

## **Second Stage/ Radiation Physics Lab**



Islamic University / Najaf  
College of Medical Technology  
Department of Radiology Techniques



Second Stage /Radiation PhysicsLab.

# **Compton Scattering**

## **Lecture 1**

By

**Dr. Ali Al Abadi**

**M.Sc. Sara Jafar**

**M.Sc. Ali J. Azeez**

**M.Sc.NoorA.AL-Quraishi**

**M.S.c.Mustafa Raad Alfahham**

## **The aim of the experiment:**

Find the wavelength of (x) rays as a function of the scattering angle.

## **Theory:**

\*Compton scattering occurs when the incident x-ray photon is deflected from its original path by an interaction with an electron. The electron is ejected from its orbital position and the x-ray photon loses energy because of the interaction but continues to travel through the material along an altered path.

\* Energy and momentum are conserved in this process, The energy change depends on the angle of scattering and not on the nature medium of the scattering. Since the scattered x-ray photon has less energy, it has a longer wavelength (inverse proportion)

$$E = \frac{hc}{\lambda} \dots\dots\dots(1)$$

\*in 1923 Arthur Compton discover led to his award of the 1927 Nobel Prize in Physics, The discovery is important because it proves that light cannot be explained purely as a wave phenomenon.

\*Compton's work convinced the scientific community that light can behave as a stream of particles (photons) whose energy is proportional to the frequency.

$$p = \frac{h}{\lambda} \dots \dots \dots (2)$$

The change in wavelength of the scattered photon is given by:

$$\lambda' - \lambda = \frac{h}{m_e c} (1 - \cos\theta) \dots \dots \dots (3)$$

*where*

$\lambda'$  = wavelength of scattered x-ray photon

$\lambda$  = wavelength of incident x-ray photon

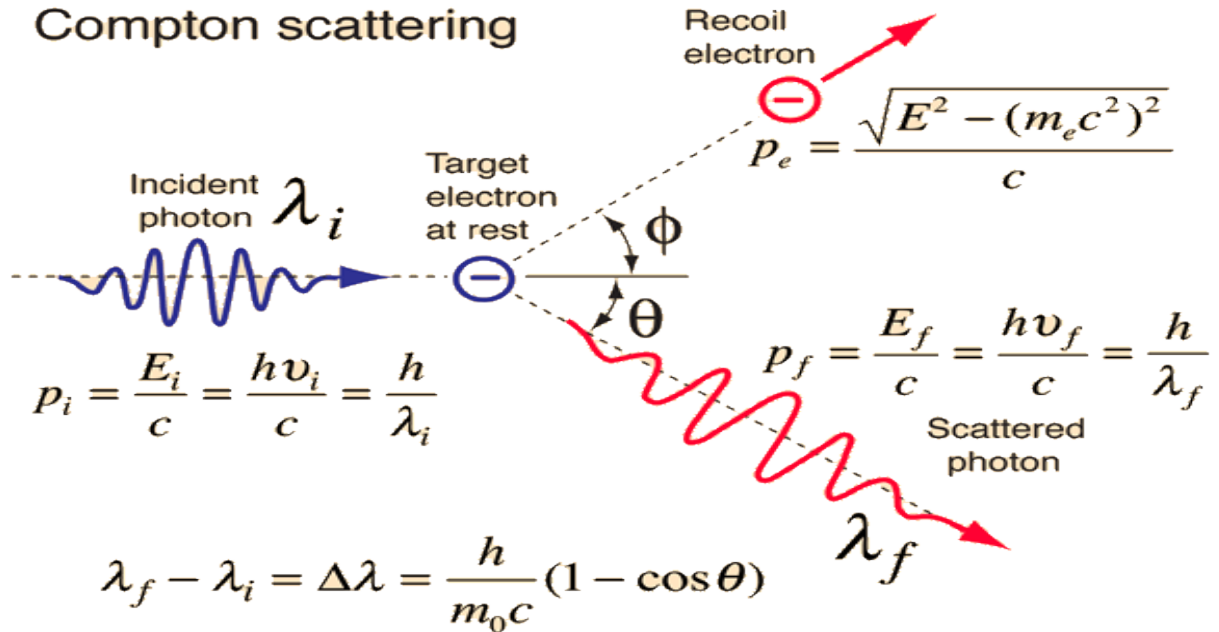
$h$  = Planck's Constant

$m_e$  = the mass of an electron at rest

$c$  = the speed of light

$\theta$  = The scattering angle of the scattered photon

## Compton scattering



### Experiment results

1- the Compton effect is dependent on the number of electrons per gram in the absorbing material, which for most elements is approximately the same ( $3 \times 10^{23}$ ).

2-An exception the element hydrogen which has no neutrons in its nucleus and therefore hydrogen electron density which is **twice** that of all other elements ( $6 \times 10^{23}$ ).

3-the Compton effect is it becomes the main process when human tissues are treated in the (30 keV to 30 MeV) energy range which is the diagnostic and therapeutic radiation range.

4-the Compton effect does not depend on atomic number (unlike photoelectric effect and pair production).