

Marwari college Darbhanga

Subject---physics Hons

Class--- B. Sc. Part 3

Paper –06 ; Group—A

Topic--- Gamma Ray (Nuclear Physics)

Lecture series. --68

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Gamma Ray

A **gamma ray**, or gamma radiation (symbol γ or Y) is a penetrating electromagnetic radiation arising from the radioactive decay of atomic nuclei. It consists of the shortest wavelength electromagnetic waves and so imparts the highest photon energy. Paul Villard, a French chemist and physicist, discovered gamma radiation in 1900 while studying radiation emitted

by radium. In 1903, Ernest Rutherford named this radiation gamma rays based on their relatively strong penetration of matter; in 1900 he had already named two less penetrating types of decay radiation (discovered by Henri Becquerel) alpha rays and beta rays in ascending order of penetrating power.

Gamma rays from radioactive decay are in the energy range from a few kiloelectronvolts (keV) to approximately 8 megaelectronvolts (~8 MeV), corresponding to the typical energy levels in nuclei with reasonably long lifetimes. The energy spectrum of gamma rays can be used to identify the decaying radionuclides using gamma spectroscopy. Very-high-energy gamma rays in the 100–1000 teraelectronvolt (TeV) range have been observed from sources such as the Cygnus X-3 microquasar.

Gamma rays are one of the most energetic form of light produced in hottest areas of universe. They are also produced by supernova explosions as well as by radioactive material in space. Gamma rays cannot be reflected in mirrors like X-rays, instead they will pass right through the mirror.

Gamma rays are a type of ionizing radiation and are hence extremely dangerous. Ionizing radiation are high energy radiation, enough to pull away electrons from their atoms, thereby charging the particles (converting them into ions), hence the name.

The main ways of producing gamma-rays are by nuclear reactions.

1. * Nuclear Fusion
2. * Nuclear Fission
3. * Alpha Decay
4. * Gamma Decay
- 5.

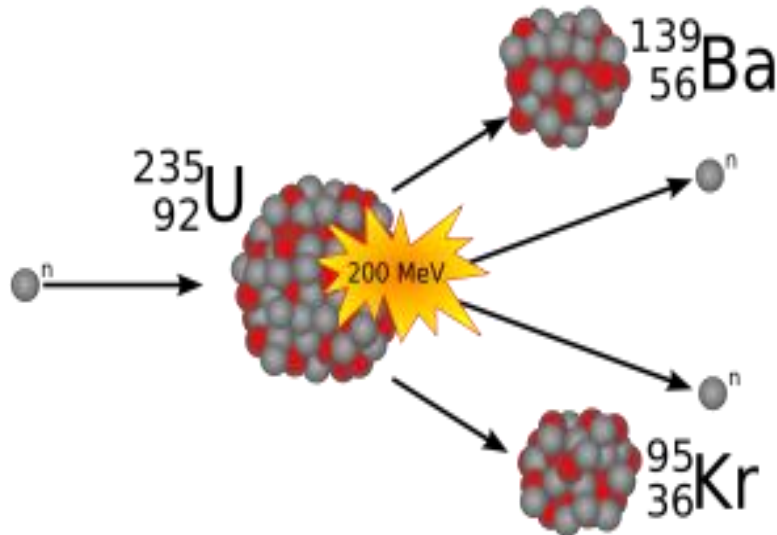
Uses of Gamma Rays:

1. * Sterilise medical equipment
2. * Sterilise food (irradiated food)
3. * Used as tracers in medicine
4. * Radio Therapy- In oncology, to kill cancerous cells
5. * Gamma Ray Astronomy
- 6.

Nuclear Fission

When the nucleus of an atom splits into lighter nuclei through a nuclear reaction the process is termed as nuclear fission. This decay can be natural spontaneous splitting by radioactive decay, or can actually be simulated in a lab by achieving necessary conditions (bombarding with neutrinos). The resulting fragments tend to have a combined mass which is less than the original. The missing mass is what is converted into nuclear energy in the above reaction. Therefore, nuclear fission is defined as:

The process in nuclear physics in which the nucleus of an atom splits into two daughter nuclei.



When Uranium-235 atom is bombarded with a neutron, it splits into two lighter nuclei Barium and Krypton.

Nuclear Fusion

Nuclear fusion is a reaction through which two or more light nuclei collide into each other to form a heavier nucleus. This reaction takes place with elements which have a low atomic number, such as Hydrogen.

Both nuclear fusion and fission produce a massive amount of energy.