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Gravity and Zero Point Energy

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Abstract

When Planck introduced the ½hν term to his 1911 black body equation he showed that there is a residual energy remaining at zero degree K after all thermal energy ceased. Other investigators, including Lamb, Casimir, and Dirac added to this information. Today zero point energy (ZPE) is accepted as an established condition. The purpose of this paper is to demonstrate that the density of the ZPE is given by the gravity constant (G) and the characteristics of its particles are revealed by the cosmic microwave background (CMB). Eddies of ZPE particles created by flow around mass bodies reduce the pressure normal to the eddy flow and are responsible for the force of gravity. Helium atoms resonate with ZPE particles at low temperature to produce superfluid helium. High velocity micro vortices of ZPE particles about a basic particle or particles are responsible for electromagnetic forces. The speed of light is the speed of the wave front in the ZPE and its value is a function of the temperature and density of the ZPE

Keywords: Zero point energy; Gravity; Super fluid helium; Electromagnetism; Strong force.

1. Introduction

In 1911 Planck introduced his "second equation"[1]

$$E = h\nu/ (e^{h\nu/kT} - 1) + ½ h\nu \quad (1)$$

This included an additional term, hν/2. When *T* becomes zero the exponential term becomes infinite and the first term becomes zero, but there is still a residual energy remaining in the form of the second term, which is Planck's constant times frequency. Depending upon the value of ν, this energy could be quite high. This has been calculatwed[2] to be as high as 10^{110} J/cc. In 1916 Walther Nernst [3] suggested that there were vast amounts of zero point energy in the universe. In 1928 P. Dirac [4] stated that space was filled with a large number of negative spaces, and the holes in these spaces were positive electrons. In 1947 W. E. Lamb discovered changes in the fine structure of the hydrogen atom that became known as the Lamb Shift. [5] These changes were later shown to be due to the zero point energy (ZPE) [6]. In 1947 Hendrik Casimir [7] proposed that two closely spaced neutral conducting metal plates would exclude the wavelengths of the ZPE longer than the spacing of the plates. This would produce a weaker pressure between the plates and the stronger external pressure would produce a force on the plates.

In 1951 Dirac [8] proposed an ether of particles in an article in *Nature*. He stated: "With the new theory of electrodynamics we are rather forced to have an aether." The first tests of the Casimir effect were conducted by M. J.

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Sparnaay at Philips Labs in Eindhoven and reported in 1957 and 1958 [9,10]. The results did not contradict Casimir's formula. The Casimir effect was measured more precisely by Mohideen and Roy [11] and G. Bressi et al [12] in 1998 and 2002. In 1967 Andre Sakharov [13] proposed that gravity was not a fundamental force but was the result of fluctuations (zitterbewegung) of the ZPE. In 1988, H. E. Puthoff [14], starting with Sakharov's concept of gravity being the result of ZPE vibrations derived an equation which he said "can then be written in Newton's law form". The first patent (# 5,590,031) was issued to Dr. Frank Mead, for ideas involving extracting energy from the ZPE, on Dec. 31, 1996. Other patents have followed.[15] Serious thought was also given to space propulsion by the ZPE at the NASA Breakthrough Propulsion Physics Research Program [16,17]. The Jovian Corp in conjunction with the University of Colorado is conducting research in energy extraction from the ZPE and a patent, Quantum Vacuum Energy Extraction No. 7379286, was issued to Haisch and Moddel of that corporation on 5/27/03. Haisch and Rueda [18] published an article in 1998 proposing that an electromagnetic force that interacts the ZPE with a particle might be the source of inertia.

2. Discussion

2.1. Gravity

When Michelson-Morley [19] failed to detect any ether drift, the concept of an ether was therefore discarded. However, Michelson-Morley did not prove that there is *not* an ether. They only showed that there is no ether drift. The reason for this is that the earth does not drift through the ether, but rather flows in the sun's vortex of gravity producing particles at the same speed of the vortex at the earth orbit, like a cork in a stream. At the time, Michelson was inclined to agree with Stokes hypothesis, put forward in 1867. that the ether in the vicinity of the earth moves at the earth's velocity. This means that there is no relative motion between the earth and the stream of particles.

When there is a mass object present in the sea of particles, the maximum disturbance would be created if the particles continuously collided directly with the mass object. To minimize this effect, the particles swirl around the mass object to create a vortex [20]. The equation for this vortex is $V = \sqrt{GM/r}$, or $V = N/\sqrt{r}$ (where N is a constant for each situation). Normally, these particles move freely in random motions and produce a uniform pressure, similar to still air. In any assembly of particles, moving freely in three dimensions, if a motion in one direction is induced it reduces the velocity in the other two directions and reduces the pressure in those directions. This is shown in the Bernoulli effect and the Venturi meter. This reduced pressure between mass bodies, in directions normal to the direction of the vortex velocity flow, together with the normal pressure external to the bodies, produces the force [21] of gravity.

2.2. Mass of ZPE particle

With regards to an ether, all the interest in zero point energy and dark matter shows that space is not empty but is filled with something. [22] Numerous particles have been proposed to occupy this space volume: neutrinos, axions, tachyons, Higgs bosons, and Weakly Interacting Massive Particles [23]. However, the only particle of this nature that has been discovered, to date, is the neutrino. In 2009 M. Margulis [24] proposed that the neutrino is the particle comprising the ether. Another reason that the neutrino has been proposed as the zero point energy particle is that zero energy is composed of virtual photons. [25] If a photon is a combination of neutrino anti-neutrino [26] this would be further evidence in favor of the neutrino. If the neutrino is not the zero degree energy particle, the most likely hypothetical particle is the axion. However, axions, if they exist, have not been discovered. For the purposes of this paper, the particles will simply be referred to as ZPE particles.

When a microphone is made sensitive enough, it can pick up the impact of individual air molecules as well as sound waves. The impact of individual air molecules appears as background noise. Background noise was what Penzias and Wilson [27] first thought they had when they detected the Cosmic Microwave Background (CMB) and made strenuous efforts to eliminate it. Roger Koch et al [28] have measured ZPE noise in Josephson junctions. Since radio waves have macro dimensions, the two particles of the photon do not strike the antenna simultaneously; so the antenna is detecting one particle at a time whose energy is determined by its velocity and frequency of vibration. Radio waves travel in packets, so an antenna sees a group of particles at once. It is suggested that the amplifiers used to detect the CMB are sensitive enough to detect the impact of a single particle. The mass of a ZPE particle can be calculated from the energy of the CMB:

$$E = kT = Mc^2 \quad (2)$$

Where: k - Boltzmann constant , T – temperature of CMB = 2.725°K. $M = 0.42 \times 10^{-39}$ kg. This mass is equivalent to 2.36×10^{-4} eV (electron-volt), which is within the range of $10^{-4} – 10^{-6}$ eV predicted for the axion [29]. M. Margullis [30]

reported that they had determined the mass of the neutrino to be 1.2 x 10^{-39} kg.

2.3. Density of space

To get a clearer picture of ZPE space, it is proposed that the velocity of light is the velocity of the wave front in the medium of ZPE particles. It is a function of the temperature and density of the ZPE. If the temperature were higher [31,32,33], the velocity would be faster: if the temperature were lower, the velocity would be slower. If the density were higher, the velocity would be slower: if the density were lower, the velocity would be higher. Thus, the velocity of light [34], c, is not a fundamental constant.

Stochastic electrodynamics (SED) states that the electron in its orbit in the hydrogen atom radiates energy and at the same time absorbs an equal amount of energy [35,36], so that in the lowest Bohr orbit the electron is in dynamic equilibrium with the surrounding ZPE particles.. This would indicate that the orbital energy of the electron equals the energy [37] of the enclosed volume of ZPE.

In any assembly of particles, the velocity of the random motion of the particles is greater than the velocity of the wave front because the wave front moves in one dimension while the random motion of the particles is in three dimensions. The theoretical ideal value of the random motion would be c√3. It is not known what this value is for the ZPE particles. In oxygen, the sound wave front velocity [38] is 317.5 m/s at 25º C, while the rms velocity of the oxygen molecules is 482.1 m/s. This gives a ratio of 1.5184 (this value will be used for n in the following equation). Particles moving faster than the speed of light was discussed by Gerald Feinberg in 1967.[39] He called these particles tachyons. The recent OPERA experiment in Italy where neutrinos from CERN arrived 60 ns faster than the speed of light provides further evidence. This experiment has since been repeated twenty times with the same result. This experiment and its results were named the #1 scientific event in 2011 by Discover magazine [40]. However, much skepticism and searches for alternate explanations still remain.

$$E = k_e e^2/r = PV = \tfrac{1}{2}\rho v^2 \left(\tfrac{4}{3}\pi r^3\right) \tag{3}$$

where: v = n x c, k_e - Coulomb's constant, r - Bohr lowest radius of hydrogen atom, e – charge, ρ - density of space: $\rho = 3k_e e^2/2v^2\pi r^4$, $\rho = 3 \times 8.99 \times 10^9 (1.6 \times 10^{-19})^2 / 2 (1.5184 \times 3 \times 10^8)^2 \pi (5.29 \times 10^{-11})^4$ and $\rho = 6.76 \times 10^{-5}$ kg/m^3, It would seem that there is a relationship between the density of space and the gravitation constant such as:

$$G = \rho x \qquad x \text{ is a dimensional function} \tag{4}$$

where: $G = L^3/MT^2$, $\rho = M/L^3$, $x = L^6/M^2T^2 = (L^3/M)^2/T^2$ In converting from cgs to MKs system of units $M/L^3 = 10^6/10^3 = 10^3$, so that $(L^3/M^2)^2 = 10^{-6}$ $G = 6.76 \times 10^{-5} \times 10^{-6} = 6.76 \times 10^{-11}$ newton-m^2 /kg^2 . This agrees with the published [41] value of 6.67 x 10^{-11} N-m^2/kg^2

It has been suggested that if space were as dense as calculated above, then gravity would act on it and cause it to collapse. Such is not the case. Gravity is not a fundamental force, like some ethereal fluid permeating space, but is a generated force, [13] just as lift is produced by the flow of air over an airfoil. When the air flow stops, the lift stops. The force of gravity is produced only by the coordinated motion of the ZPE particles swirling around a mass object, and if there is no coordinated flow, there is no force of gravity. To the contrary, the presence of these particles would tend to support space, not cause its collapse.

2.4. Gravitational

Using the previous information, concerning the density of space and the vortex motion effect, the gravitational force due to the ZPE vortex governing the earth's orbit can be calculated. The centrifugal force of the earth in its orbit is:20

$$F = MV^2/R = 3.54 \times 10^{22} \text{ Newtons} \tag{5}$$

Where: V - earth orbit velocity (m/s), R - earth orbit radius (m) , M - earth mass (kg). The ΔV of the ZPE particles necessary to balance this force is:

$$F = \tfrac{1}{2}\rho \Delta V^2 M \tag{6}$$

(Ordinarily, force is pressure times area. In this case, since gravity cannot be shielded, it means that the ZPE particles are

very penetrating and the entire mass must be used to calculate the force. If the area only were involved then parts with identical weights but varying densities would have varying areas and give inconclusive results. Also, the satellite has its own vortex, which reacts with the parent's vortex.)

$$\Delta V = \sqrt{2F/\rho M} = \sqrt{2 \times 3.54 \times 10^{22} / 6.67 \times 10^{-11} \times 5.97 \times 10^{24}} = 1.33 \times 10^{4} \text{ m/s}$$

The orbital velocity of the earth is 2.98×10^4 m/s, which may be considered as the velocity of the sun's ZPE gravitational vortex at earth orbit. In a medium where all particles have freedom of movement in three directions the velocity in the x, y, and z directions is the same and is equal to the wave front in the medium.(x = y = z = c = 299792458 m/s). In a cube, bounded by x, y, and z sides the random velocity of a particle is represented by the diagonal of the cube and is √3 times the velocity of any one of the sides. If the velocity is increased in one direction, this causes a reduction in the velocity of the other two sides. (Assuming that the diagonal velocity remains the same as originally because it is the random velocity of the particle, which remains constant).The velocity of the remaining two sides is reduced by equal amounts. The amount of velocity reduction of the two sides can be determined by simple trigonometry: θ is an angle of a right triangle whose sides are: Hypotenuse = √3 (x), Adjacent = x, Opposite = √2 (y), $s = 2.98 \times 10^4$, $x_1 = x + s$, $\cos \theta_1 = x_1/\sqrt{3}\,(x) = 0.577407660$, $\theta_1 = 54.731582940^\circ$, $y_1 = \text{sine } \theta_1\, (x\sqrt{3})/\sqrt{2} = 299777556$, and $\Delta V = c - y_1$.

Applying this procedure to the amount of increase due to the earth's orbital velocity reveals that the velocity in the other two directions is shortened by the amount: $\Delta V = 299792458 - 299777556 = 1.49 \times 10^4$ m/s. This compares favorably to the value of 1.33×10^4 required by equation (6) above .The previous calculations should show that gravity is not a fundamental force but rather the result of the coordinated flow of the ZPE particles.[42,43]

2.5. Pressure of space

$$P = \tfrac{1}{2}\rho v^2 \tag{7}$$

Using the density from Eq. 4 and letting v = c x 1.5184 (as in eq. 4) gives: $P = 6.9 \times 10^{12}$ N/m^2, or 100,000,000 psi
This pressure is far greater than the strength of any known material, and is strong enough to support the measured strengths of all materials.

2.6. Super fluid helium

Since helium[44] remains a liquid at zero degrees due to the ZPE, it should also be the ZPE that is responsible for super fluid helium. To investigate this further, consider the zero point energy of helium.[45]

$$E = \hbar^2/2(M)\,(\Delta x)^2 \tag{8}$$

where: ħ - Planck's constant/2π, M - mass of the helium atom (kg), Δx - space between helium atoms at 1 atmosphere and 0º K (m), $E = (1.0544 \times 10^{-34})^2/2\,(6.64 \times 10^{-27})\,(1.49 \times 10^{-10})^2$, $\underline{E = 3.76 \times 10^{-23}\ \text{J/atom}}$. Dividing by the Boltzmann constant gives an equivalent temperature of 2.7º K. This value is not the λ point of 2.19ºK,[46] where super fluidity begins, but rather corresponds more closely to the CMB temperature of 2.725º K. Dr. vanSciver,[47] using a different formula, observed "we find that the temperature at which quantum effects should become important is around 2.9º K." This would indicate that it is the ZPE particles themselves that are impinging on the helium atoms and giving them the unusual properties of super fluid helium. Both helium and the ZPE are collections of particles and as such obey the Maxwell-Boltzmann equation for energy distribution. When the helium is cooled to 2.7º the CMB and ZPE energy distribution curves begin to coincide and a resonance between the ZPE particles and the helium atoms begins. This is the onset of the two fluid model proposed by Landau[48] in which the mixture of helium atoms is composed of normal helium atoms with normal viscosity and superfluid helium atoms with zero viscosity. This process proceeds down to 0º K, at which point all of the helium atoms are superfluid. Super fluid helium could not climb up the walls of a container without input from an external source of energy.

2.7. Electromagnetism

When a photon of sufficient energy is halted, it can produce an electron and a positron. This is further evidence that a photon consists of two opposite spinning particles, or neutrino anti-neutrino. To become an electron or positron, the photon particles must form a resonance with the surrounding sea of ZPE particles. Dr. David Koltick and his team directed a beam of high energy particles at electrons to investigate the cloud of virtual particles surrounding them.[49] It is

proposed that this cloud is a vortex that produces charge. The equation for this vortex is $V = e/\sqrt{Mr}$ or, $V = N/\sqrt{r}$ (where N is a constant). That charge is a function of the dynamics of the surrounding sea of ZPE particles and not of the charged particles themselves, is indicated by the fact that electrons and protons produce charges of the same magnitude, but with opposite directions of their vortex swirl. There is a great difference between an electron and a proton. If charge were only two dimensional, it could reverse simply by turning over. To prevent this, charge must be three dimensional, or "handed". The circumferential movement is electrostatic charge and the axial movement is magnetism. When two particles with the same charge approach each other their adjacent spins are opposite to each other and a pressure builds up to force the particles apart. When two particles with opposite charge approach each other their adjacent spins are in the same direction. This results in a lower pressure between them and the external pressure forces them together. The reason that two opposite charges do not touch is because the unified flow between them ultimately has enough pressure to resist the pressure of the external ZPE field. A stable condition of charge results when the angular momentum of the spinning particle (or particles) is the same as h, the angular momentum of the ZPE particles surrounding the spinning particle. For the electron:

$$h = m_e c \lambda_e. \qquad \text{where: } \lambda_e \text{ is the Compton wavelength} \tag{9}$$

2.8. The strong force

In the Standard Model the strong force is 100x the electrostatic force. Combining this with the Casimir equation gives:

$$F = \pi\, hc\, A/480\, a^4 = 100\, k_e\, q^2/r^2 \tag{10}$$

where: A = area involved, a = separation of particles, k_e = Coulomb's constant, q = charge, r = separation of charges. If it is assumed that (A) is a function of (a), (the closer the distance, the smaller the affected area) then the linear dimensions cancel and we are left with:

$$\pi^2\, hc/480 = 100\, k_e\, q^2$$

$$9.87 \times 6.62 \times 10^{-34} \times 3 \times 10^8 /480 = 100 \times 8.99 \times 10^9 (1.6 \times 10^{-19})^2$$

$$0.408 \times 10^{-26} = 2.3 \times 10^{-26}$$

The close similarity of these two values would indicate that the strong force is the ultimate Casimir force where the particles are so close that virtually all frequencies of the ZPE field are excluded and the full force of Section E. acts on the particles involved.

The strength of the electromagnetic fields is a function of the vortex flows of the ZPE particles around the charged particles, but this force is not as strong as the total ρv^2 pressure of the ZPE field as calculated in Section E. A. Mehta[50] modified Casimir's formula to accommodate curved surfaces. Using this modified formula with the published size of the proton and a separation of 1 fm he calculated that the Casimir force holding the two protons together was approximately 33 times stronger than the electrostatic forces pushing them apart

The strong force can involve a neutron and a proton or a proton and a proton. The neutron-proton reactions are normally seen on earth while proton-proton reactions require the energy of the interior of the sun. If some external force or momentum should force the neutron and the proton, or proton and proton close enough together (in the order of 10^{-15}m) they would block out the flow of all wavelengths of the ZPE field between them, similar to the Casimir effect. However, in the Casimir effect, because of mechanical limitations of the minimum distance separating the plates, only the longer wavelengths are blocked and the effect is very weak. In the strong force all of the wavelengths are blocked and the effect is very strong because the entire ρv^2 pressure of the ZPE field is brought to bear against the objective areas of the nucleons. The vortex field of the proton serves as a buffer, acting like a spring, to prevent the nucleons from coming in direct contact with each other. The farther the nucleons are apart the weaker this spring effect becomes so that the force of the constant external pressure appears stronger with greater separation. The strong force is limited to a short range because as soon as the nucleons become separated enough for the shorter ZPE wavelengths to get between them the strong force is rapidly reduced. This would explain why the strong force gets stronger with greater separation but acts only over a very short distance.

The graph of the strong force is the result of two opposing forces: the force of the ZPE field ($\frac{1}{2}\rho AV^2$) forcing the nucleons together and the resistance of the nucleons to the forces pushing them together (for the proton- proton reaction this is $k_e e^2/r^2$). See Fig. 1.

2.9. Gravity and electromagnetism

Newton's formula for gravity ($F = GM_1M_2/r^2$) and Coulomb's formula for electrostatic force ($F = k_e e_1 e_2/r^2$) both have the

same form, which would indicate similar mechanisms. The formulas for the gravitational and electromagnetic vortices also have the same form as shown above ($V_g = N/\sqrt{r}$; $V_e = N/\sqrt{r}$). The macro movement of the ZPE particles swirling about a mass body produces the force of gravity, as described earlier. The micro movement of the ZPE particles in a resonant vortex of sufficient energy around a particle, or particles, produces charge. The reason for the vast difference in the strengths of the gravitational and electromagnetic fields lies in the velocities of the swirl of their respective vortices. The gravitational vortex velocity is in the order of a few kilometers per second (except for black holes). The electrostatic vortex velocity is much higher and considering that the electrostatic orbits are immensely smaller, the electrostatic forces must be immensely greater.

Some examples are as follows:

1. Gravity

$$M_2V^2/r = GM_1M^2/r^2 \quad (11)$$

$V = \sqrt{GM_1/r} = 2.98 \times 10^4$ m/s for earth orbital velocity.

2. Electrostatics

$$MV^2/r = k_ce^2/r^2 \quad (12)$$

$V = \sqrt{k_ce^2/Mr} = 2.19 \times 10^6$ m/s for the electron in the lowest Bohr orbit of hydrogen.

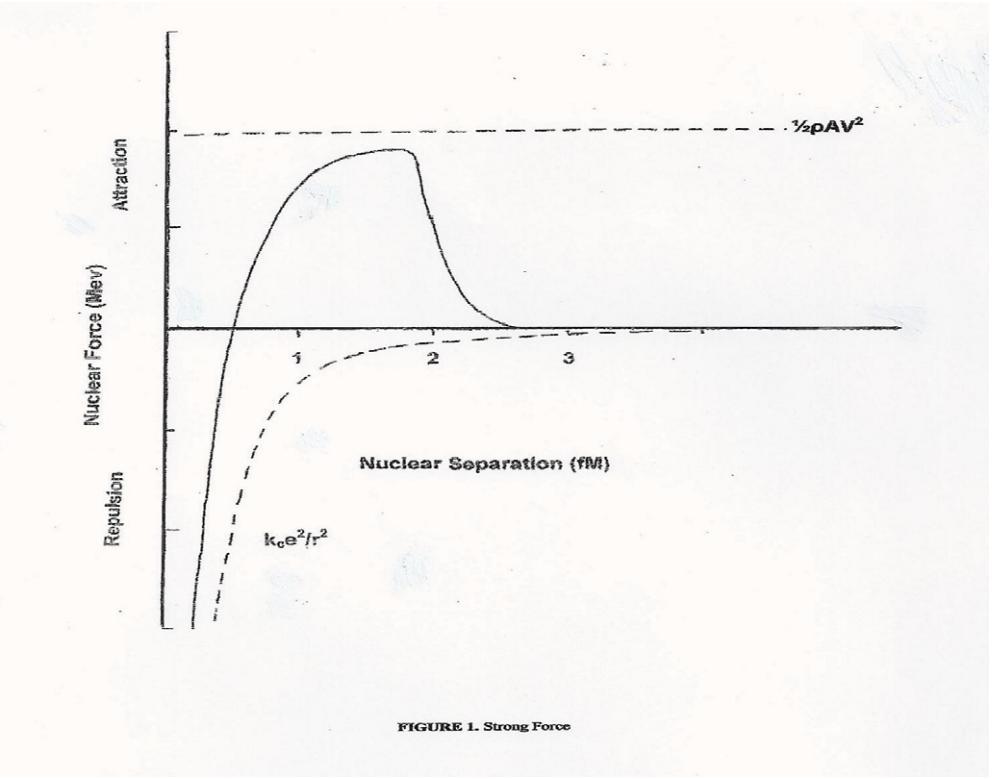

FIGURE 1. Strong Force

3. Conclusion

It is proposed that space is filled with ZPE particles and their density is measured by the gravitation constant, G. Mass objects create vortices of ZPE particles around them. The directional movement of the particles reduces the pressure around the mass objects and produces the force of gravity. The earth does not drift through the sea of ZPE particles but flows in the Sun's vortex stream at the same velocity as the stream. The average mass of a ZPE particle is calculated from the CMB energy. It is proposed that the velocity of light is the velocity of the wave front in the sea of ZPE particles and is

a function of the temperature and density of the ZPE The density of space is combined with the concept of vortex gravity previously proposed to calculate the gravitational force necessary to hold earth in orbit. The pressure of space is calculated using the density of space and the random velocity of the ZPE particles. The zero point energy of helium is calculated and compared to the energy of the CMB. Since these values are quite close, it is proposed that the CMB is the cause of super fluid helium.

A reason why neutrinos travel faster than the speed of light is proposed without jeopardizing Einstein's theory of relativity. If the speed of the wave front in the sea of ZPE particles is the speed of light then nothing can speed through the ZPE particles faster than the wave front. If the speed of light is the speed of the wave front in the ZPE particles, then the random motion of the ZPE particles must be faster than the wave front because the wave front moves in one direction while the random motion is in three directions.

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