

Cosmic Ray Modulation: Current Status of Ab Initio Models

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The aim of ab initio modulation models is to describe the solar modulation of Galactic cosmic rays from first principles, by using particle transport theory to compute the cosmic ray diffusion tensor from the properties of solar wind turbulence, and by using turbulence transport theory to specify the turbulence at all locations in the heliosphere. This is in contrast to traditional treatments of modulation, where the diffusion tensor is treated as a free parameter to be fitted to observations. The ab initio approach can, we believe, benefit all of the various fields involved; it provides demanding observational tests of both particle transport theory and turbulence theory, while at the same time putting modulation theory on a firmer foundation. This talk will review the current status of ab initio modulation models in relation to observations. It will also identify needed improvements, including improved descriptions of anisotropic perpendicular diffusion, a better understanding of the form of the turbulence energy (low wavenumber) range, and resolving lingering uncertainties about the role of drifts in modulation (full drifts versus reduced drifts).