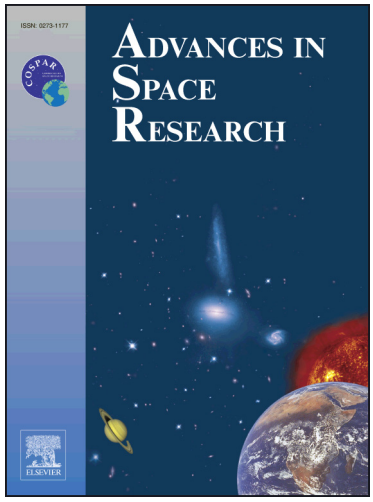

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Numerical Analysis of the Fokker-Planck Equation with Adiabatic Focusing: Realistic Pitch-Angle Scattering

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Abstract

We solve the focused transport equation of cosmic rays numerically to investigate non-isotropic models of the pitch-angle scattering coefficient. In previous work, the Fokker-Planck equation was solved either analytically by using approximations, or by using a numerical approach together with simple models for the pitch-angle scattering coefficient. It is the purpose of the current article so compute particle distribution functions as well as the parallel diffusion coefficient by solving numerically the focused transport equation for a more realistic Fokker-Planck coefficient of pitch-angle scattering. Our analytical form for the scattering parameter is based on non-linear diffusion theory that takes into account realistic scattering at pitch-angles close to 90°. This general form contains the isotropic form as well as the quasi-linear limit as special cases. We show that the ratio of the diffusion coefficients with and without focusing sensitively depends on the ratio of the turbulent magnetic field and the mean field. The assumed form of the pitch-angle Fokker-Planck coefficient has an influence on the parallel diffusion coefficient. In all considered cases we found a reduction of the ratio of the diffusion coefficients if the ratio of magnetic fields is reduced.

Key words: magnetic fields, turbulence, energetic particles

1 Introduction

Understanding the acceleration and propagation of cosmic rays is a fundamental problem in astrophysics and space science. The motion of these particles is

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