Plasma Response to Waves in Arbitrary Magnetic Field Geometry

Brent Goode[1], J.R. Cary[1], L.A.Berry[2]

[1.] Center for Integrated Plasma Studies, University of Colorado
Boulder, CO 80302
[2.] Oak Ridge National Lab
Oak Ridge, TN 37831

Abstract

We examine the effects of non-uniform magnetic fields on the propagation and absorption of RF waves in plasmas. The effects we include are curvature, and gradients in field strength in arbitrary directions. Of these, only the lowest order effects of parallel gradients have been previously examined. In addition to higher order gradient terms and curvature effects, collisions are included in a more comprehensive manner. Except for the first order parallel gradients, these physical effects are all mechanisms that cause decorrelation between resonant particles and waves. The relative strength of these decorrelation mechanisms depends heavily on the plasma parameters, and the magnetic field geometry. Methods for determining the dominant decorrelation mechanism based on geometric and plasma parameters are presented. In addition numerical calculations of wave propagation and absorption for a one-dimensional case are performed using a conductivity tensor calculated with these new effects, and the results are compared with those of previous theory.