PARTICLE MATTER WAVE THEORY BASED ON THE ECE WAVE EQUATION.

by

M. W. Evans,

Civil List

(www.webarchive.org.uk, www.aias.us, www.upitec.org, www.et3m.net,

www.atomicprecision.com)

ABSTRACT

A new particle matter wave theory is developed to account for the severe self inconsistencies found in earlier work in the particle particle theory of Compton scattering and other scattering and absorption phenomena. The theory is based on a minimal prescription incorporated in the Einstein energy equation. The resulting Hamilton Jacobi equation is shown to be the classical version of an ECE wave equation that describes particle scattering in terms of particle matter wave theory instead of particle particle theory. The particle matter wave theory is self consistent and successfully describes scattering phenomena, for example the Compton scattering of two massive particles.

Keywords: ECE wave equation, particle field theory, scattering phenomena.

UFT 181

1. INTRODUCTION

In UFT 158 ff of this series of papers {1 - 10} it was found that the de Broglie Einstein equations {11, 12} become severely self inconsistent in the standard particle particle theory of scattering and absorption. The self inconsistency shows up for example in the Compton scattering of two particles with mass when momentum conservation is properly taken into account. The work reported in UFT 158 ff was checked with computer algebra, which eliminates any possibility of calculation error. Therefore the de Broglie Einstein equations were found to be limited in applicability, a surprising result for physics because these equations result directly from special relativity and the basics of quantum theory proposed by Planck and de Broglie. It is well known that special relativity and quantum mechanics are precise theories when tested independently. The self inconsistency manifests itself in an apparent variation of the mass of a given particle. In UFT 160 the concept of covariant mass was proposed, a concept based on the ECE wave equation, and this new concept proposed as a postulate to accompany the two de Broglie Einstein postulates.

In Section 2, a minimal prescription is used to describe the interaction of a particle of given measured mass with the matter wave of another particle. The matter wave is due to the field potential of the second particle. The minimal prescription is incorporated in the Einstein energy equation of special relativity to give a relativistic Hamilton Jacobi equation on the classical level. This equation is shown to be the classical limit of an ECE wave equation. In Section 3, some results of UFT 158 ff. are interpreted self consistently in terms of a particle interacting with the matter wave of a second particle. The matter wave is missing from the Einstein de Broglie equations and the apparent variation of mass found in UFT 158 ff. and UFT 171 can be interpreted through the angular frequency and wave-vector of the matter wave. The total mass of the particle is the mass of the free particle (the mass recorded in standards laboratories) combined with the mass of its matter wave. It is shown that standard Compton scattering theory appears to work because the incoming photon is massless, so it is its own matter wave.

2. MINIMAL PRESCRIPTION AND HAMILTON JACOBI EQUATION.

Consider the energy momentum of a free particle of measured mass m_0:

$$p^\mu = \left(\frac{E}{c}, \underline{p} \right) \quad -(1)$$

where E is its total energy and $\underline{p}$ is its relativistic momentum. In special relativity the free particle is described by the Einstein energy equation:

$$E^2 = c^2 p^2 + m_0^2 c^4 \quad -(2)$$

which can be deduced from the relativistic momentum:

$$\underline{p} = \gamma m_0 \underline{v} \quad -(3)$$

where γ is the well known Lorentz factor. The de Broglie Einstein equations {11, 12} are:

$$E = \gamma m_0 c^2 = \hbar \omega \quad -(4)$$

$$\underline{p} = \gamma m_0 \underline{v} = \hbar \underline{\kappa} \quad -(5)$$

and put together the quantum theory and special relativity. Here ω is the angular frequency of the matter wave, and $\underline{\kappa}$ is its wave-vector. The equations can be combined as:

$$p^\mu = \hbar \kappa^\mu . \quad -(6)$$

Particle scattering is described in standard physics using Eq. (6) in the laws of conservation and momentum. It was shown in UFT 158 ff. and UFT 171 that this procedure is severely inconsistent with the exception of Compton scattering of a massless particle (the photon), from an initially static electron. The cause of the inconsistency is the assumption that the particle masses are constant.

In this section, the interaction is described by a minimal prescription:

$$p^{\mu} \rightarrow p^{\mu} - \hbar \kappa^{\mu} \quad -(7)$$

analogous to the well known minimal prescription

$$p^{\mu} \rightarrow p^{\mu} - eA^{\mu} \quad -(8)$$

for the interaction of an electron with an electromagnetic potential A^{μ}, where -e is the charge on the electron. Therefore in Eq. (7), $\hbar \kappa^{\mu}$ is the matter wave of particle 2 and p^{μ} the energy momentum of particle 1. Using Eq. (7) in Eq. (2) gives the relativistic Hamilton Jacobi equation:

$$\left(p^{\mu} - \hbar \kappa^{\mu}\right)\left(p_{\mu} - \hbar \kappa_{\mu}\right) = m_0^2 c^2 \quad -(9)$$

which may be expanded as:

$$p^{\mu} p_{\mu} + \hbar^2 \kappa^{\mu} \kappa_{\mu} - \hbar\left(\kappa^{\mu} p_{\mu} + p^{\mu} \kappa_{\mu}\right) = m_0^2 c^2 \quad -(10)$$

Now write the left hand side as:

$$p^{\mu} p_{\mu} - \hbar^2 R_1 = m_0^2 c^2. \quad -(11)$$

The Schroedinger postulate:

$$p^{\mu} = i\hbar \partial^{\mu} \quad -(12)$$

gives:

$$p^\mu p_\mu = -\hbar^2 \Box \quad -(13)$$

and Eq. (11) becomes the classical equivalent of an ECE wave equation:

$$\left(\Box + R_1 + \left(\frac{m_0 c}{\hbar}\right)^2 \right) \phi = 0. \quad -(14)$$

Using the Schroedinger postulate R_1 can be found as follows:

$$R_1 = \kappa^\mu \kappa_\mu = \frac{\omega^2}{c^2} - \kappa^2. \quad -(15)$$

The ECE wave equation (14) describes the interaction of the matter wave of particle 2 with particle 1, of mass m_0. The mass of the matter wave may be defined by:

$$R_1 = \left(\frac{mc}{\hbar}\right)^2 = \frac{\omega^2}{c^2} - \kappa^2 \quad -(16)$$

i.e.:

$$\boxed{m = \frac{\hbar}{c}\left(\frac{\omega^2}{c^2} - \kappa^2\right)^{1/2}} \quad -(17)$$

The de Broglie Einstein equations of this mass are:

$$E = \gamma m c^2 = \hbar\omega \quad -(18)$$

$$\underline{p} = \gamma m \underline{v} = \hbar \underline{\kappa} \quad -(19)$$

and its Einstein equation is:

$$E^2 = c^2 p^2 + m^2 c^4 \quad -(20)$$

which is the classical equivalent of:

$$\left(\Box + \frac{\omega^2}{c^2} - \kappa^2 \right) \phi = 0. \quad -(21)$$

The standard de Broglie Einstein theory used the constant mass m_2 of particle two, whereas the self consistent mass is:

$$m_2 = \frac{\hbar}{c}\left(\frac{\omega_2^2}{c^2} - \kappa_2^2\right)^{1/2}. \quad -(22)$$

This mass is consistent with the minimal prescription, the Hamilton Jacobi equation, and the ECE wave equation. The Hamilton Jacobi and wave equations are not considered in the de Broglie Einstein equations. As found in UFT 158 ff and 171 this mass may vary with ω and κ and appear to be imaginary valued if:

$$\frac{\omega}{c} < \kappa. \quad -(23)$$

3. APPLICATION TO COMPTON SCATTERING

In the general theory of the scattering of an incoming particle of mass m_1 from an initially stationary particle of mass m_2, conservation of energy and momentum must be obeyed. In standard scattering theory the masses m_1 and m_2 are the constant, measured masses as recorded in the standards laboratories. The particle based conservation of energy equation is:

$$\gamma m_1 c^2 + m_2 c^2 = \gamma' m_1 c^2 + \gamma'' m_2 c^2 \quad -(24)$$

where γ is the Lorentz factor of the incoming particle colliding with a stationary particle of rest energy:

$$E_{02} = m_2 c^2. \quad -(25)$$

On the right hand side γ' is the Lorentz factor of particle 1 and γ'' that of particle 2. The particle based conservation of momentum equation is:

$$\underline{p} = \underline{p}' + \underline{p}''. \quad -(26)$$

In the Compton type theory the de Broglie momentum equations are applied as follows:

$$\underline{p} = \hbar \underline{\kappa} = \gamma m_1 \underline{v} , \quad -(27)$$

$$\underline{p}' = \hbar \underline{\kappa}' = \gamma' m_1 \underline{v}' , \quad -(28)$$

$$\underline{p}'' = \hbar \underline{\kappa}'' = \gamma'' m_2 \underline{v}'' , \quad -(29)$$

in which the masses m_1 and m_2 are constant. The Planck energy equations are also used with constant m_1 and m_2:

$$\hbar\omega = \gamma m_1 c^2 , \quad -(30)$$

$$\hbar\omega' = \gamma' m_1 c^2 , \quad -(31)$$

$$\hbar\omega'' = \gamma'' m_2 c^2 . \quad -(32)$$

As shown in UFT 160 the result is that the mass of particle 2 is:

$$x_2 = \left(\omega\omega' - \left(x_1^2 + (\omega^2 - x_1^2)^{1/2} (\omega'^2 - x_1^2)^{1/2} \cos\theta \right) \right) / (\omega - \omega') \quad -(33)$$

where:

$$x_2 = \frac{m_2 c^2}{\hbar} , \quad x_1 = \frac{m_1 c^2}{\hbar} , \quad -(34)$$

and that the mass of particle 1 is, from Eq. (33):

$$x_1^2 = \frac{1}{2a} \left(-b \pm (b^2 - 4ac')^{1/2} \right) \quad -(35)$$

where:

$$a = 1 - \cos^2\theta , \quad -(36)$$

$$b = (\omega'^2 + \omega^2) \cos^2\theta - 2A , \quad -(37)$$

$$c' = A^2 - \omega^2 \omega'^2 \cos^2\theta , \quad -(38)$$

$$A = (\omega\omega' - x_2)(\omega - \omega') . \quad -(39)$$

Here θ is the scattering angle as defined in UFT 160 (www.aias.us). It was found in UFT 158 ff. that if m_2 is assumed to be a constant, then m_1 is not a constant. This result can now be understood as in Section 2, the mass m_1 is defined by the matter wave as:

$$m_1 = \frac{\hbar}{c}\left(\frac{\omega_1^2}{c^2} - \kappa_1^2\right)^{1/2} \quad -(40)$$

and is not constant. The self consistency was revealed the most clearly in UFT 160 by considering equal mass scattering at 90°, in which case:

$$m_1 = m_2 = \frac{\hbar\omega'}{c^2} \quad -(41)$$

an absurd result because the equal masses become frequency dependent. In the self consistent theory of section 2, this absurdity does not occur, because the mass m of particle 2 interacts with the matter field mass of particle 1 as defined self consistently by Eq. (40).

In the well known case of Compton scattering of a massless photon from an initially stationary electron, Eq. (33) reduces to the well known Compton scattering formula:

$$x_2 = \frac{\omega\omega'}{\omega - \omega'}\left(1 - \cos\theta\right) \quad -(42)$$

using:

$$x_1 \rightarrow 0. \quad -(43)$$

The concept of massless photon leads, however, to numerous well known difficulties for standard physics {1 - 10}. For example E and $\underline{p}$ become indeterminate because the massless photon travels at c and the Lorentz factor is infinite, so E and $\underline{p}$ are each zero defined by infinity. The wave equation of the massless photon is:

$$\Box\phi = 0 \quad -(44)$$

because:

$$\omega = c\kappa \quad -(45)$$

and the massless photon has no rest frame. All these difficulties are inherent in the simple looking Compton formula (42) of the textbooks. The massless particle therefore exists only as a matter wave, i.e. it is defined by:

$$E = \hbar\omega, \quad \underline{p} = \hbar\underline{\kappa}. \quad -(46)$$

In this case the Compton formula is accidentally consistent with the theory of section 2, and this is why it appears to work. As soon as the concept of photon with mass is introduced, the correct formulae to use must be (33) and (35) and the correct concepts to use must be those of Section 2.

ACKNOWLEDGMENTS

The British Government is thanked for a Civil List Pension and AIAS colleagues for many interesting discussions. David Burleigh is thanked for posting, Alex Hill for translation and Robert Cheshire and Simon Clifford for broadcasting work.

REFERENCES

{1} M. W. Evans, H. Eckardt and D. W. Lindstrom, "Generally Covariant Unified Field Theory" (Abramis, 2005 onwards), in seven volumes.

{2} M. W. Evans, S. Crothers, H. Eckardt and K. Pendergast, "Criticisms of the Einstein Field Equation" (Cambridge International Science Publishing, 2011).

{3} Kerry Pendergast, "The Life of Myron Evans" (Cambridge International Science Publishing, 2011).

{4} L. Felker, "The Evans Equations of Unified Field Theory" (Abramis, 2007).

{5} The ECE websites, www.webarchive.org.uk, www.aias.us, www.atomicprecision.com, www.et3m.net, www.upitec.org.

{6} M. W. Evans, Ed., J. Foundations Phys. Chem., first 24 issues in press (Cambridge International Science Publishing).

{7} M. W. Evans, Ed., "Modern Non Linear Optics" (Wiley, 2001, second edition).

{8} M. W. Evans and S. Kielich (Eds.), ibid., (Wiley, 1992, 1993, 1997, first edition).

{9} M. W. Evans and L. B. Crowell, "Classical and Quantum Electrodynamics and the B(3) Field" (World Scientific, 2001).

{10} M. W. Evans and J. - P. Vigier, "The Enigmatic Photon" (Kluwer, Dordrecht, 1994 to 2002).

{11} L. de Broglie, Comptes Rendues, 177, 507 (1923).

{12} L. de Broglie, Phil. Mag., 47, 446 (1924).