

# The Compton Effect Compton Scattering And Gamma Ray

Arthur Compton

*studied the scattering and absorption of gamma rays. Further research along these lines led to the discovery of the Compton effect. He used X-rays to investigate*

Arthur Holly Compton (September 10, 1892 – March 15, 1962) was an American particle physicist who won the 1927 Nobel Prize in Physics for his discovery of the Compton effect, which demonstrated the particle nature of electromagnetic radiation. It was a sensational discovery at the time: the wave nature of light had been well-demonstrated, but the idea that light had both wave and particle properties was not easily accepted. He is also known for his leadership over the Metallurgical Laboratory at the University of Chicago during the Manhattan Project, and served as chancellor of Washington University in St. Louis from 1945 to 1953.

The effect was discovered in 1923 by Arthur Holly Compton while researching the scattering of X-rays by light elements, which earned him the Nobel Prize in Physics in 1927. The Compton effect significantly deviated from dominating classical theories, using both special relativity and quantum mechanics to explain the interaction between high frequency photons and charged particles.

Compton edge

*In gamma-ray spectrometry, the Compton edge is a feature of the measured gamma-ray energy spectrum that results from Compton scattering in the detector*

In gamma-ray spectrometry, the Compton edge is a feature of the measured gamma-ray energy spectrum that results from Compton scattering in the detector material. It corresponds to the highest energy that can be transferred to a weakly bound electron of a detector's atom by an incident photon in a single scattering process, and manifests itself as a ridge in the measured gamma-ray energy spectrum. It is a measurement phenomenon (meaning that the incident radiation does not possess this feature), which is particularly evident in gamma-ray energy spectra of monoenergetic photons.

The detailed equations for cross sections (barn/atom) of all mentioned effects connected with gamma ray interaction with matter are...

### Compton scattering

*Compton scattering (or the Compton effect) is the quantum theory of scattering of a high-frequency photon through an interaction with a charged particle*

Compton scattering (or the Compton effect) is the quantum theory of scattering of a high-frequency photon through an interaction with a charged particle, usually an electron. Specifically, when the photon interacts with a loosely bound electron, it releases the electron from an outer valence shell of an atom or molecule.

### Non-linear inverse Compton scattering

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Non-linear inverse Compton scattering (NICS), also known as non-linear Compton scattering and multiphoton Compton scattering, is the scattering of multiple low-energy photons, given by an intense electromagnetic field, in a high-energy photon (X-ray or gamma ray) during the interaction with a charged particle, in many cases an electron. This process is an inverted variant of Compton scattering since, contrary to it, the charged particle transfers its energy to the outgoing high-energy photon instead of receiving energy from an incoming high-energy photon. Furthermore, differently from Compton

scattering, this process is explicitly non-linear because the conditions for multiphoton absorption by the charged particle are reached in the presence of a very intense electromagnetic field, for example...

Electron scattering has many applications ranging from the use of swift electron in electron microscopes to very high energies for hadronic systems that allows the measurement of the distribution of charges for nucleons and nuclear structure. The scattering of electrons has allowed us to understand many details about the atomic structure, from the ordering of atoms to that protons and neutrons are made...

Photons can interact with matter at the atomic level (e.g. photoelectric effect and Rayleigh scattering...

### Electron scattering

*scatter several times. Multiple scattering: when electron(s) scatter many times over. The likelihood of an electron scattering and the degree of the scattering*

Electron scattering occurs when electrons are displaced from their original trajectory. This is due to the electrostatic forces within matter or, if an external magnetic field is present, the electron may be deflected by the Lorentz force. This scattering typically happens with solids such as metals, semiconductors and insulators; and is a limiting factor in integrated circuits and transistors.

### Gamma ray

*secondary gamma rays by the mechanisms of bremsstrahlung, inverse Compton scattering and synchrotron radiation. A large fraction of such astronomical gamma rays*

A gamma ray, also known as gamma radiation (symbol  $\gamma$ ), is a penetrating form of electromagnetic radiation arising from high-energy interactions like the radioactive decay of atomic nuclei or astronomical events like solar flares. It consists of the shortest wavelength electromagnetic waves, typically shorter than those of X-rays. With frequencies above 30 exahertz ( $3 \times 10^{19}$  Hz) and wavelengths less than 10 picometers ( $1 \times 10^{-11}$  m), gamma ray photons have the highest

photon energy of any form of electromagnetic radiation. Paul Villard, a French chemist and physicist, discovered gamma radiation in 1900 while studying radiation emitted by radium. In 1903, Ernest Rutherford named this radiation gamma rays based on their relatively strong penetration of matter; in 1900, he had already named two less...

Most radioactive sources produce gamma rays, which are of various energies and intensities. When these emissions are detected and analyzed with a spectroscopy system, a gamma-ray energy spectrum can be produced.

A detailed analysis of this spectrum is typically used to determine the identity and quantity of gamma emitters present in a gamma source, and is a vital tool in radiometric assay. The gamma spectrum is characteristic of the gamma-emitting nuclides contained in the source, just like in an optical spectrometer...

Electronic anticoincidence

*size, gamma rays may Compton scatter out of the detector's volume before they deposit their entire energy. In this case, the energy reading by the data*

Electronic anticoincidence is a method (and its associated hardware) widely used to suppress unwanted, "background" events in high energy physics, experimental particle physics, gamma-ray spectroscopy, gamma-ray astronomy, experimental nuclear physics, and related fields.

In the typical case, a desired high-energy interaction or event occurs and is detected by some kind of detector, creating a fast electronic pulse in the associated nuclear electronics. But the desired events are mixed up with a significant number of other events, produced by other particles or processes, which create indistinguishable events in the detector. Very often it is possible to arrange other physical photon or particle detectors to intercept the unwanted background events, producing essentially simultaneous pulses...

In 1919, Compton was awarded one of the first two National Research Council Fellowships that allowed students to study abroad. He chose to go to the University of...

When a gamma ray scatters within a scintillator or a semiconductor detector and the scattered photon escapes from the detector's volume, only a fraction of the incident energy is deposited in the detector. This fraction...

Compton

*Compton scattering, an effect observed when photons interact with electrons Compton wavelength, a quantum mechanical property of a particle Compton (surname)*

Compton may refer to:

Gamma spectroscopy

*mechanisms are the photoelectric effect, the Compton effect, and pair production. Through these processes, the energy of the gamma ray is absorbed and converted*

Gamma-ray spectroscopy is the qualitative study of the energy spectra of gamma-ray sources, such as in the nuclear industry, geochemical investigation, and astrophysics. Gamma-ray spectrometry, on the other hand, is the method used to acquire a quantitative spectrum measurement.

Other effects, like the photonuclear absorption, Thomson or Rayleigh (coherent) scattering can be omitted because of their nonsignificant contribution in the gamma ray range of energies.

Gamma ray cross section

*photoelectric effect, Compton (incoherent) scattering, electron–positron pair production in the nucleus field and electron–positron pair production in the electron*

A gamma ray cross section is a measure of the probability that a gamma ray interacts with matter. The total cross section of gamma ray interactions is composed of several independent processes: photoelectric effect, Compton (incoherent)

scattering, electron–positron pair production in the nucleus field and electron–positron pair production in the electron field (triplet production). The cross section for single process listed above is a part of the total gamma ray cross section.

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