Atomic Collisions: Electron And Photon Projectiles

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If a high energy photon interacts with an electron, the interaction can be described by the Compton scattering relationship or by the 4-vector formulation of relativistic momentum. As a specific example, consider a 10GeV photon in a head-on collision with an electron at rest. If we apply the Compton formula, with $\lambda = h/p$ (deBroglie relationship) for a back-scattered photon where $\theta = 180^\circ$, this relationship can be expressed in terms of the quantity $p_c$. and rearranging gives. Since $p_c >> m_e c^2$, Conservation of energy then tells us that the electron energy after the collision is 9.999744 GeV. Electrons can lose energy in collisions with atomic electrons, leading to excitation and ionization of the medium. At low electron energies, radiative losses are negligible. The relative importance of ionization to excitation increases rapidly with the energy of the electron. These results were obtained using the default electron and photon settings in MCNP4B. Simulations for angles between 0’ and 100 include the stainless steel entrance window, while angles greater than 10’ had no stainless steel window. This is consistent with the experiment. Proton n-changing collisions and electron l-changing collisions are.

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