THE DYNAMICS OF ECE2 VACUUM PARTICLES

by

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ABSTRACT

The dynamics are developed of the fundamental vacuum particle discovered in UFT338. The relativistic hamiltonian of the vacuum is inferred, and the Hilbert constant is reinterpreted in terms of the velocity of the vacuum particle multiplied by the universal power absorption coefficient as in UFT49. It is argued that the universe is an equilibrium between elementary and vacuum particles. This process has no beginning and no end. The mass of the universe is made up of the combined mass of elementary and vacuum particles. Some examples are given of Compton type scattering processes between the two types of particle.

Keywords: ECE2 theory, dynamics of vacuum particles.

UFT 339

1. INTRODUCTION

In recent papers of this series the high impact ECE2 papers (UFT313 - UFT320, and UFT322 - UFT338) have been developed from the correct geometry of the second Bianchi identity, inferred in UFT88, UFT99, UFT109 and the Jacobi Cartan Evans identity of UFT313). One of the major inferences of the ECE2 series is that there exists a new kind of relativity named ECE2 special relativity whose equations are largely the same in structure as those of special relativity but which exist in a space with finite torsion and curvature in general, described by a spin connection. So ECE2 special relativity is a fusion of the old special relativity (flat Minkowski spacetime, no spin connection, curvature or torsion) and ECE general relativity {1 - 12}. It gives equations of electrodynamics and gravitation that are identical in structure. It has been shown, for example, (UFT325), that precession of the perihelion can be described by simultaneously solving the hamiltonian and lagrangian of ECE2 special relativity. No other ideas are needed to produce planetary precession. Other major discoveries of the ECE2 series include the refutation of the Dirac equation by showing the unphysical nature of its basic approximation, and the refutation of quantum electrodynamics by deriving the anomalous g factor of the electron from the vacuum particle. Many other developments are possible in several areas of physics , engineering and cosmology, for example the synthesis of pairs of elementary particles and antiparticles from colliding and transmuting vacuum particles, vehicular propulsion by the vacuum, and the explanation of the radiative corrections with vacuum particle dynamics.

Section 2 of this paper gives a short summary of the theory of vacuum particle mass and velocity, gives a new explanation for the Hubble constant, and initiates several types of Compton scattering theory involving elementary and vacuum particles. This paper should be read along with its background notes which are posted with UFT339 on

www.aias.us.

Note 339(1) develops the Lorentz factor in terms of the anomalous g factor of the electron and proves the self contradictory nature of the Dirac approximation (see preceding EC2 papers). It replaces the Dirac theory with a new development that gives spin orbit fine structure and the Thomas factor without using the Dirac approximation. Note 339(2) gives the relativistic hamiltonian of the vacuum and discusses the nature of the minimal prescription. Note 339(3) is the basis of some of the discussion in Section 2 and gives a new interpretation of the Hubble constant in terms of the movement of the vacuum frame with the velocity of the vacuum particle deduced in UFT338. Using the theory of UFT49, the Hubble constant is defined by the vacuum particle (i.e. vacuum frame) velocity multiplied by a universal and fundamental power absorption coefficient. The universe does not expand, its mass is given largely by vacuum particles, and its evolutionary process is an equilibrium without beginning or end. There is no big bang and there is no hypothetical and ad hoc "dark matter", which has no basis in relativity. The new theory of this paper is firmly rooted in relativity. Note 339(4) is a convenient and detailed summary of concepts. Notes 339(5) to 339(7) are used as the basis for the discussion in Section 2 of Compton scattering and transmutation theory using inelastic and energy producing collisions. This is the source of energy from the vacuum. The latter is defined as the Aharonov Bohm vacuum in terms of the spin connection.

2. HUBBLE CONSTANT AND COMPTON SCATTERING

Consider an elementary wave / particle such as the electron interacting with the vacuum wave / particle. As discussed in UFT338, its background notes, and in the background notes to this paper, the angular frequency of the electron matter wave is changed to:

$$\omega \rightarrow \omega + \omega_1 \qquad -(1)$$

where ω_1 is the angular frequency of the vacuum wave / particle. The wave vector of the elementary wave / particle is changed to:

$$\underline{k} \rightarrow \underline{k} + \underline{k}_1 . \quad -(2)$$

The de Broglie / Einstein equations of the elementary wave / particle of experimentally measured mass m become:

$$E = \hbar(\omega + \omega_1) = \gamma m c^2 \quad -(3)$$

$$\underline{p} = \hbar(\underline{k} + \underline{k}_1) = \gamma m \underline{v}_0 \quad -(4)$$

where $\hbar$ is the reduced Planck constant, γ is the Lorentz factor and $\underline{v}_0$ The non relativistic velocity. In general the Lorentz factor is:

$$\gamma = \frac{\hbar}{mc^2}(\omega + \omega_1) \quad -(5)$$

and for an electron at rest in the observer frame it becomes:

$$\gamma = \frac{\hbar}{mc^2}(\omega_0 + \omega_1) = 1 + \frac{\hbar\omega_1}{mc^2} \quad -(6)$$

As in UFT338 the anomalous g factor of the electron is:

$$g = 1 + \gamma \quad -(7)$$

and can be measured with great accuracy. So Eqs. (6) and (7) give the angular frequency of the vacuum particle and the Lorentz factor, which in turn gives the vacuum particle velocity or the velocity of the vacuum frame with respect to the static electron. Finally the de Broglie Einstein equation:

$$\hbar\omega_1 = \gamma m_1 c^2 \quad -(8)$$

gives the mass of the vacuum particle and that of 80% of the universe, dogmatically asserted without proof to be "dark matter".

In UFT49, the Hubble constant was defined to be:

$$H = \alpha c \quad -(9)$$

from a theory that entirely rejected "big bang". The latter's metric is well known to be incorrect due to neglect of torsion. In Eq. (9) α is the power absorption coefficient of the cosmological red shift and c the vacuum speed of light. Eq. (9) can be reinterpreted as:

$$H = v(vac)\alpha_1 \quad -(10)$$

where v(vac) is the velocity of the vacuum frame or ether with respect to a static elementary particle and where α_1 is a universal power absorption coefficient. It is important to note that this type of ether is derived from ECE2 special relativity. The Hubble constant in S. I. units is:

$$H = 2.333 \times 10^{-16} s^{-1} \quad -(11)$$

and the velocity of the vacuum particle or ether frame from UFT338 is:

$$v(vac) = 0.068c \quad -(12)$$

so

$$H = 0.068c\alpha(universal) \quad -(13)$$

It is proposed that α be a universal power absorption coefficient with S. I. Units of

$$\alpha(universal) = 1.1444 \times 10^{-23} m^{-1} \quad -(14)$$

and spectroscopic units of:

$$\alpha(\text{universal}) = 1.1444 \times 10^{-25} \text{ neper cm}^{-1}. \quad -(15)$$

The universal power absorption coefficient is based on the experimental measurement of the Hubble constant. The latter is dogmatically interpreted as:

$$H = \frac{v}{D} \quad -(16)$$

where v is the velocity of an object a proper distance D from the observer. The Hubble constant no longer indicates that distant objects recede faster in an exploding universe. Rather, light from distant objects is absorbed to a greater extent in an infinite universe in equilibrium, an equilibrium between elementary and vacuum particles.

Light from a distant object can become diffuse by scattering form vacuum particles. The rest of this section is a summary of Compton scattering theory described in detail in Notes 339(5) to 339(7). The type of theory used is adapted from the by now classic papers UFT158 to UFT248. Note 339(5) gives the simplest Compton theory of the scattering of a hypothetically massless photon from a static vacuum particle, giving the result:

$$\frac{1}{\omega'} - \frac{1}{\omega} = \frac{\hbar}{m_1 c^2}(1-\cos\theta) \quad -(17)$$

where ω' is the scattered angular frequency and ω the incident frequency of the light, and where m_1 is the mass of the vacuum particle. The angle θ is defined by:

$$(\underline{k} - \underline{k}') \cdot (\underline{k} - \underline{k}') = k^2 + k'^2 - 2kk'\cos\theta \quad -(18)$$

in terms of the scattered and incident wave vectors, precisely as in the well known theory of photon scattering from a static electron {1 -12}. Over cosmological distances the light becomes diffuse as the result of many collisions with vacuum particles, so the overall average effect is:

$$\left\langle \frac{1}{\omega'} - \frac{1}{\omega} \right\rangle = \frac{\hbar}{m_1 c^2} \left\langle 1 - \cos\theta \right\rangle \quad -(19)$$

This is a simple first idea which can be refined and developed in many ways.

As first shown in the classic UFT158 - UFT248, the simple Compton theory collapses completely if attempts are made to apply it to the collision of two particles with mass. The reason is that the Compton theory is elastic scattering, whereas particle collision in general is inelastic and endoergic, described as in UFT246 to UFT248. In general there is transmutation, so the process is, schematically:

$$A + B \rightarrow C + D + E \quad -(20)$$

where E is energy released during the collision. Collision of an elementary particle with a vacuum particle produces energy from the vacuum, E. By crossover symmetry in particle physics, Eq. (20) implies:

$$A + \bar{C} \rightarrow \bar{B} + D + E \quad -(21)$$

where the bar denotes antiparticle. In an elastic collision:

$$E = 0 \quad -(22)$$

as in the usual Compton theory of the collision of a hypothetically massless photon γ and an electron e^- :

$$\gamma + e^- \rightarrow \gamma + e^- \quad -(23)$$

By cross over symmetry:

$$\gamma \rightarrow e^+ \quad (B \rightarrow \bar{C}) \quad -(24)$$

and:

$$e^- \rightarrow \gamma \quad (C \rightarrow \bar{B}) \quad -(25)$$

so Eq. (23) becomes the annihilation of a positron and an electron to give two photons:

$$e^- + e^+ \rightarrow 2\gamma . - (26)$$

However in UFT171 it was shown that an elastic collision theory of Compton type (26) collapses into nonsense. This was given the appellation "equal mass scattering". The correct theory must be inelastic with release of energy E:

$$e^- + e^+ \rightarrow 2\gamma + E. - (27)$$

It is well known that electron positron annihilation produces many different types of products in addition to two photons. The total energy of these products is E.

Similarly the scattering of a photon with mass from as static electron makes sense if and only if the process is inelastic and endoergic:

$$\gamma + e^- \rightarrow \gamma + e^- + E. - (28)$$

Similarly, the collision of two vacuum particles, each of mass m(vac), may lead to transmutation as follows:

$$vac + vac \rightarrow A + B + E - (29)$$

where A and B are elementary particles, and E is energy from the vacuum. It is known experimentally that electron / positron pairs emerge from the vacuum. In this case:

$$vac + vac \rightarrow e^- + e^+ + E. - (30)$$

This process must conserve C, P and T where C is charge conjugation symmetry, T is motion reversal symmetry and P is parity inversion symmetry. The conservation of parity requires that e^- and e^+ be produced by:

$$Vac + \overline{Vac} \rightarrow e^- + e^+ + E \quad -(31)$$

because a vacuum particle has finite mass. A particle is its own antiparticle if and only if the particle is massless. The vacuum particle has a precisely defined mass. This means that there must exist a vacuum antiparticle as well as a vacuum particle. In general synthesis of matter occurs by:

$$Vac + \overline{Vac} \rightarrow A + \overline{A} + E \quad -(32)$$

where A and $\overline{A}$ denote any elementary particle and antiaparticle from which evolve stars, galaxies, planets and so on using well known processes.

The equation of conservation of energy for a vacuum particle colliding with a static vacuum particle is:

$$\gamma m_1 \cdot c^2 + m_1 \cdot c^2 = \gamma' m_1 c^2 + \gamma'' m_1 c^2 + E \quad -(33)$$

and the law of conservation of momentum is:

$$\underline{p} = \underline{p}' + \underline{p}'' \quad -(34)$$

The energy E is calculated using the methods of UFT246 to UFT248 and is

$$E = x + \hbar(\omega - \omega') \mp \left((\omega - \omega')^2 - c'^2\right)^{1/2} \quad -(35)$$

where:

$$c' = 2\left(\omega^2 - x^2\right)^{1/2}\left(\omega'^2 - x^2\right)^{1/2}\cos\theta - 2\omega\omega' + x^2 \quad -(36)$$

and

$$x = m_1 c^2 / \hbar \qquad -(37)$$

Here ω is the angular frequency of the incoming vacuum wave particle

$$E = \gamma m_1 c^2 = \hbar\omega \qquad -(38)$$

and ω' the angular frequency of the wave particle A. The end result of this process is that electron / positron pairs, or any A and A pairs, appear from the vacuum, together with energy E from the vacuum.

The general equation for this process is described in Note 339(7):

$$\gamma m_1 c^2 + m_2 c^2 = \gamma' m_3 c^2 + \gamma'' m_4 c^2 + E \qquad -(39)$$

where particles of mass m_1 and m_2 transmute into m_3 and m_4 with release of energy E. Propulsion by the vacuum can be described by:

$$vac + e^- \Rightarrow e^- + vac + E, \qquad -(40)$$

a process in which a vacuum particle collides with an initially stationary elementary particle such as an electron. The momentum acquired by the electron is:

$$\underline{p}' = \hbar \underline{k}' \qquad -(41)$$

and energy acquired by the electron is:

$$E'(electron) = \gamma' mc^2 \qquad -(42)$$

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