248(1): Dirac Type Structure and Modification of the Compton Formula by Photon Mass.

In note 247(8) it was shown that particle collisions of the type:

$$\omega + x_2 = \omega' + \omega'' \quad -(1)$$

$$\underline{p} = \underline{p}' + \underline{p}'' \quad -(2)$$

$$x_2 = mc^2/\hbar \quad -(3)$$

result in the Dirac type equation:

$$(E - E' + mc^2)^2 = c^2(\underline{p} - \underline{p}')^2 + m^2c^4 \quad -(4)$$

where

$$E = \hbar\omega, \; E' = \hbar\omega' \quad -(5)$$

Note carefully that eq. (4) is true for collision of a particle of mass m with one of mass m_1.

For example, if ω and ω' denote the incoming and scattered photon frequencies in the Compton effect then if the photon mass is denoted by m_1:

$$\hbar^2\omega^2 = c^2\hbar^2\kappa^2 + m_1^2c^4 \quad -(6)$$

$$\hbar^2\omega'^2 = c^2\hbar^2\kappa'^2 + m_1^2c^4 \quad -(7)$$

from the Einstein energy equation:

$$E^2 = c^2p^2 + m_1^2c^4 \quad -(8)$$

Denote the photon rest frequency by

2)

$$\omega_0 = m_1 c^2 / \hbar \quad -(9)$$

then

$$\kappa^2 = \frac{1}{c^2}\left(\omega^2 - \omega_0^2\right), \quad -(10)$$

$$\kappa'^2 = \frac{1}{c^2}\left(\omega'^2 - \omega_0^2\right), \quad -(11)$$

where

$$p^2 = \hbar^2 \kappa^2, \; p'^2 = \hbar^2 \kappa'^2 \quad -(12)$$

It follows that eq. (4) becomes:

$$\left(\omega - \omega' + \frac{mc^2}{\hbar}\right)^2 = \omega^2 - \omega_0^2 + \omega'^2 - \omega_0^2 - 2\left(\omega^2-\omega_0^2\right)^{1/2}\left(\omega'^2-\omega_0^2\right)^{1/2}\cos\theta + \left(\frac{mc^2}{\hbar}\right)^2$$

$$-(13)$$

It follows from eq. (13) that:

$$\omega - \omega' = \frac{\hbar}{mc^2}\left(\omega\omega' - \left(\omega^2-\omega_0^2\right)^{1/2}\left(\omega'^2-\omega_0^2\right)^{1/2}\cos\theta - \omega_0^2\right)$$

$$-(14)$$

Eq. (14) reduces to the Compton formula:

$$\omega - \omega' = \frac{\hbar}{mc^2}\,\omega\omega'\left(1 - \cos\theta\right) \quad -(15)$$

as

$$\omega_0 \longrightarrow 0 \quad -(16)$$

3)

These are the same results as obtained in UFT160 ff with a different method.

It is now known that they can be described by the ECE fermion equation (4) with the minimal prescription and use of the SU(2) basis and correct Dirac matrices.

Photon Electron Scattering at 90°

In this case:

$$\cos\theta = 0 \quad -(17)$$

so eq. (14) reduces to:

$$\omega - \omega' = \frac{\hbar}{mc^2}\left(\omega\omega' - \omega_0^2\right) \quad -(18)$$

In the limit (16) this reduces to:

$$\omega - \omega' = \frac{\hbar}{mc^2}\,\omega\omega' \quad -(19)$$

If there exists a photon rest frequency ω_0 then from eq. (18):

$$\boxed{\omega_0^2 = \omega\omega' - \frac{mc^2}{\hbar}\left(\omega - \omega'\right)} \quad -(20)$$

In order to try to observe this quantity

4) experimentally the frequencies ω and ω' must be measured very accurately. The photon rest frequency is defined by eq. (9) and it is claimed in the standard literature that

$$m_1 \sim 10^{-50} \text{ kgm} \quad -(21)$$

so

$$\omega_0 = \frac{m_1 c^2}{\hbar} \sim 10^{-50} \times \frac{c^2}{\hbar} \quad -(22)$$

where

$$c = 2.997925 \times 10^{8} \text{ m s}^{-1}$$

$$\hbar = 1.05459 \times 10^{-34} \text{ J s}$$

So

$$\boxed{\begin{array}{l} \omega_0 = 8.52 \quad \text{radians s}^{-1} \\ \text{if } m_1 \sim 10^{-50} \text{ kgm} \end{array}} \quad -(23)$$

The electron mass is:

$$m = 9.10953 \times 10^{-31} \text{ kg}. \quad -(24)$$

So

$$x_2 = \frac{mc^2}{\hbar} = 9.10953 \times 10^{-31} \frac{c^2}{\hbar} \quad -(25)$$

$$x_2 = 7.7634 \times 10^{20} \text{ rad s}^{-1} \quad -(26)$$

$$= \text{electron rest frequency}$$

If the photon mass is 10^{-50} kg the

5) electron rest frequency is twenty orders of magnitude greater than the photon rest frequency.

In note 161(1) data were used from:

J. Lacoste Julien and M. Plamondon, "Compton Scattering: Light Reveals its Particle Nature", Lab. Report, Dept. of Physics, McGill University Canada, Feb. 4th 2002.

At 90°:

$$\omega = 1.006 \times 10^{21}\ \text{rad s}^{-1} \quad -(27)$$

$$\omega' = 0.440 \times 10^{21}\ \text{rad s}^{-1} \quad -(28)$$

experimentally. Here

$$x_2 = \frac{mc^2}{\hbar} = 7.7634 \times 10^{20}\ \text{rad s}^{-1} \quad -(29)$$

So from eq. (20):

$$\omega_0^2 = 1.006 \times 0.440 \times 10^{42} - 7.7634 \times 10^{20} \times 0.566 \times 10^{21}$$

$$= (4.43 - 4.39) \times 10^{41}$$

$$= 0.04 \times 10^{41} = 0.4 \times 10^{40}$$

i.e. $$\omega_0 = 0.63 \times 10^{20}\ \text{rad s}^{-1} \quad -(30)$$

As found in previous work, the photon mass is far larger than 10^{-50} kgm.

There are two possible explanations for this total failure of standard physics:

1) The experimental data are inaccurate;
2) the starting equations (1) and (2) must be modified.

The equations (1) and (2) refer to an elastic collision between two particles. In an inelastic collision:

$$\omega + x_2 = \omega' + \omega'' + E_1 \quad -(31)$$

where the energy E_1 is released in the collision. Effectively ~~therefore~~:

$$\omega' \rightarrow \omega' + E_1 \quad -(32)$$

if the extra energy is released as electromagnetic radiation. If this assumption is made for the sake of argument then E_1 must be accompanied by an extra momentum $\underline{p_1}$ defined by

$$E_1^2 = c^2 p_1^2 + m_1^2 c^4 \quad -(33)$$

So eq. (2) becomes:

$$\underline{p} = \underline{p}' + \underline{p}'' + \underline{p}_1 \quad -(34)$$

The next step is to rederive eq. (4), taking into account E_1 and $\underline{p}_1$, and to rederive eq. (20).

It seems very unlikely that the photon mass is 10^{-50} kgm. In previous UFT papers the standard method used to derive this result have been criticised. The energy E_1 and momentum $\underline{p}_1$ may also be those of other particles generated in a collision. In low energy nuclear reactions E_1 denotes the energy given off in a nuclear fusion.

Finally, note carefully that the Dirac type structure (4) remains true for any collision process. Therefore any collision can be described by the ECE fermion equation.