Refutation of the De Broglie / Einstein theory.

by

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Abstract

By considering the electron Compton scattering of one electron from a stationary second electron, it is shown straightforwardly that the de Broglie / Einstein theory is severely inconsistent. This means that the twentieth century concepts of special relativity and quantum mechanics are not compatible. A suggestion for improvement is made using the Einstein Cartan Evans (ECE) unified field theory, in which the concept of mass is proportional to scalar curvature.

Keywords: Self inconsistency of the de Broglie Einstein theory, ECE theory, special relativity, quantum mechanics.

1. Introduction

The de Broglie Einstein equations of 1922 to 1924 [1, 2] are generally considered to be the basis of twentieth century physics and led directly to the Schroedinger equation. In these equations the total energy E and momentum $\boldsymbol{p}$ of any particle, including the photon, are expressed in terms of special relativity on the one hand and quantum mechanics on the other. The expression for energy and linear momentum must be the same from both aspects of physics, and so were equated by Louis de Broglie while developing his famous concept of wave particle duality, the basis of much of twentieth century natural philosophy (physics) and also chemistry and the life sciences. Compton used X ray scattering from a metal foil [3] to show that his experimental data appeared to verify the de Broglie Einstein equations. This has been become known as Compton scattering, now a routine laboratory experiment.

It is shown in Section 2 that complete consideration of wave particle duality leads to severe internal inconsistencies in the de Broglie / Einstein theory, which can be refuted straightforwardly. This is a major advance in natural philosophy and should lead to an entirely new physics. In Section 2 a suggestion is made to use the Einstein Cartan Evans (ECE) unified field theory [4-12] to begin the development of a new theory of Compton scattering. The internal inconsistency of the de Broglie / Einstein theory is shown most clearly and most simply by consideration of electron Compton scattering at right angles from an initially stationary target electron. A complete consideration of wave particle dualism leads then to the absurd result that the electron mass is proportional to the wave frequency of the scattered electron. The electron mass must be constant, so the de Broglie / Einstein theory fails catastrophically.

In Section 3 the algebra used in this paper is checked by computer algebra, and some numerical refutations given of the theory using experimental data for photon electron and electron-electron Compton scattering taken routinely by undergraduates and others in the laboratory.

2. The complete theory of Compton scattering.

The complete theory of Compton scattering must be based logically on the de Broglie Einstein equations. The equation for relativistic total energy E is:

$$E = \hbar\,\omega = \gamma\, mc^2 \tag{1}$$

and that for relativistic momentum is:

$$\boldsymbol{p} = \hbar\,\boldsymbol{\kappa} = \gamma\, m\boldsymbol{v} \tag{2}$$

where γ is the Lorentz factor:

$$\gamma = \left(1 - \frac{v^2}{c^2}\right)^{-1/2} . \tag{3}$$

These equations were claimed by de Broglie to be true for any elementary particle of mass m, including the photon. They are therefore claimed to be true for the electron as well as the photon, and indeed for any elementary particle such as the proton or neutron. In these equations v is the magnitude of the velocity vector of the particle, and c is considered to be a universal constant, the maximum speed attainable in special relativity. Special relativity is considered to describe the particulate aspect of nature and quantum mechanics the undulatory or wave like aspect of nature. This is the famous wave particle duality of de Broglie given full expression. The two aspects for a given elementary particle were equated by de Broglie, resulting in equations (1) and (2). Here ħ is the reduced Planck constant, ω the angular frequency of the wave, and $\boldsymbol{\kappa}$ its wave-number vector. For any given particle the two aspects of nature, particle and wave, must describe that same particle, so they are equated as in Eqs. (1) and (2). This theory has been developed elaborately in the twentieth century, but here we show quite simply that its basics are severely self-inconsistent.

Consider the scattering of a particle of mass m from an initially stationary particle of mass M in the classical relativistic theory of de Broglie. The process conserves total energy and total momentum. The conservation of total energy is described by:

$$\gamma\, mc^2 + M c^2 = \gamma'\, mc^2 + \gamma''\, M c^2 \qquad (4)$$

On the left hand side appears the total energy of the particle m added to the rest energy of the stationary particle M. On the right hand side appears the total energies of the two scattered particles. The Lorentz factors are:

$$\gamma = \left(1 - \frac{v^2}{c^2}\right)^{-1/2}, \quad \gamma' = \left(1 - \frac{v'^2}{c^2}\right)^{-1/2}, \quad \gamma'' = \left(1 - \frac{v''^2}{c^2}\right)^{-1/2} \qquad (5)$$

The conservation of total momentum is described by:

$$\hbar\, \boldsymbol{\kappa} = \hbar\, \boldsymbol{\kappa}' + \boldsymbol{p}'' \quad . \qquad (6)$$

On the left hand side appears the momentum of the incoming particle and on the right hand side the sum of the momenta of the scattered particles. The incoming particle of mass m has an initial wave-vector, $\boldsymbol{\kappa}$ and is scattered with a wave vector $\boldsymbol{\kappa}'$. The initially stationary target particle of mass M acquires the momentum $\boldsymbol{p}''$. In the usual textbook theory of the photon electron Compton effect [13-14] the Einstein energy equation is used to relate the energy and momentum of the target electron of mass M after collision:

$$E''^2 = p''^2 c^2 + M^2 c^4 \quad . \qquad (7)$$

The photon is assumed to travel always at c, and to have no mass, and in the usual theory c is interpreted as the vacuum speed of light. So in the textbook theory:

$$\kappa = \frac{\omega}{c} \quad , \quad \kappa' = \frac{\omega'}{c} \quad . \qquad (8)$$

The solution of these equations is the usual textbook equation of the photon-electron

Compton effect::

$$\lambda_f - \lambda_i = \lambda_c \, (1 - \cos \theta) \tag{9}$$

where λ_f is the scattered wavelength, λ_i is the initial wavelength, and λ_c the Compton wavelength:

$$\lambda_c = \frac{h}{Mc} \ . \tag{10}$$

Here h is the Planck constant, M the electron mass, and θ the angle of scatter. In UFT 158 it was shown that consideration of finite photon mass, as suggested by de Broglie himself, leads to a catastrophic self inconsistency in the theory. Here in this Section, this inconsistency is illustrated further by reference to electron-electron scattering at right angles. The Compton theory leading to Eq. (9) works if and only if the incoming particle is treated as a wave of no mass, and if and only if the target particle is treated as a particle of mass.

Consider the conservation of energy equation (4) in the case of equal mass scattering:

$$\gamma \, Mc^2 + \ Mc^2 \ = \ \gamma' \, Mc^2 + \gamma'' Mc^2 \tag{11}$$

for example electron-electron scattering. The equation becomes:

$$\gamma + 1 = \gamma' + \gamma'' \tag{12}$$

which is:

$$\gamma'' = \ \gamma \ - \ \gamma' + 1 \ . \tag{13}$$

The energy hypothesis (1) of de Broglie gives:

$$\frac{\gamma'}{\gamma} = \frac{\omega'}{\omega} \quad , \quad \frac{\gamma''}{\gamma} = \frac{\omega''}{\omega} \quad , \quad \frac{\gamma''}{\gamma'} = \frac{\omega''}{\omega'} \quad . \tag{14}$$

The electron is a wave as well as a particle, so the three angular frequencies ω, ω´ and ω´´ are experimental observables. From Eqs. (12) to (14) the Lorentz factors may be expressed in terms of these experimental observables as follows:

$$\gamma' = \left(1 + \frac{\omega'' - \omega}{\omega'} \right)^{-1} \quad , \tag{15}$$

$$\gamma'' = \left(1 + \frac{\omega' - \omega}{\omega''} \right)^{-1} \quad , \tag{16}$$

$$\gamma \ = \left(\frac{\omega'' + \omega'}{\omega} - \ 1 \right)^{-1} \ . \tag{17}$$

It follows that:

$$v^2 = c^2 \; (1 - (\frac{\omega'' + \omega'}{\omega} - 1)^2) \; , \tag{18}$$

$$v'^2 = c^2 \; (1 - (\frac{\omega'' - \omega}{\omega'} + 1)^2) \; , \tag{19}$$

$$v''^2 = c^2 \; (1 - (\frac{\omega' - \omega}{\omega''} + 1)^2) \; . \tag{20}$$

If the de Broglie hypothesis is correct the electron mass should be the following constant:

$$M = \frac{\hbar \, \omega}{\gamma c^2} = \frac{\hbar \, \omega'}{\gamma' c^2} = \frac{\hbar \, \omega''}{\gamma'' c^2} \; . \tag{21}$$

Using the velocity equations (18) to (20), the three expressions for electron mass are:

$$M = \frac{\hbar \, \omega}{\gamma c^2} = \frac{\hbar}{c^2} \; (\omega' + \omega'' - \omega) \; , \tag{22}$$

$$M = \frac{\hbar \, \omega'}{\gamma' c^2} = \frac{\hbar}{c^2} \; (\omega' + \omega'' - \omega) \; , \tag{23}$$

$$M = \frac{\hbar \, \omega''}{\gamma'' c^2} = \frac{\hbar}{c^2} \; (\omega' + \omega'' - \omega) \; . \tag{24}$$

In each case:

$$M = \frac{\hbar}{c^2} \; (\omega' + \omega'' - \omega) \tag{25}$$

if the de Broglie hypothesis is correct.

Consider now the momentum conservation equation (6) when m is the same as M.

The equation is:

$$\boldsymbol{p} = \boldsymbol{p}' + \boldsymbol{p}'' \; . \tag{26}$$

By elementary vector analysis:

$$p^2 = p'^2 + p''^2 + 2 \, p' p'' \cos \theta \tag{27}$$

where θ is the scattering angle. If the second de Broglie hypothesis (2) is correct, Eq. (27) means:

$$\kappa''^2 = \kappa^2 + \kappa'^2 - 2\,\kappa\,\kappa' \cos\theta \quad . \tag{28}$$

For the sake of clarity of purpose consider the case of ninety degree scattering:

$$\cos\theta = 0 \;\; , \;\; \theta = \pi/2 \quad . \tag{29}$$

Eq. (28) simplifies to:

$$\kappa''^2 = \kappa^2 + \kappa'^2 \quad . \tag{30}$$

Using Eqs. (1) and (2) again, Eq. (30) becomes:

$$\omega''^2\, v''^2 = \omega^2\, v^2 + \omega'^2\, v'^2 \quad . \tag{31}$$

Using the velocities (18) to (20) in Eq. (31), and using Eq. (25) gives, after some algebra:

$$\left(\frac{Mc^2}{\hbar}\right)^2 = \omega^2 + \omega'^2 - \omega''^2 \tag{32}$$

Finally solve Eqs. (25) and (32) simultaneously for *M.* The two equations give the quadratic:

$$x^2 + (\omega - \omega')\, x - \omega\, \omega' = 0 \tag{33}$$

where

$$x = \frac{Mc^2}{\hbar} \quad . \tag{34}$$

The two roots of the quadratic are:

$$x = \frac{1}{2}\left(\omega - \omega' \pm (\omega + \omega')\right) \tag{35}$$

and the physically meaningful positive root is:

$$x = \omega' \tag{36}$$

which is simply:

$$M = \frac{\hbar\omega'}{c^2} \quad . \tag{37}$$

This result was checked by computer algebra. It is an absurd result because the electron mass is not constant, it is proportional to ω´, which in general is not a constant.

Therefore the de Broglie Einstein theory has been refuted for the electron, a major disaster for the so called “standard model” of physics.

In ECE theory the mass M is defined by scalar curvature:

$$R = \left(\frac{Mc}{\hbar}\right)^2 \tag{38}$$

and ECE gives the sensible result:

$$R = \left(\frac{\omega'}{c}\right)^2 \tag{39}$$

because R is not a constant in general. Therefore ECE is preferred in yet another way over the standard model. In Section 3, numerical methods are used to refute the de Broglie Einstein theory in several other ways.

3. Parameter study of selected quantities.

As has been shown in Eqs. (18-25), the energy conservation law gives simple expressions of the velocities and mass terms for scattering of particles with equal mass. Besides the frequency ω of the incoming particle, these terms depend on the frequencies ω' and ω'' of the final states of both scattered particles. The question is which ranges are allowed to give terms $v > 0$ and $M > 0$. We have performed parameter studies with normalized velocities and frequencies by setting

$$c = \omega = 1. \tag{40}$$

We The frequencies ω' and ω'' were varied in the interval between 0.5 and 1.2. Negative values of velocities have been masked out by black regions. As can be seen from Fig. 1, there is a diagonal line in the $\omega' - \omega''$ plane where v vanishes. This is a clear violation of energy conservation because a stationary particle cannot bring itself or another particle to motion.

Figs. 2 and 3 show a certain plausibility. When the ingoing particle transfers more and more energy to the target, its own kinetic energy decreases, as is visible by v' going to zero for raising ω''. The converse is valid for v'' and ω' as can be seen from Fig. 3.

The resulting mass M has been graphed in Fig. 4. According to Eq. (25) it depends linearly on the frequency parameters. This appears as a flat plane in the figure. To conform to de Broglie Einstein the mass must be constant on a diagonal line which means

$$\omega' + \omega'' = \text{const.} \tag{41}$$

This is plausible because this corresponds to an energy transfer between both particles in the scattering process. However if Eq. (38) is used which is derived from momentum conservation, M depends on ω' alone which must be variable. This contradicts to the findings from energy conservation as well as the graph of Fig. 4.

According to Eq. (38) the scalar curvature of ECE theory depends quadratically on M which is depicted in Fig. 5. However the picture looks differently again if Eq. (39) were used. The result that R would depend on ω' alone is not plausible at all.

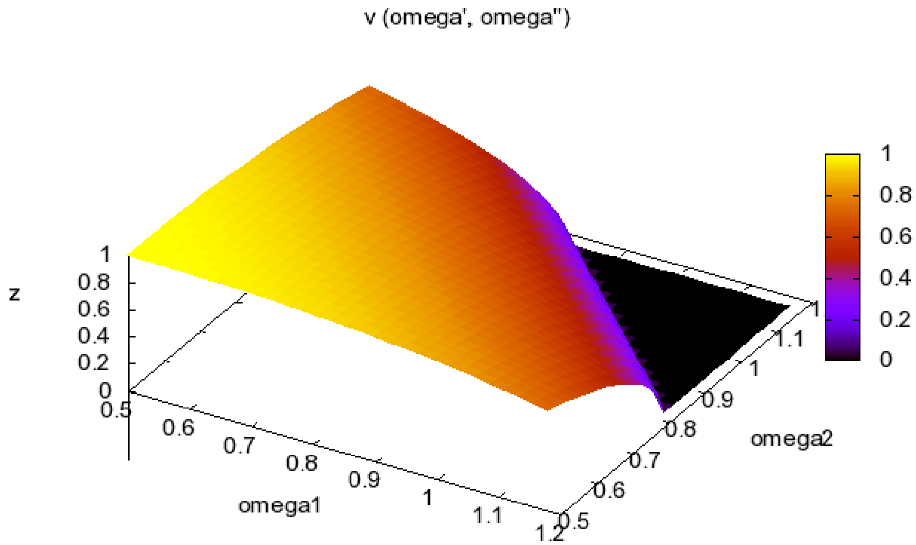

Fig. 1. 3D contour plot of v (ω', ω'') for ω=1.

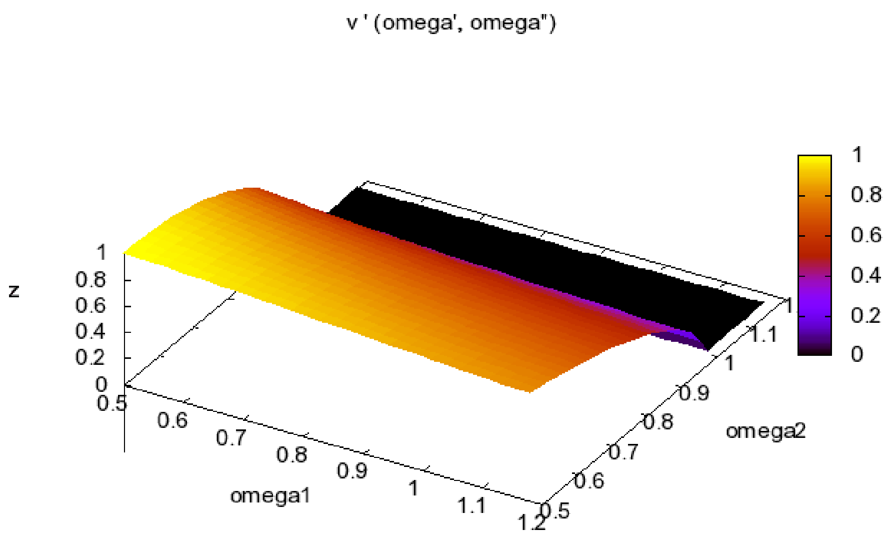

Fig. 2. 3D contour plot of v' (ω', ω'') for ω = 1.

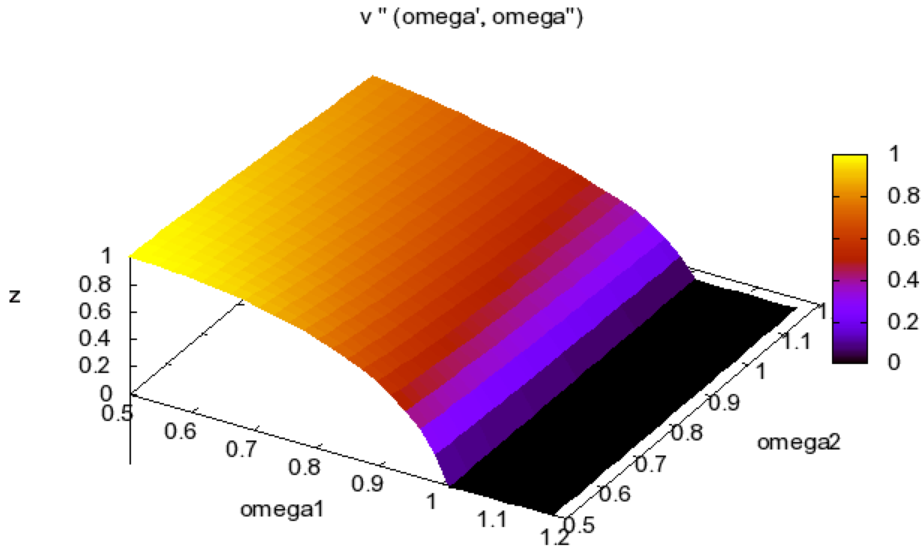

Fig. 3. 3D contour plot of $v''(\omega', \omega'')$ for $\omega = 1$.

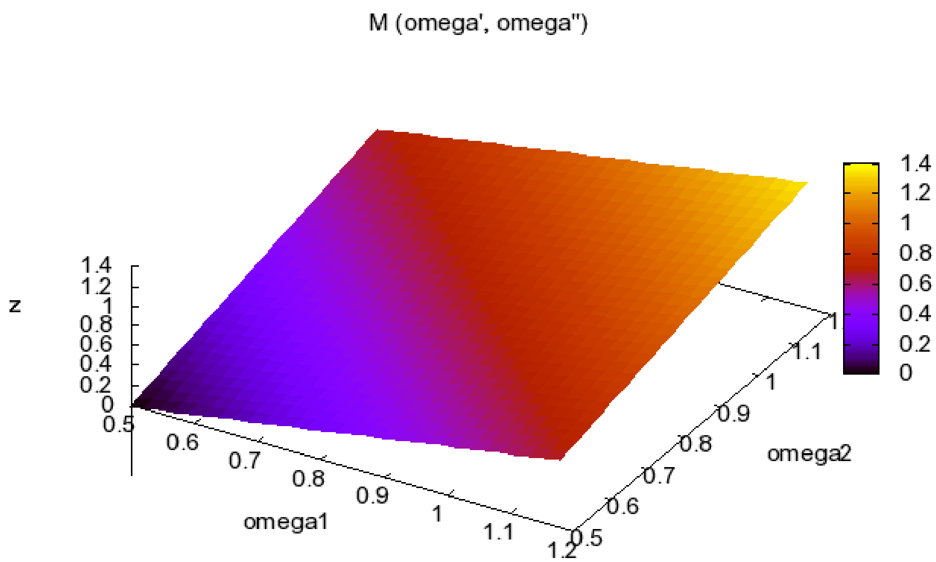

Fig. 4. 3D contour plot of $M(\omega', \omega'')$ for $\omega = 1$.

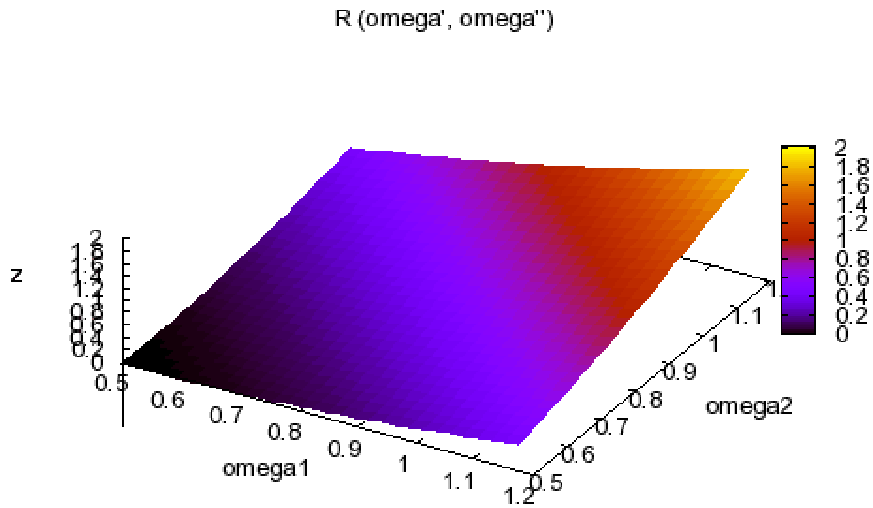

Fig. 5. 3D contour plot of *R* (ω', ω'') for ω = 1.

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