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Solar Modulation of the Proton Local Interstellar Spectrum with AMS-02, Voyager 1 and PAMELA

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In recent years, the increasing precision of direct cosmic rays measurements opened the door to indirect searches of dark matter with high-sensitivity and to more accurate predictions for radiation doses received by astronauts and electronics in space. The key ingredients in the study of these phenomena are the knowledge of the local interstellar spectrum (LIS) of galactic cosmic rays (GCRs) and the understanding of how the solar modulation affects the LIS inside the heliosphere. Voyager 1, AMS-02 and PAMELA measurements of proton fluxes provide invaluable information, allowing us to shed light on the shape of the LIS and the details of the solar modulation during solar cycles 23 and 24. A new parametrization of the proton LIS is presented, based on the latest data from Voyager 1 and AMS-02. Using the framework of the force-field approximation, the solar modulation parameter is extracted from the time-dependent proton fluxes measured by PAMELA. A modified version of the force-field approximation with an energy-dependent modulation parameter is introduced, yielding better results on proton data than the force-field approximation. The results are compared with the modulation parameter inferred by neutron monitors.

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