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Solar Energetic Particle transport along meandering field lines and the interpretation of wide longitudinal events

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Recent multi-spacecraft Solar Energetic Particle (SEP) observations have challenged the traditional view of SEP production and interplanetary transport. The observations suggest fast SEP access to a wide range of heliographic longitudes. The recent case studies that fit the SEP observations with 3-dimensional diffusive SEP transport simulations suggest a narrow source region, and strong cross-field diffusion beyond that permitted by the current theoretical understanding. Laitinen et al (2013) suggested a new approach to the modelling of interplanetary SEP transport, based on their finding that the cross-field diffusion early in an SEP event is not diffusive. The model incorporates field-line meandering into the Fokker-Planck (FP) transport equation framework. In this presentation, we report on the implementation of the new model within a stochastic differential equation framework for particle transport and field-line wandering. We show how it is able to reproduce the observed fast access of SEPs to wide range of longitudes with realistic interplanetary transport conditions even for a narrow source region. Results of a parametric analysis on how the level of interplanetary turbulence and the SEP source characteristics affect the SEP intensities at at 1 AU are presented, and we discuss the implications for the SEP event origins and the role of interplanetary turbulence in the interpretation of SEP observations.

Author: Dr EFFENBERGER, Frederic (Stanford University)

Co-authors: Dr KOPP, Andreas (University Kiel); Dr MARSH, Mike (University of Central Lancashire); Dr DALLA, Silvia (University of Central Lancashire); Dr LAITINEN, Timo (University of Central Lancashire)

Presenter: Dr EFFENBERGER, Frederic (Stanford University)

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