

Relativistic solar protons in the GLE 23 February 1956.

The new study

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Characteristics of relativistic solar protons (RSP) are obtained and their dynamics studied in the event of 23 February, 1956 the largest in history GLE. The data of available then neutron monitors and muon telescopes are used. The technique of the analysis included: a) calculation of asymptotic cones of ground based detectors, b) modeling of cosmic ray detector responses at variable parameters of solar proton flux; c) determination by a least square procedure of primary solar proton parameters outside magnetosphere by comparison of computed responses with observations. It is shown, that the RSP flux consisted of two components: prompt and delayed ones. The prompt component with exponential energetic spectrum caused a giant impulselike increase at a number of European cosmic ray stations. The delayed component had a power law spectrum and was a cause of gradual increase at CR stations in the North American region. The carried out analysis of the GLE 23.02.1956 repeated the two component structure of RSP flux observed in many other investigated by us events with relativistic solar protons. The energy spectrum of PC has exponential form that may be an evidence of the acceleration by electric fields arising in the reconnecting current sheets in the corona. The accelerated particles of PC leave the corona along open field lines with diverging geometry that results in strong focusing of a bunch. Generation process of DC particles having the power-law spectrum probably is linked with arising CME. Thus DC particles are released later and their source in the corona is extended in time and azimuth.