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QCD Processes in Cosmic Ray Air Showers

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The origin and properties of Ultra High Energy Cosmic Rays (UHECR) is a long standing question in astroparticle Physics. Dedicated extensive air shower experiments are in place since many years and have strongly contributed to our understanding of High and Ultra High Energy Cosmic Ray Physics. Recently, in particular, the Pierre Auger Collaboration and the Telescope Array Collaboration, thanks to the excellent performance of their hybrid detector arrays, are providing us new exciting observations of UHECRs. Although these recent results have brought a deeper insight in primary cosmic ray properties, still they are largely affected by the poor knowledge of the nuclear interactions in the earth's atmosphere. The average and RMS of the measured depth of the shower maximum (XMAX) are good indicators of the composition of UHECRs. However the predictions of XMAX by air-shower simulations depend on the hadronic interaction model used in the Monte Carlo. A calibration of the energy scale in the 10ˆ15 ÷ 10ˆ17 eV energy range accessible to LHC provides crucial input for a better interpretation of primary cosmic ray properties, in the region between the "knee"and the GZK cut-off. The Large Hadron Collider forward (LHCf) experiment was designed with the aim to provide a calibration of the hadronic interaction models in the whole energy range spanned by LHC by measuring the neutral forward particle produced in p-p as well as in p-Ion collisions. In this talk an introduction to HECR and UHECR Physics will be provided and the link between cosmic rays physics and accelerator physics will be discussed with particular emphasis to the results obtained at LHC by the LHCf experiment.

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