Compton Effect Encyclopedia Article

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The Compton effect (sometimes called Compton **scattering**) occurs when an x ray collides with an **electron**. In 1923, Arthur H. Compton did experiments bouncing **x rays** off the electrons in graphite atoms. Compton found the x rays that scattered off the electrons had a lower **frequency** (and longer **wavelength**) than they had before striking the electrons. The amount the frequency changes depends on the scattering angle, the angle that the x ray is deflected from its original path. Why?

Imagine playing pool. Only the cue ball and 8 ball are left on the table. When the cue ball strikes the 8 ball, which was initially at rest, the cue ball is scattered at some angle. It also loses some of its **momentum** and kinetic **energy** to the 8 ball as the 8 ball begins to move. The x-ray **photon** scattering off an electron behaves similarly. The x ray loses energy and momentum to the electron as the electron begins to move. The energy and frequency of **light** and other electromagnetic **radiation** are related so that a lower frequency x-ray photon has a lower energy. The frequency of the x ray decreases as it loses energy to the electron.

In 1905, **Albert Einstein** explained the **photoelectric effect**, the effect that causes solar cells to produce **electricity**, by assuming light can occur in discrete particles, photons. This photon model for light still needed further experimental confirmation. Compton's x-ray scattering experiments provided additional confirmation that light can exhibit particle-like behavior. Compton received the 1927 Nobel Prize in physics for his work. Additional experiments show that light can also exhibit wave-like behavior and has a wave particle duality.