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Cosmic Rays in Thunderstorm Atmosphere: Observable Effects and Implications

ALEKSANDR S. LIDVANSKY and NAIL S. KHAERDINOV

Institute for Nuclear Research, Russian Academy of Sciences, 60th October Anniversary pr. 7a, Moscow, 119312 Russia

Secondary cosmic rays deep in the atmosphere represent a continuous flux of charged particles whose propagation is disturbed by many factors. During thunderstorms the strong electric field of the atmosphere is one of such factors. We discuss the experimental data on correlations of the intensities of different components of cosmic rays with the strength of the near-earth electric field in the periods of thunderstorms. Observations were made in the Baksan Valley (North Caucasus) at an altitude of 1700 m a. s. l. for several summer seasons. The large array for studying extensive air showers was used as a particle detector. An electric field mill and a meter of precipitation electric current were installed on the roof of the building in the center of the array. It is shown that the data on the soft component (electrons, positrons, and gamma rays) can be interpreted as an indication to existence of runaway electrons predicted by Wilson many years ago. The data on the hard component (muons) were taken at several energy thresholds, and the electric field effect is seen in the muon flux up to the threshold of 1 GeV. The problems of theoretical description of both groups of data are discussed.

Keywords: Cosmic rays; runaway electrons; lightning initiation.