

Fundamental particles

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Elementary Particles

Elementary particles consists of two groups: Elementary Particles are the smallest building units in our Universe . First group contains leptons and the second group contains quarks, but there is also another new particle which was discovered in July 2012 in Switzerland in Cern, named Higgs Boson. These three particles form the standard model of the elementary particle physics, which describes the interaction between these particles. In current understanding , particles are excitations of quantum fields and interact following their dynamics. This standard model contains of 24 fundamental particles. The Higgs-boson, which is also a part of the system should be neglected, because it needs still a lot of research to understand this particle. The Leptons are not interconnecting with the strong nuclear force and there are three generations of these particles. The first one involves electron and electron neutrino, the second one muon and muon neutrino and the third consists of particle T and tau neutrino. Every Lepton group has also an antiparticle. This ensures a constant potential of the Lepton. Anti particles have the same mass, but opposite charge or magnetic moment.

The generations of quarks differs according to the property called flavor. There are six "flavors" of quarks. There are quarks u (up) and d (down), which occurs in the first generation. The second one is composed of s (strange) c (charm). The third generation is composed of b (bottom) and t (top). Each of the six "flavors" of quarks can have three different "colors".

Quarks are components of the hadrons. Mesons are Hadrons composed of one quark and one antiquark. The second group of Hadrons are called baryons (e.g., protons and neutrons) and they are composed of three quarks. A proton is composed of two up quarks and one down quark. (The color is not important, only that all three colors be present)

Each of these elementary particles interacts with other elementary particles, through one or more forces. The electromagnetic force (between particles with electric charge), the strong force (between particles with color charge, such as the quarks), the weak force (between all leptons and quarks), and the gravitational force (between all particles). These forces are mediated by yet another set of elementary particles, the gauge bosons: When two particles interact, they exchange one or more gauge bosons. The gauge bosons include the W and Z bosons, which mediate the weak nuclear force, the gluon, which mediates the strong nuclear force, and the photon, which mediates the electromagnetic force.

Whether these particles might themselves be composed of more fundamental building blocks is an open question, and the construction of a "theory of everything" that would explain the properties of all of the known particles and forces remains the ultimate goal for modern physics.

Sources: Frantisek Vitek- Lectures on Biophysics with Medical Orientation
http://en.wikipedia.org/wiki/Elementary_particle

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