The number of electron-hole pairs produced is linearly proportional to the energy lost by the ionizing particle, X-ray, or gamma-ray. The amount of charge collected by the electric field of the Ge diode is converted into a pulse by a charge sensitive preamplifier, which is discussed in Section 4.6.

4.2 Nuclear Interactions

The X-ray and gamma-rays interact with the Ge crystal to produce electron-hole pairs by photoelectric, Compton, or pair production interactions. A charged particle creates electron-hole pairs directly.

In a photo-electric interaction all of the gamma energy is absorbed and a sharp line is produced in the spectrum, while a Compton interaction, only a fraction of the energy is transferred to electron-hole pairs. This results in a broad continuum from 0 energy up to a maximum energy $E_C$ given by $E_C = E(1 + 255.5/E)^{-1}$ where $E$ is the incident energy in KeV. The remaining energy of the Compton scattered photon may be either fully, partially or not absorbed by the crystal. In a pair production interaction an electron-positron pair is produced.

![Graph showing linear attenuation coefficient for Ge](image-url)

**Fig. 4.2**