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The Energy Content of Extensive Air Showers in the Radio Frequency Range of 30-80 MHz

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At the Auger Engineering Radio Array (AERA) of the Pierre Auger Observatory, we have developed a new method to measure the total amount of energy that gets transferred from the primary cosmic ray into radio emission. We find that this radiation energy is itself an estimator of the cosmic ray energy. It scales quadratically with the cosmic-ray energy, as expected for coherent emission. We measure 15.8 MeV radiation energy for a 1 EeV air shower arriving perpendicular to the geomagnetic field, in the frequency band of the detector from 30 to 80 MHz. These observations are compared to the data of the surface detector of the Observatory, which provide well-calibrated energies and arrival directions of the cosmic rays. We find energy resolutions of the radio reconstruction of 22% for the complete data set, and 17% for a high-quality subset containing only events with at least five stations with signal.

Collaboration

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