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The Standard Model of particle physics; thereâ€™s plenty of room at the bottom by Treeves

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Towards the end of the 1970s, a theory was postulated. The Standard Model as it was called, concerned with the forces and the interaction dynamics with other elementary particles. Because of its success in explaining a wide variety of experimental results, the Standard Model is sometimes regarded as a theory of everything.

The Model has its roots in quantum mechanics, symmetry breaking, special relativity and the ideas of physical fields. Group Theory forms the mathematical basis for the Standard Model. The equations have biggest and smallest points called Lagrangians and Hamiltonians.

The Standard Model includes twelve elementary particles known as fermions and four force carriers known as gauge bosons. The word fermion honors the physicist Enrico Fermi. Each fermion has a corresponding antiparticle. Of the twelve fermions six are quarks and the other six are leptons. The six quarks are up quark, down quark, charm quark, strange quark, top quark and bottom quark. The six leptons are electron, electron neutrino, muon, muon neutrino, tau and the tau neutrino. The electron is the best known lepton. An important fact about fermions is that they follow a rule called the Pauli Exclusion Principle. This rule says that no two fermions can be in the same place at the same time. Since no two fermions in an atom can have the same quantum numbers at the same time. Fermions also obey a theory called Fermi-Dirac statistics.

There are four basic known forces of nature, the strong force, the weak force, the electromagnetic fore and gravity. These forces affect fermions and are carried by bosons traveling between those fermions. The Standard Model explains three of these four forces.

Strong force is what holds quarks together to make hadrons such as protons and neutrons. The strong force is carried by gluons. The theory of quarks, the strong force, and gluons is called quantum chromodynamics.

The Weak force changes the flavor of a fermion and causes beta decay. The weak force is carried by three gauge bosons: W+, W- and the Z boson. The word "boson" honors the Indian physicist Satyendra Nath Bose.

Electromagnetic force explains electricity, magnetism and other electromagnetic waves that include light. This force is carried by the photon. The combined theory of the electron, photon, and electromagnetism is called quantum electrodynamics.

Gravity is the only fundamental force that is not explained by the Standard Model. It may be carried by a particle called the graviton. Physicists are looking for the graviton, but they have not found it yet. The Standard Model predicted the existence of the W and Z bosons, gluon, the top and charm quarks before these particles were observed. Their predicted properties were experimentally confirmed with good precision.

The Higgs particle is a hypothetical massive scalar elementary particle. It is the only fundamental particle predicted by the Standard Model that has yet to be observed. The Higgs boson plays a unique role in the Standard Model, by explaining why the other elementary particles, except the photon and gluon, are massive. In particular, the Higgs boson would explain why the photon has no mass, while the W and Z bosons are very heavy. Because the Higgs boson has so much mass, it takes a lot of energy to create one with the current equipments we have. The Large Hadron Collider at CERN is what scientists now use to prove the existence of the boson. These particles are believed to exist for less than a septillionth of a second. The collider will have so much energy that it should be able to make Higgs bosons.

Higgs bosons obey the conservation of energy, a law which states that no energy is created or destroyed, but instead it is transferred. First, the energy starts out in the gauge boson that interacts with the Higgs field. This energy is in the form of kinetic energy as movement. After the gauge boson interacts with the Higgs field, it is slowed down. This slowing reduces the amount of kinetic energy in the gauge boson. However, this energy is not destroyed. Instead, the energy is converted into mass-energy, which is normal mass that comes from energy. The mass created is what we call a Higgs boson.

More information about the Standard Model, the Large Hadron Collider and the Higgs Bosons can be found on the Internet. Special interest groups and relay chat can be accessed using high speed Internet connections like Xfinity Internet.

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