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Radio Detection of high-energy cosmic rays with the Auger Engineering Radio Array (AERA)

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The Auger Engineering Radio Array (AERA) is an enhancement of the Pierre Auger Observatory in Argentina. AERA is the world's largest antenna array for cosmic-ray observation. It consists of more than 150 antennas detecting the radio signal emitted by air showers, i.e., cascades of secondary particles caused by primary cosmic rays hitting the atmosphere. At the beginning, technical goals had been in focus: first of all, the successful demonstration that a large scale antenna array consisting of autonomous stations is feasible. Moreover, techniques for calibration of the antennas and time calibration of the array have been developed, as well as special software for data analysis. Meanwhile physics goals come in focus. At the Pierre Auger Observatory, air showers are simultaneously detected by several detector systems, in particular water-Cherenkov detectors at the surface, underground muon detectors, and fluorescence telescopes, which enables cross-calibration of AERA. For the direction and energy of air showers, the precision achieved by AERA is already competitive, for the type of the primary particle, several methods are tested and optimized. By combining AERA with the particle detectors we aim for a better understanding of cosmic rays in the energy range from approximately 0.3 to 10 EeV, i.e., significantly higher energies than preceding radio arrays.

Collaboration

Pierre Auger Collaboration

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