1.2 Cosmic Rays

Cosmic rays span a very wide range of energies (keV to GeV) and include charged particles as high in mass as the transition elements. From the radiation protection point of view, the most important are likely to be neutrons, electrons and protons (terrestrial cosmic rays). These are the consequence of interactions of primary cosmic rays with the earth's atmosphere. They span an approximate energy range from keV to MeV and are important at altitudes from sea level up to the height of commercial air travel.

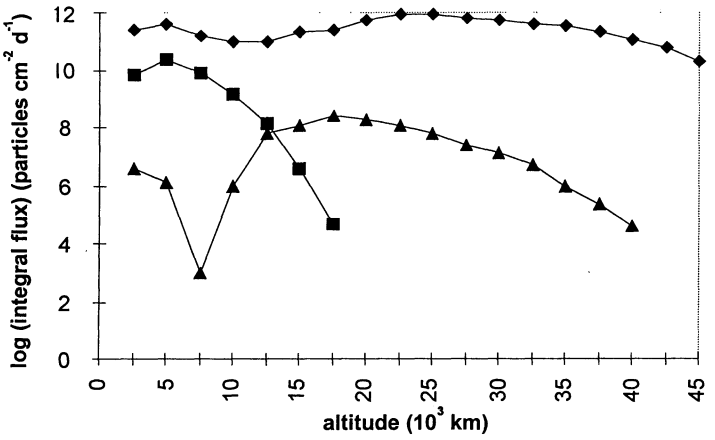

Fig. (1.1) Estimated log(integral flux) of electrons and protons versus altitude above mean sea level (MSL) in the equatorial plane. Units are particles cm^{-2} day^{-1}. Data taken from [2]. ◆ electrons > 0.5 MeV ■ protons > 10 MeV ▲ electrons > 4 MeV. Approximate fluxes at MSL are : neutrons 0.01 cm^{-2} s^{-1} MeV^{-1}, muons 0.009 cm^{-2} s^{-1} sr^{-1}, electrons 0.002 cm^{-2} s^{-1} sr^{-1}, protons 0.0002 cm^{-2} s^{-1} sr^{-1} [3].

At higher altitudes the very high fluxes of energetic charged particles, Fig. (1.1), may well affect the instrumentation required for satellite and space exploration. These cosmic rays are both galactic and solar in origin, the latter showing a variation due to the occurrence of solar flares.

Galactic and solar cosmic rays are affected by the earth's magnetic field. This gives rise to the radiation belts with the features known as the *polar horns* and the *South Atlantic anomaly*.

1.3 Radioactive Sources

Radioactive decay is the process by which a nucleus in an unstable state is able to