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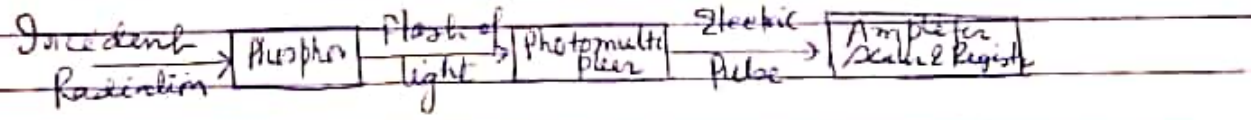
Scintillation Counter

It is a sensitive device used for the detection and measurement of high energy atomic radiations especially alpha particles. It is based on the principle that alpha particles, on striking a fluorescent material produce a tiny flash of light. These flashes, called scintillations, can be seen by an eye adapted to darkness or detected through through a microscope. The observations of scintillations ~~of scintillations~~ through low power microscope were very tedious and limited to relatively low counting rates. By the use of suitable electronic devices, it has become possible to remove the great limiting factor.

A scintillation counter essentially consists of a block of suitable fluorescent material called ~~photo~~ phosphor, a photomultiplier tube and a counting device as shown in fig



(1) A phosphor is a suitable scintillating material. In addition to a few natural ~~minerals~~ mineral crystals, certain organic liquids and even plastics which scintillate when exposed to radiations are called by the common name 'phosphor'. The most important characteristic of these phosphors is that the flash of light emitted by them is extremely short, the resolution time within the phosphor being of the order of 10^{-10} sec. This is one of the reasons which make the scintillation counter more efficient than even the tube counter.

(2) Photomultiplier. A photomultiplier or electron multiplier is a vaccum tube which uses the phenomenon of secondary emission to produce amplification of photo electric current.

When light falls on a photo sensitive surface

photoelectrons are emitted. These electrons are accelerated by an electric field and made to impinge upon a sensitive surface where they give rise to an increased number of secondary electrons. These electrons are in turn accelerated and impinge on a second sensitive target, producing more electrons by secondary emission. A number of such stages of emission and acceleration is incorporated in a highly evacuated tube and at each stage the number of electrons is multiplied. The final stream of electrons is received by a collecting electrode. The first sensitive surface on which light falls is called the photocathode, while the other sensitive targets on which emit secondary electrons are known as dynodes. These are coated with a silver oxide - caesium layer, which gives a copious emission of secondary electrons. The amplification of photomultiplier is of the order of a million.

The charge multiplication built up by ten or more dynodes makes a detectable voltage pulse which activates some electronic counting device and thus particles are counted.

The scintillation counter is not a simple apparatus, but an assembly of several contrivances which can be varied to suit the need. Scintillation counters have the following advantages over other detectors

(i) They operate in air or vacuum

(ii) The electric pulse generated is proportional to the energy of the incident particle

(iii) The counting rate is very high.

The scintillation counter fitted with any of the known inorganic phosphors has proved a very efficient detector of protons, deuterons and α particles, even in the presence of a heavy background of β- or γ radiations, since the above mentioned particles produce much stronger flashes than the electrons or γ-rays.