Geophysical Research Abstracts, Vol. 8, 04814, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04814

Hall effects in turbulence and reconnection

W. H. Matthaeus and P. Dmitruk

Bartol Research Institute, Department of Physics and Astronomy, University of Delaware (whm@udel.edu)

In order to describe the dynamics of a low density space or astrophysical plasma, the Hall term in the generalized Ohms law is thought to be the first term that emerges of importance as smaller scales, where kinetic effects become important, are included. One expects these effects to commence at scales on the order of the ion inertial scale $c/\omega_{pi} = V_A/\Omega_{ci}$, or at scales such as the thermal ion gyroradius, or the ion meandering length, which are all similar when the plasma beta is order unity. For systems that include a wide range of interacting scales, described at the large scale by MHD, the Hall term enters with a dimensionless strength $c/\omega_{pi}L$, L the energy-containing scale. Although this ratio may be very small in astrophysical systems, the Hall term becomes important at the scales relevant to reconnection and turbulent dissipation. Here we review some basic features of the nature and influences of the Hall electric field, focusing on three systems: the decay of MHD turbulence, the rate of reconnection, and the influence on the acceleration of charged test particles. Paradoxically, the Hall electric field is found to have a small effect on cascade rates, but a possibly significant effect on reconnection rates, and while evidence shows that it is negligible in the overall distribution of turbulent electric field, it is the dominant contribution to the electric field at scales near to, and somewhat smaller than, c/ω_{pi}. Clarifying this picture requires that we understand the close connection between turbulence, reconnection, and various contributions, both coherent and random, to the electromagnetic field in a dynamic plasma. This research supported by the USNSF under ATM-0539995.