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Multi-spacecraft observations of the 27-day periodicity in galactic protons from 2018 to 2019 by the HEPD-01 detector on board the CSES-01 satellite and other experiments

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Galactic cosmic ray (GCR) intensities exhibit recurrent variations caused by their passage through heliospheric structures co-rotating with the Sun, with the ~ 27 -day periodicity being the most prominent one. To study this periodicity, data collected by the High-Energy Particle Detector (HEPD-01) on board the China Seismo-Electromagnetic Satellite (CSES-01) in Low-Earth Orbit have been used to derive daily proton fluxes from August 2018 to August 2019, in the energy range between ~ 55 and ~ 200 MeV. Daily fluxes from HEPD-01 have been analyzed along with proton fluxes measured during the same period by ERNE and EPHIN, on board the SOHO spacecraft, and by AMS-02, on board the International Space Station. Using a classical time-frequency analysis, the ~ 27 -day periodicity shows a maximum occurring earlier for HEPD-01 than for high-energy data from AMS-02. Additionally, the rigidity dependence of the amplitude of the aforementioned GCR variations cannot be described by the same power law at both low and high energies. The spectrum flattens below ~ 0.8 GV with a local minimum at about 0.4 GV, showing a power-law behavior at > 1 GV. HEPD-01 observations fill the energy gap between low-energy (EPHIN, ERNE, etc.) and higher-energy (e.g., PAMELA and AMS-02) space-borne experiments, providing important information for understanding GCR periodicities.

Collaboration(s)

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