AOGS 2006

Parallel Electron and Perpendicular Ion Energisation by Parallel and Lower Hybrid Turbulence in Low Beta Plasmas with Strong Parallel Currents

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We consider parallel current driven instabilities as a mechanism for current relaxation and particle energisation. First, using linear theory and quasilinearsimulations, we explain how lower hybrid (LH) waves can efficiently compete with parallel (Buneman-driven) waves during the relaxation of the electron drift. Second, using particle simulations, we study this mechanism in detail, and find that parallel and LH waves can be linearly excited with similar intensities. The intense LH turbulence has significant observational consequences includingsubstantial parallel electron heating, perpendicular ion accelaration, and density variations (of up to about 10%) on LH wave scales. The LH waves also allow a more complete relaxationof the electron distribution that may be produced by the parallel Buneman instability alone. We also sketch the application of this theory in magnetic reconnection regions with low plasma beta and substantial guide fields, in the solar corona and Earth's magnetosphere, as well as Earth's auroral regions.