



Contribution ID: 16

Type: **not specified**

A VISION ON THE MAIN DIRECTIONS IN HIGH ENERGY PHYSICS IN THE NEXT DECADES

Tuesday, 14 May 2019 10:10 (1h 50m)

After decades of success in exploring the ultimate components of the Matter, the large High Energy Physics worldwide community is continuing its fundamental research quest. The next two decades will witness exciting searches in the Neutrinos world thanks to three major experiments that are built in USA (DUNE), in China (JUNO) and in Japon (Super/HyperKamiokande); meanwhile the largest accelerator in the world, the LHC (Large Hadron Collider), at CERN (Geneva, CH) will increase its exploration capability thanks to upgrading both the machine and the 4 associated experiments. The increase in Luminosity by a factor of at least 5 and increase to the nominal energy value of 14 TeV (currently 13TeV) in the center of mass, will strengthen the Physics reach of this Machine. This goes together with the major upgrades, on the ALICE, ATLAS, CMS and LHCb experiments. These upgrades consist in drastic modification of several detectors and/or of their associated signal processing or data handling, in rebuilding some major parts using novel technologies and in adding some new detection capabilities. This school will review some of these main aspects. The upgrades of these experiments will further increase the overall Physics potential of the HL-LHC era that will start in 2025. They are also pioneering the new detection technologies that will inspire and serve the design and construction of the experiments for the next generation of HEP machines, without forgetting their cross-disciplinary and high tech industrial outcomes.

Meanwhile, and in parallel to the success of the LHC, a long term R&D period on different next HEP machine concepts with the related Physics studies are ongoing, aiming to pursue on the Particle Physics ultimate Quest. Decisions on the main directions to go are expected by the end of this decade and are crucial for the next 50 years.

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Session Classification: PLENARY MORNING SESSION