Highlights

In 2016 the LHC machine surpassed its design parameters and allowed the ATLAS experiment to collected more data than in all previous years together.
One merciless result of the increased statistics was the evaporation of the hints of anomalies that caused so much excitement in 2015, as mentioned in our last report. Alas, they turned out to be statistical fluctuations.

However, the increased statistics also offered new opportunities for the Discovery LHC group to search for ever more rare events, such as instances of lepton flavor non-conservation, as well as new opportunities for precision measurements of the Standard Model parameters. Our phenomenology group then stands ready to incorporate the measurements into constraints on any new effects beyond the Standard Model using the tools of effective field theory. This approach has attracted great interest, as evidenced by the high attendance at our "Higgs Effective Field Theories 2016" conference.

We also had a chance to analyze the data taken in December 2015 with the ALICE detector where lead ions collided at the monstrous total energy of one *Peta* electron volt. This analysis confirmed previous indications that the quark-gluon plasma state of matter, dominating the universe up to the age of one millionth of a second, is close to being an "ideal fluid" with minimal viscosity.

In a special run at the end of 2016, Pb nuclei were collided with single protons and we hope that these data will shed new light on the controversial question of whether "small systems" of quarks and gluons exhibit collective behavior.

Meanwhile, the scattering amplitude group made giant strides. Anyone who has tried to make just a "one-loop correction" to a quantum mechanical amplitude knows how complicated it is. However, this year our amplitude group reached the unprecedented 8- and even 10-loop calculation, which is about 2.7 million times more complicated than the one-loop problem. Hereby the Discovery center has really become a champion of precision quantum field calculations.

The IceCube group made great progress in the analysis of the data from the South Pole, setting new competitive limits on both dark matter annihilation in the Milky Way and on the parameters of possible extra neutrinos outside the Standard Model.

Such extra, "sterile", neutrinos are also the main target of a new theoretical and experimental research effort led by Oleg Rychayskiy. In 2016 he shared an ERC Advanced Grant to investigate these hypothetical particles that potentially could explain the mystery of Dark Matter.

An even more intractable mystery is the so-called Dark Energy that apparently accelerates the expansion of the universe. However, in a remarkable analysis from 2016 Niels Bohr Professor Subir Sarkar and Discovery student Jeppe Trøst Nielsen pointed out that the empirical evidence for Dark Energy is weaker than previously assumed.

Finally, the data from the Planck satellite is a goldmine for the centers research into the earliest moments of the universe as well as into ongoing astrophysical phenomena. These data will in the future be supplemented by data from the DeepSpace observatory in Greenland. In the 2016 the electronics were tested and will be installed in 2017.