, LLD, FRS, *The Universe Around Us,* Cambridge University press, 1929, p. 329.

"Children lose interest … because a natural interest in the world around them has been replaced by an unnatural acceptance of the soundness of certain views, the correctness of particular opinions and the validity of specific claims." - David Lewis, *You can teach your child intelligence,* Book Club Associates, London, 1982, p. 258.

"But I even in private free myself from the blame of seeking after novelty by suitable proofs: let my doctrines say whether there is love of truth in me or love of glory: for most of the ones I hold have been taken from other writers: I build my whole astronomy upon Copernicus' hypotheses concerning the world, upon the observations of Tycho Brahe, and lastly upon the Englishman, William Gilbert's philosophy of magnetism." - Johannes Kepler (1571-1630), *Epitome of Copernican Astronomy, IV,* 1618. Translated by C.G. Wallis, *Great Books of the Western World*, volume 16, 1952, p. 850.

"It seems that it was in Egypt that chemistry was born; 'chemia' … became the study of the methods of converting base metals into gold. The exact origin of this idea is uncertain. It may have started with dishonest Egyptian goldsmiths who alloyed gold with a cheap metal and pretended to have converted the latter into gold … the capture of Alexandria by the Arabs in the seventh century A.D. brought new life into the study of the subject now called al-chemia (alchemy; 'al' = 'the' in Arabic). The most famous of the Arabic alchemists was Jabir, who lived in Baghdad in the eighth century… Jabir is given the honour of discovering oil of vitriol (sulphuric acid), aqua fortis (nitric acid) and aqua regia [royal water, KNO_3], which can dissolve gold; he raised alchemy to the level of an experimental science, and it became a dignified subject of study." - Dr Samuel Glasstone, PhD, DSc, *Chemistry in Daily Life,* Methuen & Co., London, 1929, p. 5.

"Learn from science that you must doubt the experts. ... Science is the belief in the ignorance of experts."

- Feynman, *The Pleasure of Finding Things Out,* 1999, p187.

"Physical knowledge has advanced much since 1905, notably by the arrival of quantum mechanics, and the situation has again changed. If one examines the question in the light of present-day knowledge, one finds that the aether is no longer ruled out by relativity, and good reasons can now be advanced for postulating an æther. ... with the new theory of electrodynamics we are rather forced to have an æther."

- P. A. M. Dirac, "Is There an æther?", *Nature*, v168 (1951), pp. 906-7.

"Infeld has shown how the field equations of my new electrodynamics can be written so as not to require an æther. This is not sufficient to make a complete dynamical theory. It is necessary to set up an action principle and to get a Hamiltonian formulation of the equations suitable for quantization purposes, and for this the æther velocity is required."

- P. A. M. Dirac, "Is there an æther?", *Nature*, v169 (1952), p. 702.

"... when one varies the motion, and puts down the conditions for the action integral to be stationary, one gets the equations of motion. ... In terms of the action integral, it is very easy to formulate the conditions for the theory to be relativistic: one simply has to require that the action integral shall be invariant. ... [this] will automatically lead to equations of motion agreeing with relativity, and any developments from this action integral will therefore also be in agreement with relativity."

- P. A. M. Dirac, *Lectures on Quantum Mechanics*, 1964 (Dover, New York, 2001, pp. 4-5).

Haag's theorem shows that complex state vector path amplitude (the Dirac interaction picture), $|\psi_S> = |\psi_0> e^{iS/\hbar}$, makes the self-consistency of renormalization in quantum field theory impossible to prove. There is no complex state vector; the correct formula is $\psi_S = \psi_0 \cos(iS/\hbar)$, i.e. the real component of Euler's formula $e^{iS/\hbar} = \cos(S/\hbar) + i \sin(S/\hbar)$. We will prove that the complex component can be dropped because the only specific information $e^{iS/\hbar}$ carries beyond $\cos(S/\hbar)$ in the path integral is the *direction* of the resultant arrow, which is *always that of the real axis* because all path integrals follow the *direction* of least action (even where quantum interference affects the *magnitude or length* of that resultant arrow on an Argand diagram). First, let's first trace the origins of $e^{iS/\hbar}$ back in time from Feynman's 1948 path amplitude, through Dirac's 1932 interaction picture based on Schroedinger's 1926 time-dependent equation, to its root in Herman Weyl's 1918 unified gauge theory[6]. Weyl (1885-1955) connected the metric tensor of general relativity, $g_{\mu\nu}$, to Maxwell's field potential, A_μ, with a complex exponent:

$$g_{\mu\nu}' = g_{\mu\nu} \exp[\int\{iq/(\hbar c)\} \nabla\times A_\mu \, dS]$$

The curl operator ($\nabla\times$) here follows from London's 1927 electron orbit (loop integral) notation for Weyl's gauge transformation. (Using Stokes's theorem, the integral of the curl operation upon a function is equivalent to doing a line integral around a loop, so a curl operator can be substituted for the London's loop integral.) The complex exponential gravitational scaling factor in this transformation is a resizing of the spacetime metric in general relativity for "gauge invariance" (Eichinvarianz) by Weyl, by analogy to the gauge sizes of railway lines. Weyl mistakenly at first believed that $g_{\mu\nu}'$ really varied as a function of the electromagnetic field, and in 1918 sent this to Einstein (prior to publication), who rejected Weyl's theory by pointing out that such a periodic variation of the metric as a function of the electromagnetic field would cause unobserved line spectra variations.

Weyl accepted Einstein's criticism as implying the invariance of the metric, $g_{\mu\nu}' = g_{\mu\nu}$, so that $\exp[\int\{iq/(\hbar c)\} \nabla\times A_\mu \, dS] = 1$, which implies $\int\{iq/(\hbar c)\} \nabla\times A_\mu, dS = 2\pi n$, where n is an integer. Erwin Schroedinger saw this as an elegant way to quantize the electromagnetic field, and then succeeded in applying it to model the discrete orbital electron energy levels of the Bohr atom in his 1922 paper[7], *On a Remarkable Property of the Quantum Orbits of a Single Electron.*

Weyl's exponent can be simplified to $e^{iat/\hbar}$, where a is a constant. Throughout science, particularly in subjects like chemical chain reactions, radioactive decay, bacteria growth and radiation shielding by matter, the first-order differential equation $ax = dx/dt$ is ubiquitous, giving an exponential solution: $x_t/x_0 = e^{at}$. If a is negative, the exponent is negative (indicating decay), and if a is complex you get a complex exponent which is interpreted as a phase vector rotating on an Argand diagram (a graph with an imaginary number axis). Rearrange it: $a\,dt = (1/x)dx$, integrate, then make both sides a power of e, to remove the natural logarithm resulting from the integration of $(1/x)dx$. So in 1922 Schroedinger knew that Weyl's $x_t/x_0 = e^{iat/\hbar}$ gauge transformation factor is a simple solution to the first-order equation, $iax = \hbar\, dx/dt$. Schroedinger in 1926 settled on wavefunction amplitude ψ for x and Hamiltonian energy operator $\mathbf{H}$ for a, and multiplied both sides by i, producing the famous time-dependent Schroedinger equation[40]: $\mathbf{H}\psi = -i\hbar\, d\Psi/dt$.

Schroedinger extended a standing wave equation into three dimensions. The wavefunction ψ (amplitude) of a standing wave in a 1-d stretched string is described at a fixed point by an equation of the form $\psi = A \sin(2\pi ft) = A \sin(2\pi vt/\lambda)$, where A is the maximum amplitude, $f = v/\lambda$ is the wave frequency (cycles per second, or Hertz), v is its velocity, λ is its wavelength, and t is time. Particular values of the variable (velocity, wavelength or time in a standing wave equation) which produce *peaks* in a wavefunction can be interpreted as corresponding to quantized energy states in the Bohr theory of the atom, and these discrete peak values for a variable are "eigenvalues." But the single ψ theory is false: the electron is subjected to *multipath interference* with *many* ψ from quanta of its own field. Schroedinger form, $\nabla^2\psi = -(2\pi mv/h)^2\psi = d^2\psi_x/dx^2 + d^2\psi_y/dy^2 + d^2\psi_z/dz^2$, where kinetic energy $mv^2/2$ is the difference between total energy E and potential energy U, so $(mv)^2 = 2m(E - U)$.

"It is shown that when a Burgers screw dislocation [in a crystal] moves with velocity v it suffers a longitudinal contraction by the factor $(1 - v^2/c^2)^{1/2}$, where c is the velocity of transverse sound."

- C. F. Frank, 'On the equations of motion of crystal dislocations', *Proceedings of the Physical Society of London,* A62, pp. 131-141.

In *Science* in 1889, FitzGerald proposed that the Michelson-Morley experiment was contracted in the direction of its motion by the head-on gravitational field force in the direction of its motion; this prevented the experiment from detecting absolute motion. This is just the Pythagorean theorem for light. If the instrument contracts in the direction of its motion by the factor $(1 - v^2/c^2)^{1/2}$, then light moving on two perpendicular paths in the instrument takes the same time on each path. The variation in "absolute" velocity is cancelled out by the contraction of the instrument, so rotating the instrument varies the path lengths and prevents a the time taken by light along perpendicular paths from varying, so there is no variation in interference fringes. Because the mass of the classical electron is inversely proportional to its length, Lorentz found that mass increases with velocity due to this FitzGerald contraction, and since the rate of oscillation decreases as the mass increases, time-dilation also occurs. Finally, Newton's second law is $F = dp/dt = d(mv)/dt$, so that the work energy due to this force pushing a mass m distance dx is given by

$$dE = F\,dx = d(mv)\,dx/dt = d(mv)v = v\,d(mv) = v^2dm + mv\,dv.$$

Comparison of this Newtonian result with the derivative of Lorentz's mass increase formula $m_v = m_0(1 - v^2/c^2)^{-1/2}$, gives $dm = dE/c^2$, thus $E = mc^2$. The 2008 paper by Carlos Barceló and Gil Jannes, *A Real Lorentz-FitzGerald Contraction,* explains emergent Lorentz invariance and relativity[41]:

"Many condensed matter systems are such that their collective excitations at low energies can be described by fields satisfying equations of motion formally indistinguishable from those of relativistic field theory. The finite speed of propagation of the disturbances in the effective fields (in the simplest models, the speed of sound) plays here the role of the speed of light in fundamental physics. However, these apparently relativistic fields are immersed in an external Newtonian world (the condensed matter system itself and the laboratory can be considered Newtonian, since all the velocities involved are much smaller than the velocity of light) which provides a privileged coordinate system and therefore seems to destroy the possibility of having a perfectly defined relativistic emergent world. In this essay we ask ourselves the following question: In a homogeneous condensed matter medium, is there a way for internal observers, dealing exclusively with the low-energy collective phenomena, to detect their state of uniform motion with respect to the medium? ... we show that a real Lorentz-FitzGerald contraction takes place, so that internal observers are unable to find out anything about their 'absolute' state of motion. Therefore, we also show that an effective but perfectly defined relativistic world can emerge in a fishbowl world situated inside a Newtonian (laboratory) system. This leads us to reflect on the various levels of description in physics, in particular regarding the quest towards a theory of quantum gravity. ... Remarkably, all of relativity (at least, all of special relativity) could be taught as an effective theory by using only Newtonian language. ... In a way, the model we are discussing here could be seen as a variant of the old ether model. At the end of the 19th century, the ether assumption was so entrenched in the physical community that, even in the light of the null result of the Michelson-Morley experiment, nobody thought immediately about discarding it. Until the acceptance of special relativity, the best candidate to explain this null result was the Lorentz-FitzGerald contraction hypothesis. ... we consider our model of a relativistic world in a fishbowl, itself immersed in a Newtonian external world, as a source of reflection, as a *Gedankenmodel*. ... Coming back to the contraction hypothesis of Lorentz and FitzGerald, it is generally considered to be *ad hoc*. However, this might have more to do with the caution of the authors, who themselves presented it as a hypothesis, than with the naturalness or not of the assumption. ... The ether theory had not been *disproved,* it merely became *superfluous*. Einstein realised that the knowledge of the elementary interactions of matter was not advanced enough to make any claim about the relation between the constitution of matter (the 'molecular forces'), and a deeper layer of description (the 'ether') with certainty. Thus his formulation of special relativity was an advance within the given context, precisely because it avoided making any claim about the fundamental structure of matter, and limited itself to an *effective* macroscopic description."

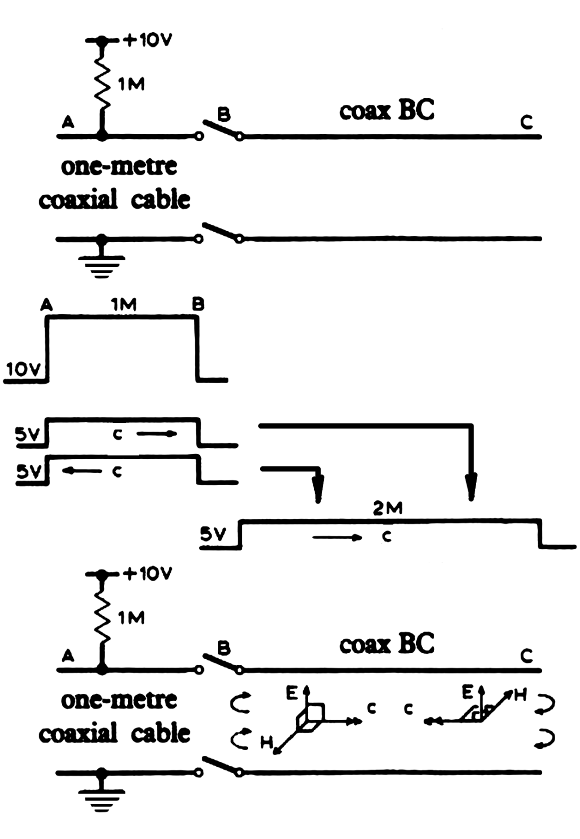
Einstein reversed the FitzGerald-Lorentz derivations by *postulating* relativity and then *deriving the contraction formula as an abstruse consequence of this postulate.* FitzGerald-Lorentz *postulated the contractionto explain relativity (the Michelson-Morley null result).*

Figure 00: in the December 1980 and March 1983 issues of *Wireless World,* I. Catt gave experimental evidence that charge corresponds to trapped light-velocity Heaviside-Poynting energy. A 1 m long 50 ohm transmission line was charged to 10 volts via a 1 megaohm resistor. It was then discharged into coax BC, *entering as a 2 metres long 5 volt pulse of light velocity energy which carries the same energy:*

"A steady charged capacitor is not steady at all; it contains energy current, half of it travelling to the right at the speed of light, and the other half travelling to the left at the speed of light."

Thus, the 5v portion travelling to the right exits first, immediately followed by the 5v portion going to the left, after it reflects rightward. There is no mechanism for electromagnetic energy to enter a line at at speed other than c, or to slow down.

80 WIRELESS WORLD DECEMBER 1980



After the switch was closed, energy current must have started off to the *left,* bounced off the open circuit at A, and then returned.

A steady charged capacitor is not steady at all; it contains energy current, half of it travelling to the right at the speed of light, and the other half travelling to the left at the speed of light.

We are driving towards the principle that *energy (current) E×H cannot stand still; it can only travel at the speed of light.* Any apparently steady field is a combination of two energy currents travelling in opposite directions at the speed of light.

E and *H* always travel together in fixed proportion Z_0. In the case of the so-called steady charged capacitor, the electric fields of the two energy currents add but the magnetic fields cancel, so that it has come to be thought that a charged capacitor is devoid of magnetic field.

For long distance radio prior to satellites, long wavelength (relatively low frequency, i.e. below UHF) was used so that radio waves would be reflected back by "the" ionosphere tens of kilometres up, overcoming the blocking by the earth's curvature and other obstructions like mountain ranges. The problem was that there was no single ionosphere, but a series of conductive layers (formed by different ions at different altitudes) which would vary according to the earth's rotation as the ionization at high altitudes was affected by UV and other solar radiations.

So you got "multipath interference", with some of the radio waves from the transmitter antenna being reflected by different layers of the ionosphere and being received having travelled paths of differing length by a receiver antenna. E.g., a sky wave reflected by a conducting ion layer 100 km up will be longer than one reflected by a layer only 50 km up. The two sky waves received together by the receiver antenna are thus out of phase to some extent, because the velocity of radio waves is effectively constant (there is a slight effect of the air density which slows down light, but this is a trivial variable in comparison to the height of the ionosphere).

So what you have is a "path integral" in which "multipath interference" causes a bad reception under some conditions. This is a good starting point to checking what happens in the "double-slit experiment". Suppose, for example, you have two radio waves received out of phase. What happens to the "photon"? Does "energy conservation" cease to hold? No. We know the answer: the field goes from being observable (i.e. onshell) to being offshell and invisible, but still there. It's hidden from view unless you do the Aharonov–Bohm experiment, which proves that Maxwell's equations in their vector calculus form are misleading (Maxwell ignores "cancelled" field energy due to superimposed fields of different direction or sign, which still exists in offshell energy form, a hidden field).

Notice here that a radiowave is a very good analogy because the "phase vectors" aren't "hidden variables" but measurable electric and magnetic fields. The wavefunction, Psi, is therefore not a "hidden variable" with radio waves, but is say electric field E measured in volts/metre, and the energy density of the field (Joules/m^2) is proportional to its square, "just as in the Born interpretation for quantum mechanics". Is this just an "analogy", or is it the deep reality of the whole of QFT? Also, notice that radio waves appear to be "classical", but are they on-shell or off-shell? They are sometimes observable (when not cancelled in phase by another radio wave), but they can be "invisible" (yet still exist in the vacuum as energy and thus gravitational charge) when their fields are superimposed with other out-of-phase fields. In particular, the photon of light is supposed to be onshell, but the electromagnetic fields "within it" are supposedly (according to QED, where all EM fields are mediated by virtual photons) propagated by off-shell photons. So the full picture is this: every charge in the universe is exchanging offshell radiations with every other charge, and these offshell photons constitute the basic fields making up "onshell" photons. An "onshell" (observable) photon must then be a discontinuity in the normal exchange of offshell field photons. For example, take a situation where two electrons are initially "static" relative to one another. If one then accelerates, it disrupts the established steady state equilibrium of exchange of virtual photons, and this disruption is a discontinuity which is conventionally interpretated as a "real" or "onshell" photon.

Concluding comment

Educational psychologist Lawrence Kohlberg[42] has found that peoples go through six stages of ethical development:

(1) Conformity to rules and obediance to authority, to *avoid punishment.*

(2) Conformity to *gain rewards.*

(3) Conformity to *avoid rejection.*

(4) Conformity to *avoid censure.* (Chimps and baboons.)

(5) Arbitrariness in enforcing rules, for the common good.

(6) Conscious revision and replacement of unhelpful rules.

The same steps could be expected to apply to scientific ethical development. However, the disguised form of politics which exists in science, where decisions are taken behind closed doors and with no public discussion of evidence, stops at stage (4), the level of ethics that chimpanzees and baboons have been observed to achieve socially in the wild. Jean-Jacques Rousseau states in *The Social Contract, or Principles of Political Right,* 1st ed., 1762, book III, chapter 4, Democracy:

"In the strict sense of the term, there has never been a true democracy, and there never will be. It is contrary to the natural order that the greatest number should govern ... One can hardly imagine that all the people would sit permanently in an assembly to deal with public affairs; and one can easily see that they could not appoint commissions for that purpose without the form of administration changing."

If that is true of so-called democracy with all its efforts to inform the public and to collect votes, then it is all the truer of science itself, where a handful of big-shots decide behind closed doors what to publish, what to censor, and where the majority of the rank and file behave like chimpanzees and baboons. The so-called enlightenment that began roughly with Copernicus in 1500, has ended up replacing a system of religion with another faith-based system, the "superstring."

"I heartily beg that what I have here done may be read with forbearance; and that my labours in a subject so difficult may be examined, not so much with the view to censure, as to remedy their defects."

- Issac Newton, Preface dated 8 May 1686, *Principia,* 1st edition.

"I am inclined to think that scientific discovery is impossible without faith in ideas which are of a purely speculative kind and sometimes quite hazy; a faith which is quite unwarranted from the scientific point of view."

- Karl Popper.

Professor Gordy Kane's article, "String theory and the real world: Although string theory is formulated in 10 or 11 dimensions, specific string theory solutions make unambiguous, testable predictions about our four-dimensional universe," *Physics Today*, November 2010, pp. 39-43, states:

"What does it mean to test Newton's second law $F = ma$? Newton's law is a claim—that could have been wrong—about the actual relation between the force F on a particle with mass m and its acceleration a. One tests it by calculating the acceleration with a presumed force and comparing it to the measured value. The test will fail if either Newton's law or the presumed force is wrong. Could $F = ma$ be tested more generally, without recourse to positing forces and looking at actual solutions? It seems not. The situation is similar with string theory. Properties of the real world test the overall string framework and, at the same time, 'compactifications' analogous to the forces of Newtonian mechanics or the Hamiltonian of quantum mechanics."

As we have explained in this paper, Newton's 2nd law *defined* force as $F = dp/dt$, not $F = ma$, which is only partly-correct because $dp/dt = d(mv)/dt = m\, dv/dt + v\, dm/dt = ma + v\, dm/dt$. Newton's 2nd law is a *definition* of force in terms of acceleration and mass.

Newton's *Principia,* revised 2nd edition, 1713, states its *defintions* at the beginning:

1. Mass is product of density and volume,
2. Momentum is product of velocity hass mass,
3. Inertia is force opposing acceleration of mass,
4. Force is action causing the acceleration of mass,
5. Centripetal force is force directed from all directions towards a point.

In the *Scholium:* "I. Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration: relative, apparent, and common time, is some sensible and external (whether accurate or unequable) measure of duration by the means of motion... II. Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some movable dimension or measure... III. Place is a part of space which a body takes up... The motion of the whole is the same with the sum of the motions of the parts... IV. Absolute motion is the translation of a body from one absolute place into another.. ... The effects which distinguish absolute from relative motion, are the forces of receding from the axis of circular motion. For there are no such forces in a circular motion purely relative..." [Newton disproved "special relativity" by showing that you can always tell if you are spinning or not by holding a bucket of water and checking to see if the water is flat or up the sides (and presumably if you are dizzy). Of course Einstein's "special relativity" only applies to "uniform motion in a straight line," and Einstein himself claims to disprove that uniform motion in a straight line is possible, due to curved space.]

Newton defines "his" laws of motion:

"*Axioms, or Laws of Motion:* Law I. *Every body continues in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it.* [Plagarised without acknowledgement from René Descartes' *Principia Philosophiae* of 1644, where Descartes discussed "rules of Nature", writing: "If at rest we do not believe it is ever set in motion, unless it is impelled thereto by some cause. Nor that there is any more reason if it is moved, why we should think that it would ever of its own accord, and unimpeded by anything else, interrupt this motion."]

"Projectiles continue in their motions, so far as they are not retarded by the resistance of the air, or impelled downwards by the force of gravity. [*Obvious to the cave man.* Also this patronising "observation" is a *step backwards from Aristotle's actual mechanism for the projectile, whereby the flow of energy in a spacetime field physically causes inertial resistance and momentum*.]

"A top, whose parts by their cohesion are continually drawn aside from rectilinear motions, does not cease its rotation, otherwise than it is retarded by the air. [Rubbish. A spinning top is *not* retarded by the air to any significant extent, but by *heat friction of the point or bearing in motion*.]...

"Law II. *The change of motion is proportional to the motive force impressed; and is made in the direction of the right line in which that force is impressed.* [This is a *definition of force,* not a prediction.] ...

"Law III. *To every action there is always opposed an equal reaction* ... If you press a stone with your finger, the finger is also pressed by the stone." [This *merely corrects Descartes' two "laws of Nature" of 1647*. Descartes had stated: "*1.* If two bodies have equal mass and velocity before they collide then both will be reflected by the collision, and will retain the same speeds they possessed beforehand. *2.* If two bodies have unequal masses, then upon collision the lighter body will be reflected and its new velocity become equal to that of the heavier one. The velocity of the heavier body remains unchanged." Descartes' first law is right; his second wrong.]

Parallel universe proof boosts time travel hopes

By Roger Highfield
Last Updated: 10:46AM BST 24 Sep 2007

Time travellers: David Tennant as Doctor Who with Billie Piper as Rose

Science fiction looks closer to becoming science fact, reports Roger Highfield

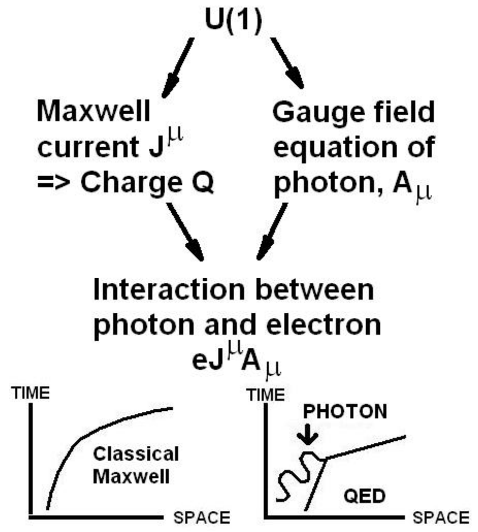
Parallel universes really do exist, according to a mathematical discovery by Oxford scientists that sweeps away one of the key objections to the mind boggling and controversial idea.

According to quantum mechanics, unobserved particles are described by "wave functions" representing a set of multiple "probable" states. When an observer makes a measurement, the particle then settles down into one of these multiple options.

But the many worlds idea offers an alternative view. Dr Deutsch showed mathematically that the bush-like branching structure created by the universe splitting into parallel versions of itself can explain the probabilistic nature of quantum outcomes. This work was attacked but it has now had rigorous confirmation by David Wallace and Simon Saunders, also at Oxford.

"Diamond (Jared Diamond, *Natural History*, v 103(9), 1994, pp. 4-10) extended [Tolstoy's] principle … to understanding the requirements for success in complex undertakings, calling it the 'Anna Karenina' principle (abbreviated here AKP). According to the AKP, for something to succeed several key aspects or conditions must be fulfilled. Failure in any one of these aspects leads to failure of the undertaking. That is, the success of complex undertakings always depends upon many factors, each of which is essential; if just one factor is lacking, the undertaking is doomed. … 'Success actually requires avoiding many separate causes of failure' (Diamond, 1997, p. 157), and if only one cause of failure is avoided, there will be no success … favorable outcomes require every detail to be right, whereas an unfavorable outcome only requires one wrong detail … A successful thing is the standardized thing, which fulfills all requirements. In this way, for instance, the AKP could explain the tendency in peer review for making conservative decisions (Lamont, 2009). In the selection of grant recipients, a grant proposal is successful only if all of the funding organization's predetermined criteria are fulfilled; a risky, novel research approach outlined in a grant proposal is not successful in peer review in its own way, because it does not fulfill all criteria that the mainstream in a research area considers important." - Lutz Bornmann and Werner Marx, *The 'Anna Karenina' principle: A mechanism for the explanation of success in science,* 1104.0807, 5 April 2011, pp. 3-6

Stueckelberg's massive gauge field can give mass to Abelian U(1) bosons in a renormalizable way, but ostensibly this Stueckelberg mass mechanism does not work for Yang-Mills SU(N) gauge theory bosons, which are precisely the bosons which have mass in the Standard Model. Therefore, Stueckelberg's mass mechanism is inapplicable to the Standard Model as it stands where U(1) hypercharge is the base of electrodynamics. An Abelian U(1) QED analogy to gravitation could naively be alleged to be non-renormalizable because the field quanta will have gravitational charge, i.e. mass. But in 1938 Ernst C. G. Stueckelberg[43] proved that by adding terms for a scalar field B to the lagrangian in the same manner as the electromagnetic field vector A_μ, but with opposite sign, gauge invariance is preserved because this forces the mass term in the lagrangian to remain invariant. Pauli in 1941 showed that for an Abelian vector field undergoing the gauge transformation $A_\mu' = A_\mu + d_\mu S$ in a



Acceleration of electron due to classical (Maxwell equations) field and by quantum electrodynamics U(1) interaction

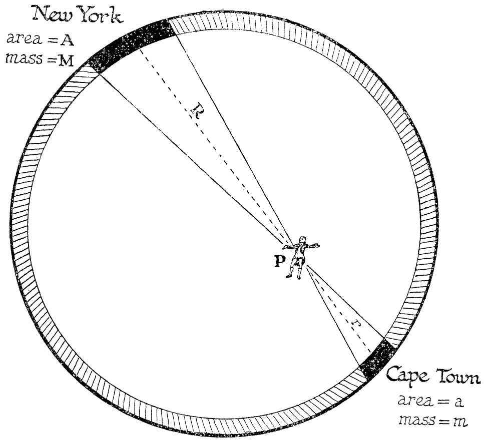


FIG. 335.—THE HOLLOW EARTH PARADOX OF NEWTON

Hence the pull of the patch of earth under New York is exactly the same as the *opposing* pull of the patch of earth under Cape Town. The two pulls cancel one another. So there is no effective pull toward the centre. Because this is equally true of any two corresponding patches, there would be no gravitational pull inside a hollow earth.

$$\text{U(1)} \quad F_{\mu\nu} = d_{\mu}A_{\nu} - d_{\nu}A_{\mu}$$

$$\text{SU(2)} \quad F_{\mu\nu} = d_{\mu}W^{a}{}_{\nu} - d_{\nu}W^{a}{}_{\mu} + \underbrace{g\varepsilon_{abc}W^{b}{}_{\nu}W^{c}{}_{\mu}}_{\text{charged boson term}}$$

"Fascism is not a doctrinal creed; it is a way of behaving towards your fellow man. What, then, are the tell-tale hall-marks of this horrible attitude? Paranoid control-freakery; an obsessional hatred of any criticism or contradiction; the lust to character-assassinate anyone even suspected of it … the majority of the rank and file prefer to face the wall while the jack-booted gentlemen ride by."

- Frederick Forsyth, *Daily Express,* 7 October 2005, p. 11.

quantum interaction, Stueckelberg's scalar field B simultaneously undergoes the corresponding transformation $B' = B + mS$, which ensures the mass term (containing mass m) in the lagrangian is made gauge invariant. Stueckelberg's lagrangian effectively replaces field A_{μ} with A_{μ} - $(1/m)d_{\mu}B$, so that the gauge transformation of the massive scalar field exactly compensates for the gauge transformation of the field quanta mass term in the lagrangian, by analogy to the production of Goldstone bosons in symmetry breaking. Stueckelberg's scalar field ensures that an Abelian quantum gravity lagrangian with *massive* spin-1 gravitons retains identical gauge and BRST invariance properties to an Abelian lagrangian with *massless* spin-1 bosons, and is therefore fully renormalizable (by analogy to quantum electrodynamics, which has massless spin-1 field quanta and is renormalizable). Therefore, by employing Stueckelberg's scalar field modification to the lagrangian, we are allowed to use an Abelian spin-1 *massive* graviton theory while retaining gauge and BRST invariance, and renormalizability. Stueckelberg's mechanism for massive bosonic field quanta is not used in the Standard Model because electrodynamics uses massless bosons, and Stueckelberg's mechanism does not retain renormalizability for the Yang-Mills SU(2) and SU(3) charged field quanta. Stueckelberg's scalar field only keeps massive Abelian U(1) type fields renormalizable. Although not employed in the Standard Model, it permits the renormalization of Abelian quantum gravity. The Standard Model uses the Higgs mechanism to supply mass to field quanta at low energies only, permitting them to become massless at high energies to make permit renormalization.

"There appears to me one grave difficulty in your hypothesis which I have no doubt you fully realize [*ahem, conveniently not mentioned or discussed in your paper*], namely, how does an electron decide with what frequency it is going to vibrate at when it passes from one stationary state to another? It seems to me that you would have toassume that the electron knows beforehand where it is going to stop."

- Professor Ernest Rutherford, letter to Niels Bohr, dated 20 March 1913. (A. Pais, *Inward Bound,* 1985, page 212.)

"Popular accounts, and even astronomers, talk about expanding space. But how is it possible for space … to expand? … 'Good question,' says [Steven] Weinberg. 'The answer is: space does not expand. Cosmologists sometimes talk about expanding space - but they should know better.' [Martin] Rees agrees wholeheartedly. 'Expanding space is a very unhelpful concept'."

- *New Scientist,* 17 April 1993, pp. 32-3.

"We don't expect you to read the paper in detail, or verify that the work is correct, but you should check that the paper is appropriate for the subject area. You should not endorse the author … if the work is entirely disconnected with current work in the area."

- http://arxiv.org/help/endorsement

"… take the exclusion principle … it turns out that you don't have to pay much attention to that in the intermediate states in the perturbation theory. I had discovered from empirical rules that if you don't pay attention to it, you get the right answers anyway …. Teller said: "… It is fundamentally wrong that you don't have to take the exclusion principle into account." … Dirac asked "Is it unitary?" … Dirac had proved … that in quantum mechanics, since you progress only forward in time, you have to have a unitary operator. But there is no unitary way of dealing with a single electron. … Bohr … said: "… one could not talk about the trajectory of an electron in the atom, because it was something not observable." … Bohr thought that I didn't know the uncertainty principle … it didn't make me angry, it just made me realize that … [they] … didn't know what I was talking about, and it was hopeless to try to explain it further. I gave up, I simply gave up …"

- Richard P. Feynman, in Jagdish Mehra, The Beat of a Different Drum (Oxford, 1994, pp. 245-248). (Quoted by Tony Smith.)

"I would like to put the uncertainty principle in its historical place: When the revolutionary ideas of quantum physics were first coming out, people still tried to understand them in terms of old-fashioned ideas … But at a certain point the old-fashioned ideas would begin to fail, so a warning was developed that said, in effect, "Your old-fashioned ideas are no damn good when …" If you get rid of all the old-fashioned ideas and instead use the ideas that I'm explaining in these lectures - adding arrows [path amplitudes] for all the ways an event can happen - there is no *need* for an uncertainty principle!"

- Richard P. Feynman, QED, Penguin Books, London, 1990, pp. 55-56.

"… when the space through which a photon moves becomes too small … we discover that light doesn't have to go in straight [narrow] lines, there are interferences created by the two holes, and so on. The same situation exists with electrons: when seen on a large scale, they travel like particles, on definite paths. But on a small scale, such as inside an atom, the space is so small that there is no main path, no "orbit"; there are all sorts of ways the electron could go, each with an amplitude. The phenomenon of interference becomes very important, and we have to sum the arrows to predict where an electron is likely to be."

- Richard P. Feynman, QED, Penguin Books, London, 1990, Chapter 3, pp. 84-5.

"The quantum collapse [in the mainstream interpretation of first quantization quantum mechanics, where a wavefunction collapse occurs whenever a measurement of a particle is made] occurs when we model the wave moving according to Schroedinger (time-dependent) and then, suddenly at the time of interaction we require it to be in an eigenstate and hence to also be a solution of Schroedinger (time-independent). The collapse of the wave function is due to a discontinuity in the equations used to model the physics, it is not inherent in the physics."

- Dr Thomas S. Love, Departments of Mathematics and Physics, California State University (Towards and Einsteinian Quantum Theory, emailed paper).

"In some key Bell experiments, including two of the well-known ones by Alain Aspect, 1981-2, it is only after the subtraction of 'accidentals' from the coincidence counts that we get violations of Bell tests. The data adjustment, producing increases of up to 60% in the test statistics, has never been adequately justified. Few published experiments give sufficient information for the reader to make a fair assessment."

- Caroline H. Thompson, http://arxiv.org/PS_cache/quant-ph/pdf/9903/9903066v2.pdf

BBC4 radio programme, *Down the Line: Series 3: Episode 2* (broadcast 11:00 pm Thursday, 7 May 2009): Professor Andrew Vester has written the book, *The String Conspiracy:* "'The thing about it is that there is no string theory, there is just a theory that there might be a theory. Nevertheless it has become the dominant theory in physics. If you don't adhere to it, you won't get funding, you won't get promotion, you won't get science prizes, you won't get a job. That's what my book is about, how string theory has stifled all other research and become like a form of medieval religious orthodoxy…. One set of beliefs has suffocated all others. … The Holy Grail of physics has always been to find the unifying theory of everything. … Einstein's theory* talks about large objects; quantum mechanics talks about very small objects and we discovered that very small objects don't behave in the same way as very large objects. … String theory was originally invented to explain the behaviour of hadrons. … Yoichiro Nambu recognised that the dual resonance model of strong interactions could be explained by a quantum mechanical model of strings. …. according to string theory we can have up to 26 dimensions." [Actually the mainstream limit has been taken as 11 dimensions since good old Ed's brilliant M-theory unification in 1995.]

Call-in from Katrina (squeaky girl voice): "I'm a Christian, and for me string theory is so important because it explains God's miracles. If you think about our world, the brane world, as a television inside a house; that is the bulk world, and we have only got our three dimensions where we are in the television, and in the bulk world there is the other [dimensions] out there, and that is where God is, and why we can't see Him."

Andrew Vester (depressed voice): "That's exactly the point I've been making about string theory. It's based on belief, there is no actual proof that any of the string theory stuff actually exists, and it's exactly the same with religious belief. There's no definite proof that God exists, therefore the belief in string theory is extremely close to the belief in God. And yes, they're both dealing with things we can't see, things that are hidden."

Malcolm Gladwell, a former science writer for the Washington Post, in 2000 wrote *The Tipping Point* (Little, Brown and Co.). Gladwell explains on pages 258-9 that fashion is often counter intuitive: "The world … does not accord with our intuition. … Those who are successful at creating social epidemics do not just do what they think is right. They deliberately test their intuitions. Without the evidence … which told them that their intuition about fantasy and reality was wrong, Sesame Street would today be a forgotten footnote in television history. Lester Wunderman's gold box sounded like a silly idea until he proved how much more effective it was than conventional advertising. That no one responded to Kitty Genovese's screams sounded like an open-and-shut case of human indifference, until careful psychological testing demonstrated the powerful influence of context. … human communication has its own set of very unusual and counterintuitive rules.

"… We like to think of ourselves as autonomous and inner-directed, that who we are and how we act is something permanently set up by our genes and our temperament. … We are actually powerfully influenced by our surroundings, our immediate context, and the personalities of those around us. Taking the graffiti off the walls of New York's subways turned New Yorkers into better citizens [crime rates fell]. Telling seminarians to hurry turned them into bad citizens. … To look closely at complex behaviors like smoking or suicide or crime is to appreciate how suggestible we are in the face of what we see and hear, and how acutely sensitive we are [unless autistic] to even the smallest details of everyday life. … social change is so volatile and often inexplicable, because it is the nature of all of us to be volatile and inexplicable. … By tinkering with the presentation of information, we can significantly improve its stickiness."

Freeman Dyson, "Innovations in Physics," *Scientific American,* Vol. 199, No. 3, September 1958, pp. 74-82: "I have observed in teaching quantum mechanics (and also in learning it) that students go through the following experience: The student begins by learning how to make calculations in quantum mechanics and get the right answers; it takes about six months. This is the first stage in learning quantum mechanics, and it is comparatively easy and painless. The second stage comes when the student begins to worry because he does not understand what he has been doing. He worries because he has no clear physical picture in his head. He gets confused in trying to arrive at a physical explanation for each of the mathematical tricks he has been taught. He works very hard and gets discouraged because he does not seem able to think clearly. This second stage often lasts six months or longer, and it is strenuous and unpleasant. Then, quite unexpectedly, the third stage begins. The student suddenly says to himself, 'I understand quantum mechanics,' or rather he says, 'I understand now that there isn't anything to be understood'. The difficulties which seemed so formidable have mysteriously vanished. What has happened is that he has learned to think directly and unconsciously in quantum mechanical language, and he is no longer trying to explain everything in terms of pre-quantum conceptions."

---

*Einstein wrote to M. Besso in 1954: "I consider it quite possible that physics cannot be based on the [classical differential equation] field principle, i.e., on continuous structures. In that case, nothing remains of my entire castle in the air, [non-quantum] gravitation theory included …"

"Crimestop means the faculty of stopping short, as though by instinct, at the threshold of any dangerous thought. It includes the power of not grasping analogies, of failing to perceive logical errors, of misunderstanding the simplest arguments if they are inimical to Ingsoc, and of being bored or repelled by any train of thought which is capable of leading in a heretical direction. Crimestop, in short, means protective stupidity." - George Orwell, *Nineteen Eighty Four,* Chancellor Press, London, 1984, p. 225.

Copy of a comment to Tommaso Dorigo's blog:
http://www.scientificblogging.com/quantum_diaries_survivor/cdf_vs_dzero_and_winner#comment-15435
05/22/09 | 05:31 AM

"And I think I am now convinced, dear reader, beyond any reasonable or unreasonable doubt, that who discovered the Omega_b particle is CDF. However mildly unlikely it may look, DZERO probably picked up a fluctuation mixed up with the true signal, and heavily underestimated their mass systematics." - Tomasso

Hi Tommaso, your conclusion is also justified by a quantum gravity model prediction for mass that baryons should have masses close to an integer when expressed in units of 3/2 multiplied by the electron mass divided by alpha: 1.5*0.511*137 = 105 MeV.

CDF: 6054.4/105 = 57.88
D0 = 6165.0/105 = 58.71

The CDF mass is closer to an integer than D0, so it is more likely correct. This quantum gravity model attributes mass to an integer number of massive particles which interact with hadrons and leptons, giving them their masses. Like Dalton's early idea of integer masses for atoms, it's not exact because of the possibility of isotopes (e.g. the mass of chlorine was held up against Dalton's idea until mass spectrometry showed that chlorine is a mixture of isotopes with differing numbers of massive neutrons) not to mention the mass defect due to variations in binding energy. But like Dalton's idea, it is approximately correct for all known hadron and leptons:

If a particle is a baryon, it's mass should in general be close to an integer when expressed in units of 3/2 multiplied by the electron mass divided by alpha: 1.5*0.511*137 = 105 MeV.

If it is a meson, it's mass should in general be close to an integer when expressed in units of 2/2 multiplied by the electron mass divided by alpha: 1*0.511*137 = 70 MeV. E.g. pion mass masses are about 140 MeV.

Acknowledgements

Guy Grantham, Tommaso Dorigo, Tony Smith, Mario Rabinowitz, John Hunter, John Gribbin, Sean Carroll, John Suleman, Jack Sarfatti, Vergon Vertner, Phil Reed, Martin Eccles, Frank Ogden, David S. Walton, Malcolm Davidson, Phil Gibbs, Carl Brannen, A. G. Callegari, James Delingpole, Susan Miller, Louise Riofrio, Thomas S. Love, Danny Ross Lunsford, Carl Brannen, Marni Sheppheard, Lubos Motl, Jacques Distler, and Clifford V. Johnson.

References

1. http://www.grc.nasa.gov/WWW/k-12/Numbers/Math/documents/ON_the_EXPANSION_of_the_UNIVERSE.pdf (page 5: about 3×10^{52} kg of mass in 9×10^{21} stars are in galaxies seen by the Hubble Space Telescope); $a = 6.9 \times 10^{-10}$ ms^{-2} (L. Smolin, *The Trouble With Physics,* Houghton Mifflin, N.Y., 2006, p. 209).

2. N. Cook papers: *Electronics World,* Oct 1996, p 896; *Science World,* ISSN1367-6172, Feb 1997; *Electronics World,* 105, 496 (1999); ibid, 107, 41 (2001); ibid, 108, 46–49 (2002); ibid, 109, 47–52 (2003), etc.

3. S. Perlmutter, et al., "Discovery of a Supernova Explosion at Half the Age of the Universe", *Nature,* v. 391 (1998), pp. 51-54.

4. Email from Stanley G. Brown, Editor of PRL, dated as sent 02/01/03 17:47, Subject: Your_manuscript LZ8276 Cook.

5. Tilman Sauer, "The Relativity of Discovery: Hilbert's First Note on the Foundations of Physics", arXiv:physics/9811050

v. 1 26 Nov 1998, p. 52.

6. H. Weyl, "Gravitation und Elektrizitat", *Sitzungsberichte der Preussischen Akademie der Wissenschaften,* v. 26 (1918), pp. 465-480.

7. E. Schroedinger, "On a Remarkable Property of the Quantum-Orbits of a single Electron", *Zeitschrift f. Physik,* v. 12 (1922), pp. 13-23.

8. E. Schroedinger, "Quantization as an Eigenvalue Problem", *Annalen der Physik,* v. 81 (1926), p. 162.

9. H. Weyl, "Electron and Gravitation", *Zeitschrift f. Physik,* v. 56 (1929), p. 330.

10. F. London, "Quantum Mechanical Interpretation of Weyl's Theory", *Zeitschrift f. Physik,* v. 42 (1927), p. 375.

11. http://blogs.discovermagazine.com/cosmicvariance/2007/05/24/string-theory-not-dead-yet/

12. M. Fierz and W. Pauli, "On relativistic wave equations for particles of arbitrary spin in an electromagnetic field," *Proc. Roy. Soc. London.,* v. A173 (1939), pp. 211-232: "*In the particular case of spin 2, rest-mass zero, the equations agree in the force-free case with Einstein's equations for gravitational waves in general relativity in first approximation …*"

13. A. Zee, *Quantum Field Theory in a Nutshell,* Princeton University Press, 1st ed., 2003. Zee presents Feynman and Hibbs' 1965 "Path Integrals and Quantum Mechanics" book approach to the path integral, which contrasts to Feynman's mechanistic 1985 book, "QED". In particular, Feynman in 1965 fell for the reductionist fallacy in the double slit experiment, which he corrects in the 1985 book. Zee used the flawed 1965 reductionist fallacy-disproved Feynman path integral approach of c*ompletely drilling away a screen* to "show" that photons take all kinds of curving paths *as if being diffracted from an infinite number of slit edges, which no longer exist.* The mechanism for light diffraction by a screen is that the electromagnetic field of light *interacts with the electromagnetic field of the onshell electrons at the screen hole edges.* If you take away the screen completely, there is no reason for light to take completely random curling paths everywhere. Feynman in 1985 thus dropped the curly paths and illustrated the path integral with straight lines (Newton's 1st law) for all vacuum paths: the variability is then in the *varying angles* of reflection or refraction, not in randomly curling paths (see our Fig. 36). Zee also makes the mistake on page 34 of claiming that a two-indice stress-energy tensor needs a spin-2 graviton to mediate an always attractive force, without stating that this is based on the false implicit assumption that the universe *contains only two gravitationally interacting masses, which "attract."* However, Zee's is a *relatively good physics book, and at least makes an attempt to deal with real world physics.*

14. http://blogs.discovermagazine.com/cosmicvariance/2009/04/09/string-wars-the-aftermath/ (2009).

15-17. G. Sparano, G. Vilasi and S. Vilasi's January 2011 arXiv paper "The gravity of light", http://arxiv.org/abs/1009.3849v5

18-20. Robert M. Wald, "The Formulation of Quantum Field Theory in Curved Spacetime," arXiv: 0907.0416v1 [gr-qc}, 2 July 2009, pp. 2-7. (Also: Robert M. Wald, *Quantum Field Theory on Curved Spacetimes and Black Hole Thermodynamics*, University of Chicago press, 1994.)

21. Richard A. Muller, "The cosmic background radiation and the new aether drift," *Scientific American,* May 1978.

22. Yves-Henri Sanejouand, arXiv:0908.0249v1 [physics.gen-ph] 3 Aug 2009.

23. S. Perlmutter, et al., "Discovery of a Supernova Explosion at Half the Age of the Universe", *Nature,* v. 391 (1998), pp. 51-54.

24. E. Teller, "On the change of physical constants", *Physical Review,* v. 73 (1948), p. 80. Teller's "no-go theorem" error for Dirac's large numbers time-varying *G* hypothesis is naive falsification, like the Michelson-Morley experiment. See also: R. H. Dicke, "Dirac's cosmology and Mach's principle", Nature, v192, p440, 1961; P. A. M. Dirac, "The cosmological constants", Nature, v139, p323, 1937; P. A. M. Dirac, "A new basis for cosmology", Proceedings of the Royal Society, vA165, p199, 1938; F. J. Dyson, "The Fundamental constants and their time evolution", in A. Salam and E. P. Wigner, "Aspects of

Quantum Theory", CUP, 1972.

25. Louise Riofrio: http://riofriospacetime.blogspot.com/

26-27. "Lesage's Shadows": http://www.mathpages.com/home/kmath131/kmath131.htm

28. D. R. Lunsford, "Gravitation and Electrodynamics over SO (3,3)," *Int. J. Theor. Phys.,* v. 43 (2004), No. 1, pp.161-177, (http://doc.cern.ch//archive/electronic/other/ext/ext-2003-090.pdf) arXiv.org censorship: http://www.math.columbia.edu/~woit/wordpress/?p=128&cpage=1#comment-1920

29. Tony Smith, Arcadian Pseudofunctor discussion comment http://kea-monad.blogspot.com/2007/08/m-theory-lesson-86.html#c2972911476435728454 (August 17, 2007 8:53 AM): "Since my view is that '... the color (red, blue, green) comes from the position of the singleton (0 or 1) in the given binary triple ...[such as]...
i = 100 = red up quark
j = 010 = blue up quark
k = 001 = green up quark ...
"I agree that color emerges from '... the geometry that confined particles assume in close proximity ...'.

30. Peter Woit, "Quantum Field Theory and Representation Theory: A Sketch," arxiv: hep-th/0206135v1, 2002, pp 51-2, showing that the most trivial possible Clifford algebra representation of U(2) spinors in Euclidean spacetime produces this chiral electroweak isospin and hypercharge association: P. Woit, "Supersymmetric quantum mechanics, spinors and the standard model," *Nuclear Physics,* v. B303 (1988), pp. 329-42.

31. Robert Elia, *First Measurement of the Left-Right Asymmetry in Z-boson Production,* SLAC-PUB-6169, July 1993.

32. A. Aspect, J. Dalibard and G. Roger, "Experimental Test of Realistic Local Theories via Bell's Theorem", *Physical Review Letters,* v. 47 (1982), p460. (Also: A. Aspect, P. Grangier, and G. Roger, *Phys Rev Lett*, v. 49, p. 91, 1982; J. S. Bell, "On the Einstein-Podolsky-Rosen Paradox", *Physics,* v. 1, p. 195, 1964; Albert Einstein, Boris Podolsky and Nathan Rosen, "Can Quantum Mechanical Descriptions of Nature Be Considered Complete?", *Physical Review,* v47, p777, 1935.)

33. Paul Forman, "Weimar culture, causality, and quantum theory: adaptation by German physicists and mathematicians to a hostile environment," *Historical Studies in the Physical Sciences,* v. 3 (1971), pp. 1-115.

34. I. Catt, *The Catt Anomaly,* Westfields Press, 1996; I. Catt, "Crosstalk," *IEEE Trans. Elect. Comp.* 16(6): 743-763 (1967).

35-36. http://en.wikipedia.org/wiki/Weinberg_angle

37. http://www.staff.science.uu.nl/~hooft101/ (Last revised: September 19, 2011): "I found in 1970 how to renormalize the theory, and, more importantly, we identified the theories for which this works, and what conditions they must fulfil. One must, for instance, have a so-called *Higgs*-particle."

38. Stuart A. Raby, Richard C. Slansky, and Geoffrey B. West, "Particle Physics and the Standard Model," *Los Alamos Science,* Summer/Fall 1984 issue (pp. 23-53), at page 44.

39. Chris Oakley, http://www.cgoakley.demon.co.uk/qft/index.html

40. E. Schroedinger, "An Undulatory Theory of the Mechanics of Atoms and Molecules," *Physical Review,* v. 28, 1926, pp. 1049-1070.

41. Carlos Barceló and Gil Jannes in 2008 published a paper called *'A Real Lorentz-FitzGerald Contraction', Foundations of Physics, Volume 38, Number 2 / February, 2008, pp. 191-199*

42. Lawrence Kohlberg, "Stage and Sequence: the Cognitive Development Approach to Socialization," in D. A. Goslin, Ed., *Handbook of Socialization Theory and Research,* Rand-McNally, Co., Chicago, 1969, pp. 347-380.

43. Henri Ruegg and Marti Ruiz-Altaba, *The Stuckelberg Field,* arxiv: hep-th/0304245v2, 28 July 2003.