Scintillation Detectors Encyclopedia Article

Scintillation Detectors

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Contents

Scintillation Detectors Encyclopedia Article.....1

Contents.....2

Scintillation Detectors.....3

Scintillation Detectors

Scintillation detectors are used in experiments to determine when ionizing particles have hit a target. When the detector receives that type of **radiation**, it absorbs it and emits **light** in a process called **luminescence**. The intensity of the luminescence from a scintillation detector will be proportional to the **energy** and intensity of the incoming radiation. Scintillation detectors may be used to detect any sort of **ionizing radiation** (radiation that causes atoms to ionize) and not just electromagnetic radiation.

A good scintillation detector must allow the light its own atoms emit to pass through easily. Most often, scintillation detectors are used in combination with photomultiplier tubes, which convert a visible light signal into an electronic pulse. Plastic scintillators are often used in conjunction with clear light guides which funnel the light into photomultiplier tubes. In all cases, the properties of the scintillation detector and the properties of the photomultiplier tube should be well matched to maximize efficiency in detection. Sometimes the entire combination of phosphorescent substance, photomultiplier tube, and associated circuits is referred to as the scintillation detector.

Scintillation detectors were originally developed in the 1950s to solve the problem of low efficiency rates in the gas-filled detectors in use at the time. They have the added benefit that they are very fast and have very little deadtime, which is the time it takes for a detector to recover from a single measurement and be ready for the next. However, since most of the materials used in scintillation detectors are **semiconductors**, it was not until the 1960s that the industry was developed many of the designs currently in use. Different material choices result in different efficiencies and resolution. In many cases, the efficiency--how many of the photons passing through get detected--has to be balanced with the resolution; in other words, how clearly one can tell the photon's timing and energy. Different factors will be important in different experiments.

Some materials currently used in scintillation detectors are sodium iodide, cesium iodide, bismuth germanate, and barium fluoride. There are also less common organic materials used for detection purposes. In addition, sometimes small impurities are added to make the scintillation detectors more efficient. These impurities are known as activators. Scintillation detectors are used in **nuclear physics**, **astrophysics**, and many other applications. They allow single particles to be counted and tracked.