Spark Chamber Encyclopedia Article

Spark Chamber

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Imagine an electrical system consisting of a brass plate and a wire parallel to it, separated by a gap of about 1 millimeter. Then, establish a potential difference of at least 1,000 volts across the gap. In 1931, the German physicist Greinacher found that the passage of an alpha particle through such a system generated a spark between the wire and the plate. With that discovery was born the principle of the spark chamber.

Since Greinacher's initial discovery, the spark chamber has gone through a number of modifications. In one form, the device consists of a number of parallel metallic plates, all charged to a high voltage. The plates are surrounded by some gas, originally argon, but more recently, air, neon, an argon-neon mixture or a helium-neon mixture. Credit for the first working model of a spark chamber of this design is usually given to two Japanese physicists, Fukui and Miyamoto, who announced their design in 1959. When a charged particle passes through a spark chamber, it creates a series of gas ions. These ions act as conductors between the charged plates, setting off a line of sparks that corresponds to the path of the particle. After sparking has occurred, the chamber must be cleared of ions before it can be activated again. The recovery time of the most efficient spark chambers is less than 1 millisecond.

One of the most desirable properties of a spark chamber is the ability to design the system so that it is activated only when an important event occurs. That is, the spark chamber can be wired to a "preview chamber" that detects the presence of an incoming particle and prepares the main chamber to record its pathway. Spark chambers are highly adaptable instruments. It is possible to change the material, thickness, number, and spacing of plates to deal with the special requirements of an experiment. An external magnetic field can also be used to determine the charge, mass, and velocity of particles passing through the chamber. Particle paths in a spark chamber can be recorded by stereo cameras, electronic recording devices, and acoustical systems.