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Cosmic Ray Observations with the Square Kilometre Array

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Building on the successful cosmic ray observations with the LOw Frequency ARray (LOFAR) telescope, the low frequency part of the Square Kilometre Array (SKA), currently undergoing construction in Australia, will serve as a next-generation cosmic ray observatory in the coming decade. It is planned to have an extremely homogeneous and dense antenna layout of roughly 60,000 antennas in an area of 1 km². With its wide frequency band of 50 - 350 MHz, SKA will be able to measure cosmic rays with energies of 10^{16} to 10^{18} eV with an expected energy resolution of better than 5%. Current simulations show that SKA will not only be able to reconstruct X_{max} within a resolution of $< 10 \text{ g cm}^{-2}$ but also reconstruct other composition-dependent shower variables that can resolve ambiguities of the cosmic-ray mass composition and the differences between hadronic interaction models. With the development of novel reconstruction frameworks that benefit from its unprecedented accuracy, SKA will further be capable of detecting substructures within the air shower and also possibly detecting PeV gamma ray-induced air showers.

Summary

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