247(5): Relativistic Theory of Electron Positron Annihilation

Consider the electron positron annihilation:

$$e^- + e^+ = 2\hbar\omega'' \quad -(1)$$

Let the electron mass be m and the photon mass m_1.

The equation of conservation of energy is:

$$\hbar\omega + \hbar\omega' = 2\hbar\omega'' \quad -(2)$$

where

$$\gamma_1 mc^2 = \hbar\omega \quad -(3)$$

$$\gamma_2 mc^2 = \hbar\omega' \quad -(4)$$

$$\gamma_3 m_1 c^2 = \hbar\omega'' \quad -(5)$$

Therefore

$$\omega'' = \frac{1}{2}(\omega + \omega') \quad -(6)$$

The equation of conservation of momentum is:

$$\underline{p_1} + \underline{p_2} = 2\underline{p_3} \quad -(7)$$

where

$$\underline{p_1} = \gamma_1 m \underline{v_1} = \hbar \underline{\kappa_1} \quad -(8)$$

$$\underline{p_2} = \gamma_2 m \underline{v_2} = \hbar \underline{\kappa_2} \quad -(9)$$

$$\underline{p_3} = \gamma_3 m_1 \underline{v_3} = \hbar \underline{\kappa_3} \quad -(10)$$

so

$$(\underline{\kappa_1} + \underline{\kappa_2})^2 = \kappa_3^2 \quad -(11)$$

and

$$\kappa_1^2 + \kappa_2^2 + 2\kappa_1\kappa_2\cos\theta = \kappa_3^2 \quad -(12)$$

) From eqs. (3) to (12):

$$\omega^2 v_1^2 + \omega'^2 v_2^2 + 2\omega v_1 \omega' v_2 \cos\theta = 2\omega''^2 v_3^2 \quad -(13)$$

The Lorentz factors are defined by:

$$\gamma_1 = \left(1 - \frac{v_1^2}{c^2}\right)^{-1/2}, \quad \gamma_2 = \left(1 - \frac{v_2^2}{c^2}\right)^{-1/2}, \quad \gamma_3 = \left(1 - \frac{v_3^2}{c^2}\right)^{-1/2} \quad -(14)$$

From eqs. (3) to (14):

$$\frac{v_1^2}{c^2} = \left(1 - \left(\frac{x}{\omega}\right)^2\right); \quad \frac{v_2^2}{c^2} = 1 - \left(\frac{x}{\omega'}\right)^2; \quad \frac{v_3^2}{c^2} = 1 - \left(\frac{x_1}{\omega''}\right)^2 \quad -(15)$$

So

$$(\omega^2 - x^2) + (\omega'^2 - x^2) + 2(\omega^2 - x^2)^{1/2}(\omega'^2 - x^2)^{1/2}\cos\theta = 2(\omega''^2 - x_1^2) \quad -(16)$$

$$= \frac{1}{2}(\omega + \omega')^2 - 2x_1^2 \quad -(17)$$

using eq. (2).

It follows that the photon mass is defined by:

$$\boxed{2x_1^2 = \frac{1}{2}(\omega + \omega')^2 - (\omega^2 - x^2) - (\omega'^2 - x^2) - 2(\omega^2 - x^2)^{1/2}(\omega'^2 - x^2)^{1/2}\cos\theta} \quad -(18)$$

3) In standard physics:

$$x_i = 0 \quad -(19)$$

So standard physics means that there must be a relation between ω, ω', x and θ. If the electron and positron collide at right angles then:

$$\cos\theta = 0 \quad -(20)$$

so in standard physics eq. (18) reduces in this case to:

$$\frac{1}{2}(\omega+\omega')^2 = 2x^2 + \omega^2 + \omega'^2 \quad -(21)$$

This is not a meaningful result because the electron mass depends on ω and ω'.

It is easy to show that the theory of electron positron annihilation collapses on a foundational level. Without eqs. (3) to (5) or eqs. (8) to (10) special relativity and quantum mechanics are not inter-consistent.

The problem is that the electron to positron collision is being considered as an elastic collision. In general, many particles can be produced by an electron positron collision. In LENR, when two nuclei collide, energy

4) is released. In another example a proton may be absorbed and the collision may produce a neutron or alpha particle. If there is no transmutation the theory of inelastic scattering is usually developed by the energy conservation equation:

$$Q + \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2} m_1 v_3^2 + \frac{1}{2} m_2 v_4^2 \qquad -(22)$$

(J. B. Marion and S. T. Thornton, "Classical Dynamics" (Harcourt, 1988, 3rd. ed.) pp 319 ff.)

Here Q is called the Q value and represents the energy loss or gain in the theory of collision. When Q is zero the kinetic energy is conserved. elastic collisions, the collision is exoergic, and when $Q > 0$, the kinetic energy is gained. When $Q < 0$, the kinetic energy is lost and the collision is endoergic. An inelastic collision is an endoergic collision, in which kinetic energy is converted to mass-energy in a nuclear reaction. So the inelastic collision is considered to be

5) $$\boxed{E_1 + E_2 = E_3 + E_4 + E} \quad -(23)$$

This is the type of theory we have seen developing in notes 247.

The major conclusion is that special relativity and quantum mechanics are inter-consistent if and only if the process of particle collision is inelastic, so energy E is always released, as in LENR.

So eq. (1) must be written as:

$$\boxed{e^- + e^+ = 2\hbar\omega + E} \quad -(24)$$

This will be developed in the next note. The remarkable thing about massless Compton scattering theory is that it is the only process in which Q is zero.