Observations of the expansion of the universe imply that our universe has begun from a tiny space in which all material and energy were contained. In such a region within a very short distance, elementary particle interaction plays an important role to determine how material behaves and therefore how the universe evolves. Thus understanding the elementary particle naturally corresponds to understanding the history of the universe.

Behavior of elementary particles is precisely described by a model, the Standard Model of elementary particle physics: almost all particles playing roles in the Standard Model have been discovered and studied precisely. Experimental observations ever made for those particles show good agreement with the prediction of the Standard Model. In this model the mass of elementary particles is generated by the Higgs boson; the mechanics is called Higgs mechanics.

Particle physicists have made long tremendous efforts to hunt the Higgs boson in order to prove that the mechanics is certainly the origin of the mass of elementary particles. However they had not succeeded before the Large Hadron Collider (LHC) at CERN in Switzerland began its operation at world’s highest colliding energy of 7-8 TeV in 2011-2012.

According to the Standard Model the Higgs boson should condense in space and affecting all elementary particles by providing their mass, but we need extremely high energy density to kick it out from condensation. The tool to do this is a particle accelerator. In summer 2012 particle physics experiment groups at LHC, ATLAS and CMS, have announced that a new boson particle is observed individually in their experiments with as large as 5σ significance. It is highly probable that this boson is the Higgs boson, which particle physicists have been seeking for.

In this session an introduction to the elementary particles is given, followed by presentations explaining how particle physicists understand the mass of elementary particles and experimentally prove the mechanism.