Einstein was Right.

The most important problem confronting physics is to understand the nature of the quanta.

His two efforts were on target:

1936 EPR showed quantum mechanics to be incomplete
1940-50s He searched for a method to unify the four forces.

Subsequent Milestones

1964-1972 J. Clauser & S. Freedman using J. Bell's analysis showed hidden variables are not the answer and support the EPR paper's conclusions of strangeness with the loss of lab frame locality.

1989-2019 LANR is a low energy and structure sensitive, whereas high energy experiments are structure insensitive.

2004-2014 The limitations on allowed quantum spaces were found.

Nature of the Quantum

Experimental Problems

Anomalous eddy current loss mechanism and the initial 1831 induction experiment by Michael Faraday.

Loss mechanism in LANR $\Rightarrow$ RF, heat, and ^4He

Analytic derivation for the 21cm line of Hydrogen by Fermi in 1930.

Theoretical Problem

No wave equation generates particle or field structure and quantization.

Quantum Information Minimum

Conservation laws govern physics as energy is conserved in quantum mechanics.

2014 Two spaces not described by the continuum are embedded in each other to generate particles and fields, boson and fermion families.

The two space: self-reference frame and the lab frame are statistically independent.

Information conservation laws have yet to be discovered.

Self-reference frame's (r,θ,ϕ) loss of access to θ and ϕ is traded for physical information represented in the lab frame (R,Θ,Φ).

Georg Cantor's continuum theorem relegate dimensions to non-physical indexing mechanism eliminating continuum spaces for physical descriptions. *1878*

Measurement Problem is reduced to a comparison between fuzzy objects in the laboratory frame. The dual spaces: self-reference frame and the lab frame are the mutual references required, eliminating the observer. *D. Bohm 1950s*

Schrödinger & Dirac equations provide no particle or field structure and are not derived from relativistic energy conservation.

Energy Conservation Laws

$E^2 = p^2 c^2 + (mc^2)^2$ and $E = \hbar\omega$ in a limited precision space $\Rightarrow$

Spatial scale of limited resolution, yields a massive longitudinal particle wave function, $\mathbf{u}(r)$, two solutions $\mathbf{u}^f$ and $\mathbf{u}^b$ for fermion and boson.

$$\frac{\partial^2 \mathbf{u}(r)}{\partial r^2} + \left(\frac{n-1}{r} + \kappa\{1 - i\gamma\}\right)\frac{\partial \mathbf{u}(r)}{\partial r} - i\kappa^2\gamma\mathbf{u}(r) = 0$$

$$\frac{\partial^2 \mathbf{g}(\tau)}{\partial \tau^2} + (\omega_c \pm i\omega)\frac{\partial \mathbf{g}(\tau)}{\partial \tau} \pm i\omega_c\omega\mathbf{g}(\tau) = 0$$

Phase limited resolution, yields a quantized transverse field wave function, $u(r)$, with two solutions u^f and u^b for fermion and boson.

$$\frac{\partial^2 u(r)}{\partial r^2} + \left(\frac{n-1}{r}\right)\frac{\partial u(r)}{\partial r} + \kappa^2\gamma u(r) = 0$$

$$\frac{\partial^2 g(\tau)}{\partial \tau^2} + \omega^2 g(\tau) = 0$$

Explicit Solutions for property generation.

Particles, n is dimension, $\kappa \sim$ mass, and γ relative energy.

$$\mathbf{u}^f(r, n) = e^{-\kappa r} \; {}_1F_1[\tfrac{n-1}{1+i\gamma}, n-1, (1+i\gamma)\kappa r]$$

$$\mathbf{u}^b(r, n) = e^{-\kappa r} \; U[\tfrac{n-1}{1+i\gamma}, n-1, (1+i\gamma)\kappa r]$$

Fields

$$u^f(r, n) = e^{-i\kappa r} \; {}_1F_1[\tfrac{n-1}{2}, n-1, 2i\kappa r]$$

$$u^b(r, n) = e^{-i\kappa r} \; U[\tfrac{n-1}{2}, n-1, 2i\kappa r]$$

Table: **Solutions applied to real particles and fields**

Dim.	Boson	Fermion	Note
no mass	**Field**	**Field**	
1	$u^b(r,1)$ field formation	$u^f(r,1)$ neutrino formation	bound
2	$u^b(r,2)$	$u^f(r,2)$	bound
3	$u^b(r,3) \rightarrow$ photon	$u^f(r,3) \rightarrow \nu_e$	free
mass	**Particle**	**Particle**	
1	$\mathbf{u}^b(r,1)$ charge formation	$\mathbf{u}^f(r,1) \rightarrow$ Down Quark	bound
2	$\mathbf{u}^b(r,2)$	$\mathbf{u}^f(r,2) \rightarrow$ Up Quark	bound
3	$\mathbf{u}^b(r,3) \rightarrow W^{\pm}\ Z^o$	$\mathbf{u}^f(r,3) \rightarrow$ electron	free

Experimental Tools

Longitudinal spin wave in iron, spin 0 boson, allows the self-reference frame to be explored to determine mass. *Wallace 1990-2009*

Electron ionization of the ^1H 1S-state for exact state energy from non-singular electron potential provides 99% of the correction without QED. *P. Kusch experiment 1967*

Nuclear short range correlation threshold determines the 6-quark energy when a proton is driven into a neutron. *Higinbotham*

Lattice electrons removing energy during D-D fusion, through a contact interaction driven by proton's charge distribution being altered. *Liboglavsek & recent RF data*

Electron neutrino refraction confirmed as a weak force effect. *Wallace 2018*

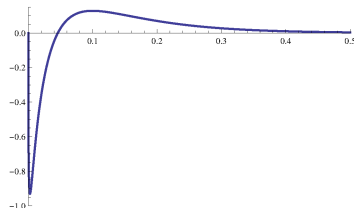# Non-Singular Electron Charge Density
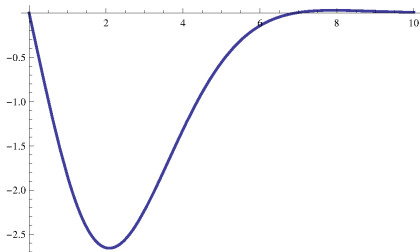
Yields 99% of the correction of the 1S state offset error from the Schrödinger solution of hydrogen. The electrostatic field contributes .13% of the energy to the total self-energy of the electron. Scale $1 = \frac{\hbar}{m_e c}$ and $\mathbf{E}(r) \sim \mathbf{u}^{f*}(r)\mathbf{u}^f(r)$.

Charge Density as function of *r*
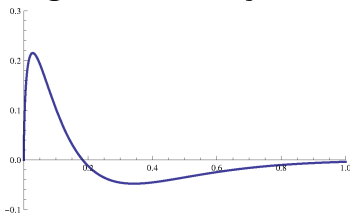
Neutron   Proton

assembled composite particles

$$u^f_{neutron}(r) = u^f(r, \kappa_1, n = 1) \circ u^f(r, \kappa_2, n = 1) \circ u^f(r, \kappa_3, n = 2)$$

Charge $= 0$ independent of the values of κ, $\kappa = \frac{mc}{\hbar}$

$$u^f_{proton}(r) = u^f(r, \kappa_1, n = 1) \circ u^f(r, \kappa_2, n = 2) \circ u^f(r, \kappa_3, n = 2)$$

Charge and charge density dependent on the ratio of κ_2/κ_3
provides LANR coupling for energy loss to the lattice.

Structural Features

Parity problem for a massive boson comes from the feature that wave function $u^b(r, \kappa, \gamma)$ that the value at $r = 0$ is not zero, but varies as a function of energy, γ, unlike the fermion behavior.

Weak Charge of the massive boson also results from the energy dependence, γ, in $u^b(r, \kappa, \gamma)$ as a function its complex argument.

Dynamics & Quantum Uncertainty
lab frame

$$\nabla^2 \Phi - \frac{1}{c^2}\frac{\partial^2 \Phi}{\partial t^2} + i\frac{2m}{\hbar}\frac{\partial \Phi}{\partial t} = \left(\frac{2m}{\hbar^2}V + \frac{1}{\hbar^2 c^2}V^2\right)\Phi$$

Derived from the relativistic conservation of energy relation with two additional terms as compared to the Schrödinger equation.

longitudinal solution for free particle: time dilation and SR contraction

transverse solution for massless field: neutrino & EM propagation and refraction

Derivation requires inertial mass satisfies $m = \frac{\hbar}{\epsilon c}$ where ϵ is the particle scale.

$V + \frac{V^2}{2mc^2} = 0$ source of quantum uncertainty that forces the statistical independence on the self-reference frame

Unifying Forces is simple once quantum mechanics is derived from its relativistic origin.

EM and Weak Forces $\Rightarrow$ Structure of the self-reference frame components whose static fields overlap generating a contact interaction in addition to radiative interactions.

Strong Force $\Rightarrow$ Composite lower dimension fermion product wave function overlapping producing an effective potential $V = V_o e^{-\alpha r}$.

Gravity $\Rightarrow$ Fermion core void of the self-reference frame is eliminated in the lab frame curving space, and producing a gravitational mass.
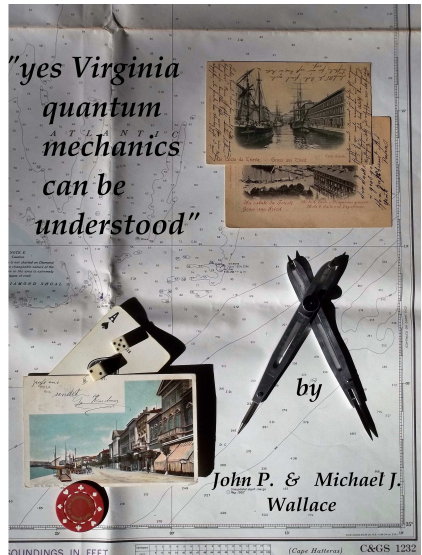
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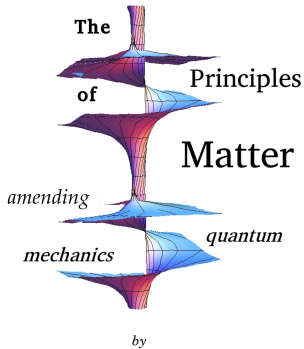
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