PH 105 – Quantum Mechanics

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7)

Assume a free electron absorbs a photon,

Energy conservation gives

hc/λ + mc2 = γmc2 ---(1)

Momentum conservation gives

h/λ = γmv ---(2)

Substitute (2) in (1)

γmvc + mc2 = γmc2

γvc +c2 = γc2

γ(c-v) = c

On solving,

(c-v)(c+v) –(c-v)2 = 0

i.e. v=c or v=0

If v=0 momentum is not conserved

And if v=c , Energy is not conserved.

Hence a free electron cannot absorb a photon.

In case of Compton effect, there-radiated photon conserves momentum and energy.