

Answer on Question #59796-Physics-Other

Can all type of photons be used for the process of pair production?

Answer

Pair production can be represented by an equation which represents the conservation of total energy (or mass-energy):

$$hf = 2(m_0c^2) + K(-e) + K(+e)$$

Here, $(m_0c^2) = 0.511$ MeV is the rest energy of an electron, which is equal to that of the positron, so the factor of 2 represents the fact that two particles of identical rest mass are created. $K(-e)$ and $K(+e)$ represent the kinetic energy of the electron and positron, immediately after their creation.

If the photon energy were exactly $2(m_0c^2) = 1.02$ MeV, the two particles would be created at rest (with zero kinetic energy) and this would be an example of the complete conversion of energy into mass. For photon energies below $2(m_0c^2)$, the process cannot occur; in other words, 1.02 MeV is the threshold energy for pair production. For photon energies above the threshold, a photon has more than enough energy to create a particle pair and the surplus energy appears as kinetic energy of the two particles.

So, the photons can be used correspond to gamma-ray radiation.