

## 20.5: Detecting Radioactivity

The particles emitted by radioactive nuclei are highly energetic and can therefore be readily detected. A *radiation detector* detects particles through their interactions with atoms or molecules. The most common radiation detectors are **thermoluminescent dosimeters** (Figure 20.7), which are issued to people working with or near radioactive substances. These dosimeters contain crystals of salts such as calcium fluoride that are excited by the ionizing radiation. The excited electrons are trapped by impurities that are intentionally introduced into the crystals. When the crystals are heated, the electrons relax to their ground state, emitting light. The amount of light emitted is proportional to the radiation exposure. These dosimeters are collected and processed regularly as a way to monitor a person's exposure. We discuss the effects and measurement of exposure in more detail in Section 20.11.

**Figure 20.7 Thermoluminescent Dosimeter**

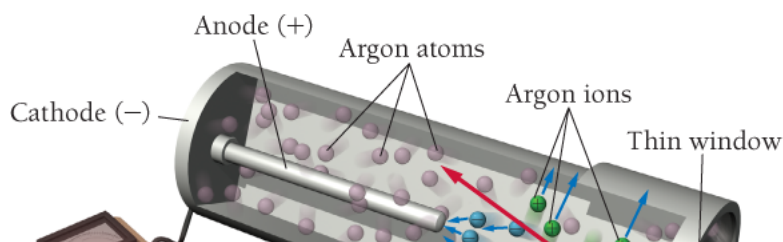
A thermoluminescent dosimeter contains crystals that when heated emit light in proportion to radiation exposure.

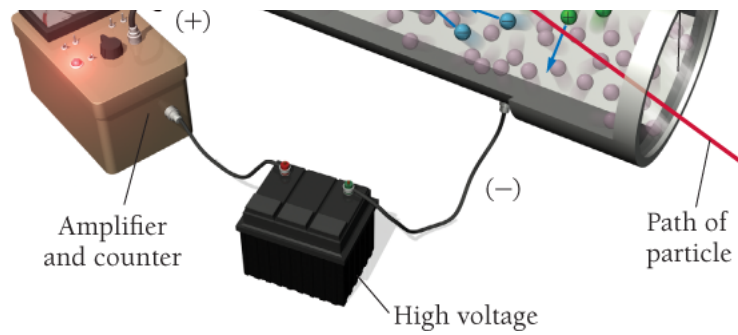


Radioactivity can be instantly detected with devices such as a **Geiger-Müller counter** (Figure 20.8). In this instrument (commonly referred to as a Geiger counter), particles emitted by radioactive nuclei pass through an argon-filled chamber. The energetic particles create a trail of ionized argon atoms. High voltage applied between a wire within the chamber and the chamber itself causes these newly formed ions to produce an electrical signal that is displayed on a meter or turned into an audible click. Each click corresponds to a radioactive particle passing through the argon gas chamber. This clicking is the stereotypical sound most people associate with a radiation detector.

**Figure 20.8 Geiger-Müller Counter**

When ionizing radiation passes through the argon-filled chamber, it ionizes the argon atoms, giving rise to a brief, tiny pulse of electrical current that is transduced onto a meter or into an audible click.





A second type of device commonly used to detect radiation instantly is a **scintillation counter**. In a scintillation counter, radioactive emissions pass through a material (such as NaI or CsI) that emits ultraviolet or visible light in response to excitation. The emitted light is turned into an electrical signal that is amplified and read on a meter.

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