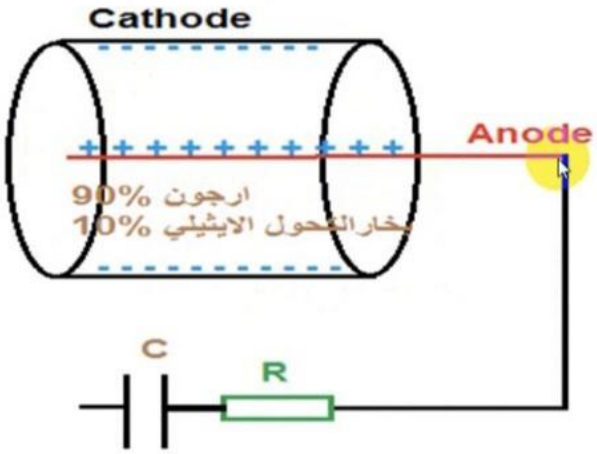
Geiger–Müller Counter

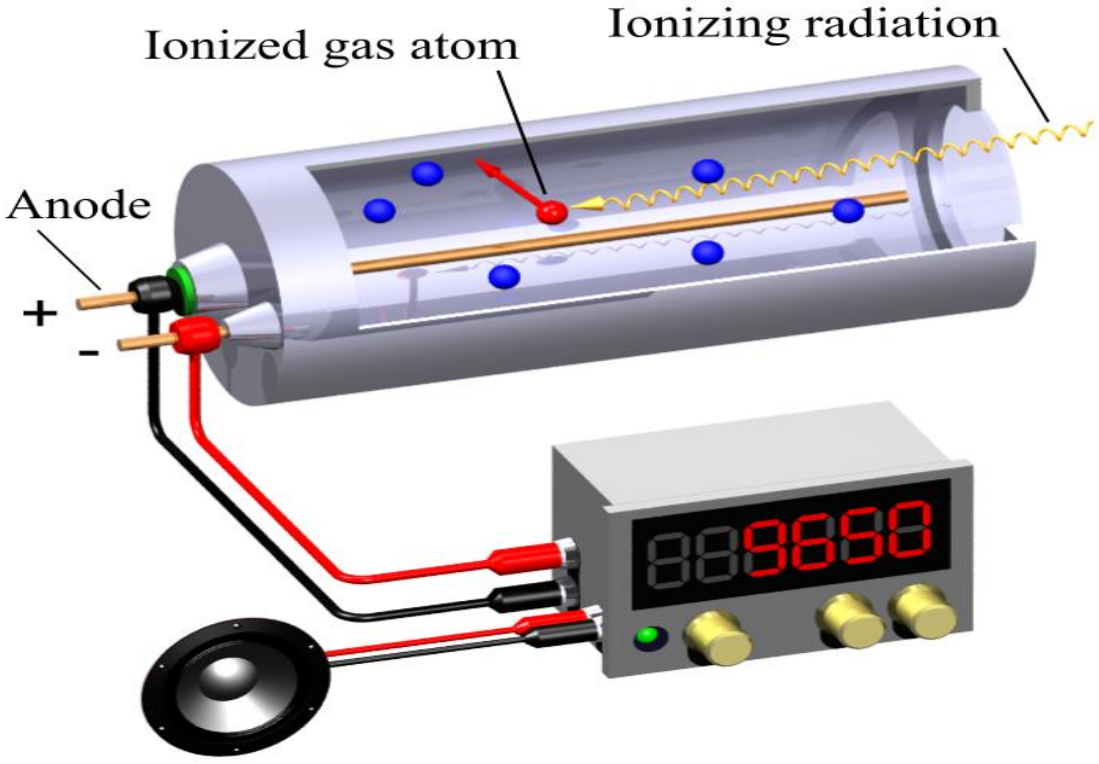
A Geiger counter (also known as a Geiger–Müller counter) is an electronic instrument used for detecting and measuring ionizing radiation. It is widely used in applications such as radiation dosimetry, radiological protection, experimental physics and the nuclear industry .

تركيب عداد جايجر



The principle of Geiger tube detection depends on the ionization of the gas atoms in the Geiger tube (air or arcon with a little organic gas such as ethyl alcohol) under pressure. Its amount is a few centimeters of mercury. We shed a certain potential difference between the wire and the walls of the cylinder. When a gamma or minute photon (alpha, beta) enters through the very thin (mica) window, we notice that no pulses are recorded by the counter due to the lack of potential difference and insufficient voltage to separate the electron from the positive ion and after ionization and the increase in voltage To reach an appropriate voltage, the gas in its path is ionized and the resulting ions move rapidly due to the electric field, so

that the positive (+) ions are directed towards the surface and negative ions (electrons) towards the inner wire, which represents the positive electrode. Very quickly, so it is a reason to charge the damaged channel. Let the wishes of the filter be the channel channel.



Types of G-M Tubes

1-End-Window Tubes: Allow detection of low-energy α and β particles through a thin mica window
2-Windowless (Thick-Walled) Tubes: Detect high-penetration β particles and photons like gamma and X-rays
3NeutronSensitive Tubes: Contain gases like boron trifluoride o r helium-3 to detect neutrons via capture reactions

Advantage

1-High Amplification. A strong signal (the amplification factor can reach about $\mathbf{10^{10}}$) is produced by these avalanches with shape and height independently of the primary ionization and the energy of the detected photon. The voltage pulse, in this case, would be a large and easily detectable ≈ 1.6 V. The technical advantage of a Geiger counter is its **simplicity of construction** and insensitivity to small voltage fluctuations. Since the process of charge amplification greatly improves the detector's signal-to-noise ratio, subsequent electronic amplification is usually not required.

2-Simplicity. G-M counters are mainly used for **portable instrumentation** due to their sensitivity, simple counting circuit, and ability to detect low-level radiation. G-M detectors are generally more sensitive to low energy and low-intensity radiations than are proportional or ion chamber detectors.

3-Simpler Electronics. G-M detectors can be used with simpler electronics packages. The input sensitivity of a typical G-M survey instrument is 300-800 millivolt, while the input sensitivity of a typical proportional survey instrument is 2 millivolt.

Disadvantages of Geiger-Mueller Counter

1-No particle identification, no energy resolution. Since the pulse height is independent of the type and energy of radiation, discrimination is not possible. There is no information on the nature of the ionization that caused the pulse. G-M detectors can not discriminate against different types of radiation (α, β, γ) or various radiation energies. This is because the size of the avalanche is independent of the primary ionization which created it.

2-Dead Time. Because of the large avalanche induced by any ionization, a Geiger counter takes a long time (about 1 ms) to recover between successive pulses. Therefore, Geiger counters cannot measure high radiation rates due to the "**dead time**" of the tube.