

Dawn of Physics of the 21st Century

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It was announced that the Nobel Prize in Physics this year will be awarded to Profs. Peter Higgs and François Englert. The citation is unusually long: “*for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN’s Large Hadron Collider.*” The discovery of the particle they predicted, aka Higgs boson, is the completion of physics of the 20th century, and also the dawn of physics of the 21st century.

Higgs boson is frozen into the entire Universe, and is stuck very tightly. Without it, electrons would shoot out at light speed, and our body would evaporate in a billionth of a second. It does an incredibly important job, *taming* the electrons, allowing for atoms to form, and creating an *order* in the Universe. Now that this particle is discovered as predicted, the standard model of elementary particles that was built over seventy years since the beginning of the 20th century appears complete.

However, the discovered Higgs boson is *faceless*, unlike any other elementary particle we have seen before. Namely it does not have spin. It is hard to believe that there is only one such elementary particle. We don’t know why it got frozen into the Universe either. Most likely it has siblings and relatives, and it should have very peculiar properties. It may well have deep connections to dark matter and dark energy. The Nobel award is only the

beginning of this research.

I had an honor to interview my old friend and famous theoretical physics, John Ellis for the current issue of the Kavli IPMU News. It took place in June, four months before the Nobel announcement. It was right after ATLAS and CMS experiments released their latest result in March; CERN announced “Having analysed two and a half times more data than was available for the discovery announcement in July, they find that the new particle is looking more and more like a Higgs boson, the particle linked to the mechanism that gives mass to elementary particles. It remains an open question, however, whether this is the Higgs boson of the Standard Model of particle physics, or possibly the lightest of several bosons predicted in some theories that go beyond the Standard Model. Finding the answer to this question will take time.” Also in this issue, our Associate Professor Kai Martens describes the latest development of the XMASS experiment, his own hunt for dark matter. Enjoy!

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