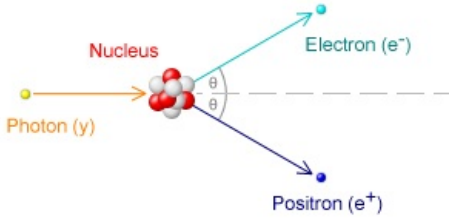
Electron-positron pairs

The formation of electron-positron pairs occurs when high energy γ radiation interacts with the electron shell of an atom. It is the highest energy possibility of the three γ-ray interactions with the shell.

At photon energies theoretically above 1,02 MeV, but practically much higher, the **photon is converted** near the atomic nucleus into a **positron** and an **electron**. At the same time, it is necessary that this happens near the atomic nucleus of another particle that can take over part of the momentum of the photon (since the momentum of the positron and electron is lower). Spontaneous transformation of a photon into an electron and a positron is not possible when it moves in a vacuum due to the law of conservation of the momentum (the sum of the momentum of the resulting electron and positron is less than the momentum supplied by the photon). The transformation itself takes place as a result of the electric field of the atomic nucleus(the greater the charge of the nucleus, the greater the probability of transformation). The kinetic energy of the created electron-positron pair is distributed randomly between the two particles.



Formation of an electron-positron pair

The following equation can be used to express the energy balance of the given event:

$$h\nu = E_e + E_p + 2m_e c^2$$

It follows the given relationship that the energy of the photon must be greater than the energy, that represents the sum of the two masses of the electron (the sum of the rest energies of the electron and the positron are still the same).

The resulting particles lose their energy during interactions with the surrounding environment, i.e. ionization or excitation. However, the positron usually combines with the electron during the **annihilation** process and thus emits two quanta of electromagnetic radiation with an energy of 511 keV. These quanta move in the opposite direction.

Links

Related articles

- Photoelectric phenomenon
- Compton scattering
- Gamma radiation

References

- NAVRÁTIL, Leoš – ROSINA, Jozef, et al. *Medicínská biofyzika.* 1. edition. Praha : Grada, 2005. 524 pp. pp. 352-353. ISBN 80-247-1152-4.

External links

- Nepřímo ionizující záření (http://cz7asm.wz.cz/fyz/index.php?page=nepiozaexample.org)