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# Study of momentum diffusion with the effect of adiabatic focusing

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Momentum diffusion of the energetic charged particles is an important mechanism of the transport process in astrophysics, physics of the fusion devices, and laboratory plasmas. In the light of observations, for the investigation of energetic particle transport through magnetized plasma, one usually assumes the magnetic field configuration as the superposition of the background magnetic field $B_0$ and the turbulent component $\delta B$. The fact that large-scale magnetic field is nonuniform in space gives rise to the so called adiabatic focusing effect of the energetic particles. Previous authors found that the along-field focuing can lead to the convective term in momentum space. Here, we explore the momentum diffusion depending on the adiabatic focusing effect along the background magnetic field. By employing the iteration method, we derive the momentum diffusion coefficient $A(\xi) = A_0 + \mathcal{M}_4(\xi)$ with the uniform field momentum diffusion coefficient $A_0$ and the modifying term $\mathcal{M}_4(\xi) = M_1(\xi) + M_2(\xi) + M_3(\xi) + M_4(\xi)$ by retaining up to the fourth order of the focusing parameter $\xi$. Thereafter, we evaluate the modifying term $\mathcal{M}_4(\xi)$ to find that it is not equal to zero for most of the cases, so that we obtain a new second order acceleration mechanism of energetic charged particles. After evaluating the modifying term, we find that it is determined by the sign of the focusing characteristic length and the cross helicity of turbulent magnetic field.

## Keywords

Interplanetary turbulence ; Magnetic fields; Solar energetic particles

## Collaboration

## other Collaboration

## Subcategory

Theoretical Results

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