CROSS-FIELD ION ACCELERATION BY KINETIC ALFVEN TURBULENCE IN AURORAL ZONES

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Strong cross-field energization of oxygen ions in the auroral zones of the Earth's magnetosphere has been mainly attributed to the resonant ion-cyclotron acceleration or to stochastic heating by high-frequency waves. We investigate the possibility that this energization is produced by low-frequency turbulence of oblique Alfven waves that are short-wavelength across the magnetic field - kinetic Alfven waves (KAWs). Although KAW turbulence is often observed at the auroral magnetic field lines, the means of energy transfer from the turbulence to the plasma particles are studied insufficiently. In this presentation we demonstrate that the strong non-adiabatic acceleration of oxygen ions across the background magnetic field occurs in the demagnetizing regions in the vicinity of strong super-critical gradients of the wave fields. Such gradients develop intermittently in KAW turbulence. The main properties of non-adiabatic ion acceleration by KAW turbulence are as follows: (i) it is non-resonant, hence it does not need any wave coherence; (ii) it has a well-defined threshold character; (iii) it can be efficient even if the super-critical gradients appear only intermittently; (iv) it is enforced by the field-aligned ion motion in the opposite direction the waves move to. These properties of the proposed energization mechanism are compatible with observed features of KAW turbulence and oxygen ions in the auroral zones.

ion acceleration, Alfven turbulence, auroral zones.

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