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Detecting cosmic rays with radio telescopes

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Detecting cosmic rays using the radio emission generated in extensive air showers that form when cosmic rays interact in the atmosphere has proven to be a highly effective technique. Existing radio telescopes can detect this signal, and the dense antenna spacing of the LOFAR telescope and the upcoming SKA telescope make these instruments ideal to probe the features of radio emission in great detail. LOFAR has been measuring cosmic rays in the 10^{17} - 10^{18} eV energy range for over a decade. This is the energy range where the origin of cosmic rays is expected to shift from Galactic sources, like supernova remnants, to extragalactic sources, like active galactic nuclei. In this talk we present an overview of the cosmic-ray measurements made at LOFAR, including precise measurements of the air shower development and the determination of the radiation energy for each air shower, and discuss the implications of these results. We also discuss prospects for cosmic-ray detection with the LOFAR 2.0 upgrade and the SKA.

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