

I) The history of the fundamental particles

1. The first particle to be discovered was the electron. It is involved in electricity, electronics, chemistry and emission of light.
2. Scientists classified particles into families which have same properties, such as mass, charge or spin.

II) Interactions between particles

1. The 4 fundamental interactions are gravity, electromagnetic interaction, weak and strong interactions.
2. Massive particles are involved in gravity, charged particles in electromagnetic interaction, neutrons in the weak interaction and nucleons (protons +neutrons) in the strong interaction.
3. Gravity is responsible for the structure of the Universe; it attracts planets, stars, galaxies to each other. Electromagnetic interaction is responsible for the unity of matter; it attracts electrons to protons in atoms, atoms together in molecules... Strong interaction holds protons and neutrons together; it is responsible for the unity of nuclei. Weak interaction involves the decay of neutrons; it is responsible for the radioactivity of certain nuclei.
4. The messenger particle of the electromagnetic interaction is the photon.
5. The messenger particle of the strong force is the gluon.
6. The elusive particle involved in the weak interaction is called the neutrino. It is elusive because it has no charge and a so tiny mass that it can go through the whole Earth without being stopped.

III) Fundamental questions

1. The Big Bang is the big explosion at the origin of the Universe. It happened 13.7 billion years ago. The Universe was very hot and very dense. Then, it has been cooling down. 96% of the Universe is made of invisible substances: dark matter and dark energy.
2. There are 12 building blocks in the standard model. They are divided into 2 types of particles: quarks and leptons. They are arranged in pairs of 3 generations. Only those of the first generation are stable, they are also the lighter particles.
3. Matter and antimatter have same mass but opposite charge. When matter and antimatter meet, they annihilate and produce energy. The positron (antiparticle of the electron) was discovered in 1932 in cosmic rays. Scientists are not able to create antimatter without creating matter at the same time.
4. The 2 invisible substances of the Universe are called dark matter and dark energy. There are 26% of dark matter and 70% of dark energy. Dark matter can be detected by its gravitational effect which makes galaxies spin faster than expected and dark energy has a global effect on the Universe which accelerates its expansion.