The Compton Effect

- 1923 – A.H. Compton struck a thin metal foil with X-rays
- found that a new, less energetic X-ray is emitted, along with an electron
- this showed that ***photons have momentum***

Einstein stated that

$$\mathbf{E = mc^2}$$

in his theory of general relativity, and Compton knew that

$$\vec{p} = m\vec{v}$$

so,

$$p = \left(\frac{E}{c^2}\right)v$$

and since v = c for a photon,

$$p = \left(\frac{E}{c^2}\right)c$$

so $$p = \frac{E}{c}$$

but the energy of a photon is

E = hf or $$E = \frac{hc}{\lambda}$$

so $$p = \frac{\left(\frac{hc}{\lambda}\right)}{c}$$

and thus $$p = \frac{h}{\lambda}$$