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OAC amphitheater

Public Talk

by **Dr. Albert de Roeck**

Professor Dr. Albert De Roeck is a senior research scientist and staff member at CERN and a professor at the University of Antwerp, Belgium. He obtained his Ph.D. at the University of Antwerp and then spent ten years at the German particle physics laboratory, DESY, where he and his team made very precise measurements of the quark and gluon structure of the proton, and performed precise tests of the strong force. To pursue his interest in discovering new physics at particle colliders, in particular supersymmetry and extra dimensions, he returned to CERN. During the last ten years, he has played a significant role in the preparation of one of the experiments at the LHC: the Compact Muon Solenoid (CMS). De Roeck is one of the leaders in the CMS physics program and was the deputy spokesperson of the experiment in 2010 and 2011. He is presently the convener of the Higgs search physics group.

The Status of our Understanding of Neutrinos and Future Prospects

Neutrinos are enigmatic elementary particles, which have fascinated us for many decades. Neutrinos are all around us, coming from the sun and outer space,- from interactions of cosmic rays in the atmosphere, from radioactive decays in the earth and from nuclear reactors, to name a few examples. Trillions of neutrinos pass through you every second during your whole life!

The Neutrino was first proposed by Wolfgang Pauli to explain mysterious results in radioactive decays. He realised that perhaps this particle, if it really existed, would probably never detected because it interacts so weakly with atomic matter. It took indeed 26 years before it was experimentally observed.Since then the neutrino particle has been an intense source of surprises. It was found that neutrinos come in different flavours and we know presently of three kind of neutrinos. Moreover in 1998 it was shown that neutrinos can 'change their flavour' in flight i.e. when the travel over longdistances. This also led us to understand that neutrinos must have a tiny mass, like most other elementary particles we know off. However, our best theory to understand elementary particles and their interactions did not expect that.

There are presently many open questions in neutrino physics. What generates the tiny masses of the known neutrinos and what is the mass pattern? Are there more than the three known neutrino flavours? Can neutrinos explain the matter-anti-matter asymmetry in the Universe? Are neutrinos their ownanti-particle, and so on. We will show that neutrino research is a very vibrant and active field with a lot of new results and future plans, that will help us to understand better the properties of these enigmatic particles and that can lead to a deeper insight in understanding the Universe.

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