



Contribution ID: 157

Type: **Poster contribution**

The modulation of galactic protons in the inner heliosphere during the recent unusual solar minimum period

Tuesday, 4 August 2015 16:00 (1 hour)

Proton observations from the PAMELA mission and a comprehensive modulation model, including a new Stochastic Differential Equation (SDE) model, are used to study the details of the modulation of cosmic rays in the inner heliosphere. Recent theoretical advances in determining the diffusion coefficients are used to compute cosmic ray intensities over the unusual last solar minimum activity period. We present proton spectra observed between 2006 and 2009 in comparison with the mentioned numerical models. The time-dependence of the magnitude of the solar magnetic field and the corresponding wavy current sheet are used, relating their time-dependence to that of the relevant diffusion coefficients and drift coefficient. The approach is further enhanced by introducing a time-dependence in the rigidity dependence of the transport coefficients as required to reproduce these observations. It will be illustrated that the model can reproduce the monthly spectra observed during the mentioned period. This makes it possible to identify the dominant modulation mechanisms for the unusual solar minimum up to 2009 and to establish why drift effects appear to be of lesser importance than during previous solar minimum cycles.

Collaboration

– not specified –

Registration number following "ICRC2015-I"

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