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Particle density fluctuations and correlations in low energy Cosmic-Ray showers simulated with CORSIKA

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The current studies of cosmic rays are focused on most energetic particles entering the atmosphere and producing a single Extensive Air Shower (EAS). There are, however, models predicting that interactions of high energy particles may result in Cosmic-Ray Ensembles (CRE) created far from the Earth. They could be observed as some number of correlated air showers of relatively low energies spread over a large area. The objective of the Cosmic Ray Extremely Distributed Observatory (CREDO) is to search for CRE using all available data from different detectors and observatories including even small but numerous detectors spread over large areas.

Interpretation of such measurements require precise information on properties of EAS in a very wide energy spectrum. Low energy EAS are analysed using events from CORSIKA, the program performing air shower simulations. The primary cosmic ray particle energy range extends from 1 TeV up to 4 000 TeV. The secondary particles at the ground level are studied, their density fluctuations and correlations in location and time. Although the fluctuations observed in multiplicity distributions are consistent with random the more detailed analysis reveals that near a selected particle the density of other particles is enhanced over that expected in the absence of correlations. The results of the analysis may be useful in further calculations, for example to obtain probability of detection of an EAS without special simulations.

Keywords

cosmic ray ensembles; extensive air showers; CORSIKA simulations; particle density fluctuations; particle location correlations

Collaboration

other Collaboration

Cosmic Ray Extremely Distributed Observatory (CREDO) Collaboration

Subcategory

Theoretical Results

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