1)

166(7): Equation for the incoming mass m_1 in General Compton Scattering.

The general equation is:

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

This is solved as follows for x_1. Here:

$$x_1 = m_1 c^2/\hbar, \quad x_2 = m_2 c^2/\hbar. \quad -(2)$$

Eq. (1) is:

$$(\omega^2 - x_1^2)^{1/2}(\omega'^2 - x_1^2)^{1/2}\cos\theta = A \quad -(3)$$

where

$$A = (\omega\omega' - x_2)(\omega - \omega') \quad -(4)$$

Define:

$$x = x_1^2. \quad -(5)$$

Therefore

$$(\omega^2 - x)(\omega'^2 - x)\cos^2\theta = (A - x)^2 \quad -(6)$$

i.e.

$$(\omega^2\omega'^2 - x\omega'^2 - x\omega^2 + x^2)\cos^2\theta = A^2 - 2xA + x^2 \quad -(7)$$

$$x^2(1 - \cos^2\theta) + x\left((\omega'^2 + \omega^2)\cos^2\theta - 2A\right) + A^2 - \omega^2\omega'^2\cos^2\theta = 0 \quad -(8)$$

This is

$$ax^2 + bx + c = 0 \quad -(9)$$

where

$$a = 1 - \cos^2\theta \quad -(10)$$

$$b = (\omega'^2 + \omega^2)\cos^2\theta - 2A \quad -(11)$$

$$c = A^2 - \omega^2\omega'^2\cos^2\theta \quad -(12)$$

$$A = (\omega\omega' - x_2)(\omega - \omega') \quad -(13)$$

So

$$x = \left(\frac{m_1 c^2}{\hbar}\right)^2 = \frac{1}{2a}\left(-b \pm (b^2 - 4ac)^{1/2}\right) \quad -(14)$$

This result is equivalent to that produced in

2) UFT 158. Data on Compton scattering sent over in previous notes can be used to test the result (14) of the de Broglie / Einstein theory.

1) In photon Compton scattering m_1 should be the mass of the photon and a constant.

2) In electron Compton scattering m_1 should be the mass of the electron and a constant.

From eq. (14):

$$m_1^2 = \left(\frac{\hbar}{c^2}\right)^2 \left[\frac{1}{2a}\left(-b \pm \left(b^2 - 4ac\right)^{1/2}\right)\right] \quad -(15)$$