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The solar modulation potential derived by spacecraft measurements modified to describe GCRs at energies below neutron monitors and above

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Galactic Cosmic Rays (GCRs) are modulated by various effects as they propagate through the heliosphere before they are detected at Earth. This transport can be described by the Parker equation (Parker, 1965). It calculates the phase space distribution of GCRs depending on the main modulation processes: convection, drifts, diffusion and adiabatic energy changes. A first order approximation of this equation is the force field approach, reducing it to a one-parameter dependency, the solar modulation potential. Utilizing this approach, Usoskin et al. (2005; 2011) reconstructed the solar modulation potential between 1936 and 2010, which by now is commonly used in many fields. However, it has been shown previously e.g. by Herbst et al. (2010) that the solar modulation potential depends not only on the Local Interstellar Spectrum (LIS) but also on the energy range of interest. Using the LIS by Usoskin et al. (2005) together with published proton intensity spectra obtained by PAMELA, heavier nuclei measurements from IMP8 and ACE/CRIS as well as neutron monitors, we have investigated this energy dependence further. We will present the results that show as expected severe limitations at lower energies including a strong dependence on the solar magnetic epoch. Based on these findings, we will outline a tool to describe GCR proton spectra in the energy range from a few hundred MeV to tens of GeV over the last solar cycles.

Collaboration

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