Muon Encyclopedia Article

Muon

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The muon is a subatomic particle that is very similar to the **electron** but more massive. The **mass** of the muon is 207 times that of the electron. Muons were first detected in **cosmic rays** by American physicist Carl D. Anderson in 1936. The muon's mass led physicists to believe it was the particle predicted by the Japanese physicist Yukawa Hideki to explain the strong interaction that binds protons and neutrons together in atomic nuclei. That particle (later determined to be a pion) would interact via the strong **force**. Further investigation showed that the muon is a member of the **lepton** family of particles, which are not affected by the strong force. Muons are one of the main components of cosmic **radiation** at the earth's surface, produced by the decay of **ions** high in the atmosphere. Although they are unstable particles, decaying with an average life of 2.2 microseconds, muons penetrate deep into the earth, traveling at velocities close to the speed of **light**, and reacting weakly with **matter**.

Since muons appeared to be identical to electrons, except for their higher mass, they were expected to decay into an electron and a **gamma ray**. The observed decay products, however, were an electron and two neutrinos. The suggestion that the muon has some internal property that distinguishes it from the electron led to the development of the concept of flavor. Each charged lepton, the muon, the electron and the tau, which was discovered later, is associated with a particular type of **neutrino**. Each neutrino shares the property of flavor with its associated charged lepton. All reaction of leptons conserve this property. Due to this conservation, any decay or reaction of a muon, except the reaction with its anti particle, the positive muon, will produce a muon-neutrino as one of its products.