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Three-dimensional anisotropic transport of solar energetic particles in the inner heliosphere

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The missions STEREO A/B with large separation distances, together with ACE, SOHO, and WIND near Earth, provide a unique opportunity to observe solar energetic particles (SEP) over a large range of solar longitudes and latitudes in the inner heliosphere. It is evident from these observations that temporal and directional characteristics of solar energetic particles strongly depend on the location of the spacecraft relative to the source at the Sun. Our three-dimensional model of SEP propagation incorporates anisotropic pitch-angle scattering by magnetic inhomogeneities in the solar wind, focusing, streaming along the large-scale magnetic field, adiabatic energy losses and pitch-angle-dependent diffusion perpendicular to the magnetic field. We report the results of a parameter study of SEP time profiles, anisotropy and pitch-angle distribution as a function of different propagation parameters, angular and radial distances from the source and the source size. A comparison of the simulation results with multi-spacecraft observations allows to diagnose the propagation conditions in interplanetary space. Possibilities to apply our model to the investigation of anisotropic transport of high energy cosmic rays in the galaxy will be discussed.

Orateur: Dr KARTAVYKH, Yulia (University of Würzburg / Ioffe Physical-Technical Institute)

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