Transport of stellar particles

Droege, Wolfgang[1]
[1]University of Wuerzburg

Magnetic processes similar to those occuring on the Sun are observed on a variety of stars with external convection envelopes (stellar winds or astrospheres). The rotation of the star coupled with convective motions generates strong magnetic fields in the stellar interior and produces a multitude of magnetic phenomena, among them stellar activity cycles, stellar flares, and very likely also stellar energetic particles. The interaction of these particles with a turbulent magnetic field embedded in the astrospheric plasma gives rise to transport effects which include pitch-angle scattering, diffusion parallel and perpendicular to the large-scale magnetic field, convection with the stellar wind and adiabatic energy losses. To conceive an idea about particle transport in astrospheres, a review of recent progress in the modeling of solar particle events will be given. Questions regarding the geometry of the turbulence, and dynamic and non-linear effects in the interaction of the particles with the turbulence will be addressed. A recently developed numerical model to simulate the pitch-angle dependent three-dimensional propagation of energetic particles in the Heliosphere, and applications to multi-spacecraft observations (e.g., ACE/Wind with STEREO) will be presented. Prospects for simulating stellar energetic particle events for a variation of large-scale magnetic field structures in an astrosphere, and for varying transport conditions in a stellar wind plasma will be discussed.