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Cosmic-ray pitch-angle scattering and isotropization

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Spacecraft observations have revealed the necessity to refine the modeling of the transport of charged energetic particles to allow for phase-space distributions that are strongly pitch-angle anisotropic. A central point is the determination of the pitch-angle diffusion coefficient that occurs in the Fokker-Planck transport equation and is used to determine the parallel mean-free path. In addition, the process of pitch-angle isotropization is important for many applications ranging from diffusive shock acceleration to large-scale cosmic-ray transport. In the talk, both a systematic comparison and new results are shown from analytical predictions for the Fokker-Planck coefficient of pitch-angle scattering and from numerical test-particle simulations. For the example of an adiabatically focused mean magnetic field, it is demonstrated how, depending on the ratio of the focusing length and the particle's Larmor radius, the Fokker-Planck coefficient can be significantly modified.