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THE QUANTUM MECHANICAL ELECTROMAGNETIC APPROACH TO GRAVITY

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SUMMARY

A proposition is developed from the concepts of a previous essay and are enhanced immensely by a quantum mechanical development. This development fulfills to a large extent the promise of the previous essay and forms a satisfying explanation of several enigmas under a unifying principal. Gravity is characterized as an essential property of matter as conceived by quantum mechanics. Considerable optimism is expressed as to the possibility of a gravitational shield. Other essential experiments are mentioned.

INTRODUCTION

During the cursory inspection of the gravity phenomenon attention is immediately focused on the fact that electrostatic, magnetic and gravitational problems have a principal solution of the same dimensionality, i.e., they follow the same differential equation. Thus one is lead to surmize that, microscopically, at least, the three phenomena are different manifestations of the same principal. This expectation is intensified when two other points are apperceived; 1. that magnetic fields are due only to moving electric charges, 2. that mathematical physics recognized no other phenomenon which is described by the same differential equation. It is significant to remark that classical electromagnetic theory is now a sub-section of quantum mechanics.

RECAPITULATION

The author finds it desirable, not only because of the restricted length of the essay, but also because the ideas presented there are essential precursors to the present essay, to draw heavily on the concepts and calculations presented in previous paper. In this paper entitled A Heuristic Electromagnetic Approach to Gravity the author described "gravitational force" as "primarily due to the interaction of charged particles:.. with levo pulses of very long characteristic length." Moreover it is considered essential to the intelligibility of the present paper to further quote the following paragraph. "The locus of a charged particle in a perpendicular electric and magnetic field is a cycloid with a principal direction of motion orthogonal to both, the electric and magnetic vector. Moreover, both positive and negative particles move in the same direction. If either the direction of the electric or magnetic vector is reversed, the principal motion of the charged particles is also reversed. In an electromagnetic wave, the direction of propagation, the electric vector, and the magnetic vector are mutually orthogonal. If these directions can be superimposed respectively upon e_1, e_2, and e_3 of right-handed cartesian coordinates, let the electromagnetic wave be described as a dextro-wave or dextro-pulse and the other case described as a levo-wave or pulse. During normal propagation the levo-wave retains its identity. Upon reflection, however, due to the reversal in the direction of the electro vector, it is transformed into the dextro-wave. The charged particle in the field of levo-wave moves in the direction of the source, even when the wave is oscillatory, and in the presence of the dextro-wave in the direction of propagation. The average force on the particle is proportional to the product of the charge and the field strength."

DEVELOPMENT

I. A flagrant violation of the principals of quantum mechanics would result if an electron or a point mass was considered as truly stationary. Consequently it might be reasonably asked, in what manner is the force upon a charge particle due to a levo wave affected by the oscillation of that particle. An estimation of the effect can be obtained by considering the particle as attracted to the ex_2 axis with a force proportional to the x_2 coordinate in the presence of orthogonal electro, magnetic fields perpendicular to the x_2 axis. (See Appendix I) The average force in the x_2 direction is obtained by integrating the force over a single period. (See Appendix II) Forces in the other directions average to zero as indicated by the periodicity of the path. This force then is

$$1. \quad \overline{F}_2 = \frac{eE}{\pi} \; \frac{eH}{mc} \; \frac{1}{\sqrt{\frac{K}{m}}}$$

when

$$\sqrt{\frac{K}{m}} \gg \frac{eH}{mc}$$

where $\sqrt{\frac{K}{m}}$ refers to the natural frequency of the free oscillating particle. In a medium of permeability μ and dielectric constant K the average force is then

$$2. \quad \overline{F}_2 = \frac{eE}{K\pi} \; \frac{eH}{\mu mc} \; \frac{1}{\sqrt{\frac{K}{m}}}$$

<u>II</u> The thesis that gravitation is ultimately a quantum phenomenon suggests to the mathematical physicist that the governing equation and conditions are those of a STURM LIOUVILLE SYSTEM; expressively, a differential equation of the form

$$Ly + K^2 y = 0 \qquad + \quad R.B.C.$$

with so called regular boundary conditions, where L is a differential operator, K^2 a positive constant, and y is the non-trivial solution of the equation. In Quantum Mechanics the operator L corresponds to the Hamiltonian of classical mechanics, K^2 corresponds to the energy eigenvalues, i.e. the energy of the stationary states, and y becomes the probability distribution function ψ. As K^2 becomes smaller and smaller the stationary states becomes everywhere dense, i.e. the character of the generalized solution approaches the classical solution.

This important principal is rendered forceful by the following: Consider the Schrodinger Wave Equation

$$3. \qquad \Delta\psi_n + \frac{2m}{K^2}(E_n - V)\psi_n = 0$$

where V is a complicated electromagnetic potential function. If the eigenvalues E_n are significantly small then as suggested before, for macroscopic phenomena it is seen by inspection that Schrodinger wave equation reduces to the electrostatic potential equations, i.e., the familiar Poisson equation.

$$\Delta \psi = \rho$$

Subject to the restriction of the Correspondence Principal namely that gravity is observed as a continuous phenomenon the wave equation enables one to estimate exactly how small t that energy must be. That K^2 should be negligable let one set

$$10^{-4} \cong K^2 \cong \frac{8\pi^2 m}{h^2} E_n \qquad m = 1.6 \times 10^{-24}\,gm$$

$$h = 6.6 \times 10^{-27}\,erg\ sec.$$

$$E_n = 3.5 \times 10^{-35}\,erg$$

This then is the upper limit as a smaller would make even more precise the classical Poisson equation. Then combined with the limit of a previous paper

$$10^{-59}\,ergs \leq E_n \leq 3 \times 10^{-35}\,ergs$$

Thus it is seen that the still crude theory places definite limits on the energy of the levo waves. Now it is intelligible that none but the most carefully designed experiments could directly detect waves within this energy range.

III. Determinism as a philosophy lost its theoretical and physical basis upon the establishment of quantum mechanics as an applicable description of the physical reality. Thus the electron now has a dual nature, exempli gratia, the collapse of the extended wave packet to a point on the oscilloscope screen, thus precise measurments begin to suffer from a real inescapable theoretical uncertainty, thus the solution y of the potential equation is superseded by a probability distribution function ψ.

Classical determinism suffered defeat when it failed to describe reality in situations involging few particles of small size. Quantum Mechanics on the other hand suggest in the Heisenberg Principle

$$\Delta x \Delta p_x \geq \frac{h}{2\pi} \qquad p_x = m v_x$$

that both the velocity and the position of a particle cannot be simultaneously determined t to every value of accuracy. From neutron diffraction it is known that the radius of a nucleus is approximately 10^{-13} centimeters. However, it is conceived not as an impenetrable ball of that radius but rather as a smear of mass whose probability density has significant value to that distance. A pragmatic description of such a situation could be that of a point mass in a state of three-dimensional oscillation. When the three dimensions are equivalent then the oscillation would be spherical around a most probable position. The frequency of these oscillations can be estimated if one assumes $\nu = \sqrt{\frac{K}{m}}$ corresponds through the restoring force constant of a harmonic oscillator. Quantum mechanically the energy of a harmonic oscillator is

$$E_v = (v + \tfrac{1}{2}) h \nu \qquad v = 0, 1, 2, 3, \ldots$$

An estimation of this energy can be obtained by considering the nucleus as a particle of mass M in a box whose sides, a are 10^{-13} cm. long; then

$$E_n = \frac{h^2}{8m} \, 3 \frac{n^2}{a^2} \qquad n = 1, 2, 3 \ldots$$

Now equating the energies substituting $\nu = \sqrt{\frac{K}{m}}$ an estimation of is calculable if the nucleus is to be considered in the ground state, i.e., $v = 0, n = 1$ So

$$\sqrt{\frac{K}{m}} \cong 3 \times 10^{23} \, sec^{-1}$$

Allow the author to recapitulate, thus properly orienting the reader for the remainder of the treatise. In a previous paper by the author it was mentioned that the electrostatic force is approximately 10^{25} times that of gravity. Now if it is allowed the author to make a most reasonable assumption, namely that the force of gravity is an inter-action of a electro-magnetic field with a charged mass, and not, say, with the volume of an atom (thus rather the volume of anucleus or an electron as above) then the author suggests that equation 2, though derived for a specific example, is in general applicable to just the case at hand. Stated succintly, the average force on a charged particle due to a radiated wave can be reduced to a minute fraction of its value if the particle is given a three-dimensional oscillation of extremely high frequency. Thus it is that in the fundamental nature of matter as suggested by Quantum Mechanics resides the key to the gravitational enigma. On the above basis the extreme difference between gravitation and electrostatic force is clarified eloquently. It should be pointed out that both fields are necessary, and not one independently. This points again to a radiated wave.

That the Quantum Mechanic Electromagnetic Postulate has consistency is demonstrated when a few additional relationships are developed. Physicists show that half of the energy of a radiated wave is magnetic and half electrostatic. Then it follows

4. $$\frac{1}{2} E_L = \int_{\substack{\text{all}\\ \text{space}}} \frac{D^2}{K 8\pi}\, d\tau = \frac{1}{c^2} \int_{\substack{\text{all}\\ \text{space}}} \frac{B^2}{\mu 8\pi}\, d\tau \qquad E_L = E \text{ of Load wave}$$

consider however D^2 and B^2 as average b, and denote that average by $\overline{D^2}$ and $\overline{B^2}$,

then $$\frac{E_L}{2} = \frac{\overline{D^2}}{K 8\pi} V = \frac{\overline{B^2}}{\mu 8\pi c^2} V$$

V = volume of radiation

therefore

5, $$\frac{\overline{F_2}}{e\frac{\sqrt{\overline{D^2 B^2}}}{c}} = \frac{\overline{F_2}}{eE} = 10^{-25} = \frac{e\sqrt{K\mu\pi}}{K\mu\pi\sqrt{V}} \quad \frac{2\sqrt{E_L}}{m} \quad \frac{1}{\sqrt{\frac{K}{m}}}$$

if $\sqrt{K\mu}$ is of the order 10 then

$$V \cong 4 \times 10^{-28}\ \overline{cm}^3$$

the extreme minuteness of indicates that, similar to all diffraction studies, the wave packet at the point of inter-action collapses to point inter-action (i.e. not as an extended field but rather as a point field). This collapse can be formulated mathematically as a Dirac Function of the coordinance and minus time. Thus, not only is the oscillatory nature of the particle essentially quantum mechanical, but also is the absorption of the levo pulse by the particle.

Allow the author to remind the reader that the production of levo waves is also quantum mechanical in nature. (see previous paper). It is speculated that the motivating force for the statistical excess of levo waves over dextro waves is in the production of resonance energy. The closer the particles are the more exchanges of levo waves can take place. This increase in exchange rate results in a larger resonance energy, hence a more stable spacial configuration.

EXPERIMENTATION

1. The Gravitational Shield. The credibility of a Gravitational shield is established entirely on the credibility on the above theory. The consistency of the theory is clearly cognoted in both papers. The dimensional gravitational constant reduces to a convenience and not insoluble enigma, since both production and absorption of levo waves is proportional to mass units. The relations between various potential equations are clarified. It would seem a fortress has fallen. However, such optimism belies the immense formulism and detailed work of construction. The plausability of a gravity shield rests then on the equation 2.

$$\bar{F}_2 = \frac{eE}{K\pi} \, \frac{eH}{\mu mc} \, \frac{1}{\sqrt{\frac{K}{m}}}$$

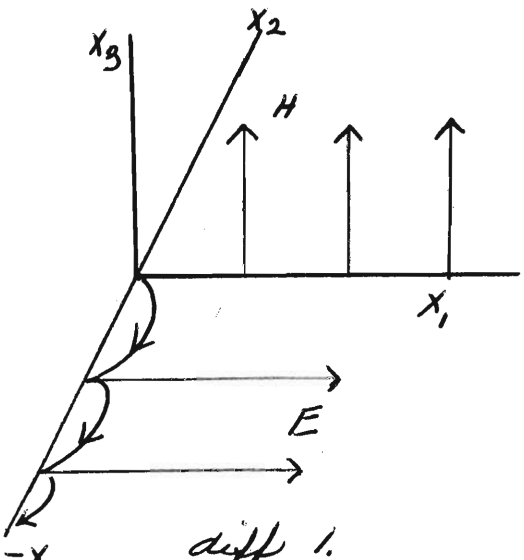
More explicitly in the statement that gravitational force is proportional to $\frac{1}{\sqrt{K\mu}}$ (see 5). More generally any method that reduces E and H at the object of interest could act as a shield. Classically these are every day materials, iron, copper, glycerol. (For an experimental set up using a shield see Appendix 3). However, the classical concepts might be necessary such as producing superconductors as equal potential surfaces at liquid helium temperatures.

2. Induced Emmision. Levo pulses of micro wave length can be produced by special equipment. These can be diffracted in such a manner that the test material is located in an

interference zone. Such a zone might contain levo pulses of low-energy corresponding to those postulated. In the presence of a levo field the material might experience a non uniform gravitational field derived from the spectroscopic principal of induce emmission.

3. Polarization. In the presence of sufficiently strong magnetic fields it may be possible to affect spacial quantization of the nucleus, corresponding to that of the Zeeman effect. Such a polarization of the nuclear oscillation should result in variations of gravitational force with the direction of the magnetic field.

APPENDIX - Part 1.



diff 1.
subs. 2

Eqn. of Motion

$$m\ddot{x}_i = gE_i + \frac{g}{c}\varepsilon_{iK}H_m - \delta_{i,}Kx_1$$

$$H = (00H) \qquad E = (E00)$$

Then

$$\ddot{x}_1 = \frac{e}{m}E + \frac{e}{mc}\dot{x}_2 H - \frac{K}{m}x_1$$

$$\ddot{x}_2 = -\frac{e}{mc}\dot{x}_1 H$$

$$\dddot{x}_1 = \frac{e}{mc}\ddot{x}_2 H - \frac{K}{m}\dot{x}_1$$

$$\dddot{x}_1 = -\left[\left(\frac{eH}{mc}\right)^2 + \frac{K}{m}\right]\dot{x}_1 = -R^2\dot{x}_1$$

$$R > 0 = \text{const.}$$

Let $\dot{x}_1 = y$ Then

$$y = A\sin Rt + B\cos Rt$$

Let $x = \dot{x} = 0$ at $t = 0$

$$\dot{x}_1 = A\sin Rt$$

Integrating

$$x_1 = \frac{A}{R}(1 - \cos Rt)$$

Evaluate A From 1, and Starting Values

$$0 = \frac{e}{m}E - \left(\frac{eH}{mc}\right)^2\frac{A}{R} - \frac{K}{m}\frac{A}{R}$$

$$0 = \frac{eE}{m} - \left[\left(\frac{eH}{mc}\right)^2 + \frac{K}{m}\right]\frac{A}{R}$$

$$\frac{eE}{m} = RA$$

$$A = \frac{eE}{mR} = \frac{eE}{m}\frac{1}{\sqrt{\left(\frac{eH}{mc}\right)^2 + \frac{K}{m}}}$$

APPENDIX - Part 2

$$\ddot{X}_2 = -\frac{eH}{mc}\frac{eE}{mR}\sin Rt$$

$$F_2 = \ddot{X}_2 m$$

$$\therefore \quad F_2 = -\frac{eH}{m}\frac{eE}{mR}\sin Rt$$

INTEGRATE OVER A SPHERE

$$\bar{F}_2 = -\frac{1}{\pi}\frac{eE}{m}\frac{eH}{R_1}$$

$$= -\frac{1}{\pi}\frac{eH}{mc}\frac{eE}{\sqrt{\left(\frac{eH}{mc}\right)^2+\frac{K}{m}}}$$

FOR $\frac{K}{m} \gg \left(\frac{eH}{mc}\right)^2$

$$\bar{F}_2 = -\frac{eE}{\pi}\frac{eH}{mc}\frac{1}{\sqrt{\frac{K}{m}}}$$

APPENDIX - Part 3