SPECTRA OF SOLAR ENERGETIC PROTONS DERIVED FROM STATISTICAL ANALYSIS OF EXPERIMENTAL DATA ON A LARGE SET OF EVENTS

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The report analyzes the energy spectra of solar energetic protons. The analysis differs from the earlier analyses in that not only a broader energy range is analyzed, but also the method of simultaneous statistical treatment of a large data set is used. The SEP events supported by the proton peak flux data in a very broad energy range (METEOR, IMP8, GOES satellites, balloons, and ground-based neutron monitors) are analyzed. The resultant energy range for the analyzed events turns out to extend from 4 MeV to 11 GeV.
The statistical and functional analysis of the experimental SEP event proton peak flux data has shown that, within a 30 MeV - 10 GeV range, the energy spectra are actually power-law functions of particle momentum without any marked droop at extremely high energies. At <30 MeV, the proton energy spectra exhibit a droop, compared with pure power-law functions, thus confirming our earlier results [1,2]. If the energy spectra are described be power-law functions of particle energy, then the spectra will exhibit a lot of knees caused by the spectral droop at low energies (E<30 MeV) and energy-to-momentum transformation at high energies. In each of the SEP events, however, the power-law function of particle momentum describe the data more accurately than the power-law function of energy. At the same time, the particle flux measurements by different experimental techniques involve significant methodological errors, which cannot be disregarded when analyzing separate SEP measurement data obtained by a unified method (either satellite or neutron monitor data).

References

[1] Nymmik, R.A. "Averaged energy spectra of peak flux and fluence values in Solar Cosmic Ray events", in proceedings *of 23rd ICRC*, Calgary 19-30, **3**, pp.29-32, 1993.
[2] Nymmik R.A., Behavioural Features of Energy Spectra of Particle Fluences and Peak Fluxes in Solar Cosmic Rays, Proc. 24th ICRC, Roma, v.3., pp.66-69, 1995.