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Radio Detection of Cosmic Particles

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Digital radio detection has become an additional standard technique for cosmic rays above 1016 eV. Antenna arrays measure the geomagnetic radio emission of extensive air showers and feature a competitive accuracy for the cosmic-ray energy and position of the shower maximum, a key parameter to estimate the type of primary particle. As enhancement to particle-detector arrays, radio antennas can thus increase the total measurement accuracy for air showers, such as at the Pierre Auger Observatory or the planned IceCube-Gen2 Surface Array. Moreover, radio arrays are a promising technique for ultra-high-energy photons and neutrinos, the latter, by searching for Earth skimming neutrinos through tau-induced air showers or by deploying radio antennas in the ice. Finally, there are synergies by using astronomical radio observatories also for cosmic-ray detection as demonstrated by LOFAR and planned for SKA-low. This talk will provide an overview of the state-of-the-art of the radio technique, including recent examples such as a prototype station operating at IceTop at the South Pole, and provide an outlook of future activities and science goals.

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