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Status of investigations of the energy deposit of cosmic ray muon bundles in the Cherenkov water calorimeter

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One of the actual problems in the ultrahigh-energy cosmic ray (UHECR) physics is the excess of multi-muon events in comparison with calculations, which is called the "muon puzzle". An excess of muons appears in the energy range of the extensive air showers (EAS) above 10ˆ17 eV. The answer to the "muon puzzle" may be found by means of the study of the energy characteristics of the muon component of EAS in a wide range of primary particle energies (from 10ˆ16 to 10ˆ18 eV). For this purpose, in the NEVOD-DECOR experiment the measurements of the energy deposit of muon bundles in the detector material have been carried out. The installation includes a Cherenkov water calorimeter NEVOD with a volume of 2000 cubic meters and coordinate-tracking detector DECOR with an area of 70 square meters. The energy deposit of muon bundles is determined from the response of the Cherenkov water calorimeter, and the coordinate-tracking detector allows one to determine the local density of muons in the bundles and the direction of their arrival, and hence to estimate the energy of the primary particle. The results of measurements of the muon bundle energy deposit in inclined showers over several years of observations are presented. The experimental dependences of the energy deposit of muon bundles are compared with the results of simulations performed with the CORSIKA software package using modern models of hadronic interactions.

Primary author(s) : YURINA, Ekaterina (National Research Nuclear University MEPHI)

Co-author(s) : BARBASHINA, Natalia (National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)); BOGDANOV, Aleksei (National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)); KHOKHLOV, Semyon (National Research Nuclear University MEPhI); KINDIN, Victor (National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)); KOKOULIN, Rostislav (National Research Nuclear University MEPhI); KOMPANIETS, Konstantin (National Research Nuclear University MEPhI (Moscow Engineering Physics Institute)); MANNOCCHI, Giampaolo (Osservatorio Astrofisico di Torino); PETRUKHIN, Anatoly (National Research Nuclear University MEPhI); SHUTENKO, Victor (National Research Nuclear University (MEPhI)); TRINCHERO, Giancarlo (Osservatorio Astrofisico di Torino); YASHIN, Igor (National Research Nuclear University MEPHI)

Presenter(s) : YURINA, Ekaterina (National Research Nuclear University MEPHI)

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