A Scalar-Energy Field That Predicts the Mass of The Electron-Neutrino

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Abstract: Using Wolff's model of spherical-wave centers, a scalar energy field is derived between rest-energy of a particle and potential energy of a hypothetical space fabric. The simple formula of $mc^2 = .5kx^2$ that results reveals a different elasticity constant k for each particle, and based on the knowledge of electro-weak unification which requires the constants k for the electron and neutrino to be the same, a mass for the electron-neutrino is predicted to be 0.065 eV.

I. Introduction

In 1975 astronomer Vera Rubin showed evidence that stars at the edge of galaxies are orbiting at the same speed as stars near the center of those same galaxies. From Newtonian mechanics it was deduced that there must be invisible matter that balances the higher than expected speed of the orbiting stars on the outer rim of galaxies. This invisible matter, known as dark matter, is assumed to be a non-baryonic particle and has been sought after in underground mines and particle accelerators for the last 30 years with no success.

Various versions of WIMPs (weakly-interacting massive particles) have been proposed theoretically to account for dark matter, similar to the kind of WIMPs that were proposed to solve the solar-neutrino problem before 1998. In 1998, the Super Kamiokande experiment showed that neutrinos oscillate between different flavors, implying a mass for the neutrino which was previously thought to be a massless particle as predicted by SU(2) transformations [1]. The lesson from the solar-neutrino problem should be an exercise for those searching for dark matter candidates - the "missing" mass is really a particle we thought was not massless to begin with. If we look at the other candidate for a massless particle, the photon, we can find evidence for its mass as well. Thus, dark matter may turn out to be the most luminous matter in universe.

II. Mass of Particles

JP Vigier suggested a photon mass of 10^{-69} Kg based on an uncertainty relationship [2]:

$$\Delta p \Delta x = h\text{-}bar \tag{1}$$

$$\Delta(mc)\Delta R_u \quad = \quad h\text{-}bar \qquad (2)$$

$$m \quad = \quad h\text{-}bar/(cR_u) \approx 10^{-69}\ Kg \qquad (3)$$

Vigier's calculation is also supported by the author's work on a simple version of quantum gravity that assumes mass-energy is the result of an elastic, deformed space [3]:

$$0.5kx^2 \quad = \quad mc^2 \qquad (4)$$

where *m* is the mass of the particle, *x* is the deformation of space and *k* is the elasticity constant of space (hereafter the Grand Unification Constant). Based on the following known masses of the stable particles that relate to the fundamental forces, we find *k* changes to match the force strength (gravity has a smaller *k* than the strong force, for instance) as $dF/dx = k$ from the elastic-force law. These values are shown in Table I.

Force Type	**Radius of Particle (x)**	**Rest Mass (m)**	**Stable Particle**	**k from (4)**
Strong	10^{-15} m	938 MeV	Proton	3×10^{20}
Electro-Weak -Electron radius -Weak range	 2.8×10^{-15} m 10^{-18} m	 0.5 MeV **.065 eV**	 electron **ν_e neutrino**	2.1×10^{16}
Gravity	10^{26} m, R_u	10^{50} Kg	Mass of universe	1.8×10^{15}
Electromagnetic	10^{-35} m, p_l	**10^{-69} Kg**	**Mass of photon**	7.2×10^{17}

Table I Mass-distance relationship of Fundamental Particles

As can be seen from the last entry in Table I, the mass of the photon is based on the deformation of space over the Planck length, which is the electron/photon interaction range. Also, the electro-weak force has been known to be combined from experiments performed at CERN in 1983 (W-Z boson, which decays). The particles in Table I (excluding the tau-neutrino and mu-neutrino, which are associated with the tauon and muon which are known to decay) are all the stable particles which have not been observed to decay in any experiment. This is evidence of the standing-wave nature of particles. The particles consisting of standing waves do not decay, whereas the particles that do decay do not consist of standing waves but transient waves which utilize a differential equation of force perturbation (such as $mx'' + bx' + kx = f(t)$, where k is as described above and b is frictional constant of the medium) rather than the simple formula of (4). The force ranges exist due to the interaction of Hubble spheres, which produces a polynomial of the third order and has three terms that produce the cosmological redshift as well as the force ranges of strong, electro-weak and gravitational [6].

III. Wave Structure of Matter

Milo Wolff's Wave Structure of Matter (WSM) theory describes a particle as the superposition of two standing waves - an incoming and outgoing wave:

$$\Phi^{IN} = \frac{A_0}{r} e^{(i\omega t + ikr)} \tag{5}$$

$$\Phi^{OUT} = \frac{A_0}{r} e^{(i\omega t - ikr)} \tag{6}$$

Wolff's description of a particle removes the infinity problems associated with renormalization at r = 0 because it can be seen by taking the limit of the sum of (5) and (6) as r approaches 0 reveals that the sum of (5) and (6) are finite in value and not infinite. It is also seen from an analysis of the particle's motion that (5) and (6) produce the effects of the Lorentz transformation based on special relativity, which is essentially the resulting classical Doppler shift of (5) and (6) [4]. The time-dilation effects of SRT are then based on the ratio of the speed of the out-wave to speed of the in-wave.

Also, as an electron moves at velocity v, the classic Doppler shift compresses the out-waves of the electron in its direction of motion (blueshift) and spreads the out-wave in the direction away from motion (redshift). This asymmetry between redshift and blueshift in the out-wave of the moving electron is the magnetic field we observe due to the moving charge and because the redshift and blueshift of the out-wave must always exist together, there should be no magnetic monopoles. The magnetic force is then described as the alignment of redshift waves with blueshift waves (attraction) or alignment of redshift-redshift or blueshift-blueshift waves (repulsion) due to phase difference between blueshifted and redshifted waves.

One would then ask, if there is a Doppler shift associated with (5) and (6), why would not the mass of a photon also experience this Doppler shift and appear to be an infinite mass as it approaches the speed of light? The answer is as simple as it is subtle - although the photon has a mass based on the deformation of space, unlike the electron and other particles that are composed of the superposition of the two waves as in (5) and (6), the photon is a not itself a wave-center superposition but instead it is the resonance of two electron wave-centers [5].

When electrons oscillate they deform space and this deformation is resonant with other electron wave-centers, which are also composed of in and out-waves. The resonance between the electron wave centers is not a superposition of waves as in (5) and (6), but just the inter-modulation difference frequency between these wave centers, which frequency then determines the photon frequency based on $h\omega = mc^2$, where ω is the mass-frequency of (5) and (6) [5]. As a photon is just a single resonance wave with no out-wave it does not "show" a mass increase in its out-wave like other particles based on the classical Doppler shift of out-waves.

IV. Conclusion

The mass of the electron-neutrino predicted in Table I as **0.065 eV/c^2** is within the estimated range of mass-squared prediction from the Super Kamiokande experiment of $5\text{x}10^{-4}$ eV^2 < m^2 < $6\text{x}10^{-3}$ eV^2 (which corresponds to a range of 0.02 eV to 0.08 eV)[1].

With the mass of the electron-neutrino predicted from Table I as 0.06 eV/c^2 and the smaller photon mass predicted as 10^{-69} Kg, the typical proton-proton reaction in stars is likely to generate more "missing mass" from neutrinos than from photons. However, there are other processes in galaxies that can generate a tremendous number of photons such as gamma ray bursts (GRB) and antimatter annihilation. The final calculation for missing mass will include dominant processes in a galaxy as well as photon-lifetimes within the galactic region. It is possible that we may discover that dark matter is actually the most luminous matter out there.

References

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