Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Understanding axisymmetric Bernstein modes in a nonneutral plasma GRANT W. HART, ROSS L. SPENCER, Brigham Young University —

We have been studying axisymmetric Bernstein modes in a nonneutral plasma using both kinetic theory and simulation. Because of the large electric fields in these unneutralized plasmas, the oscillations are shifted down from the cyclotron frequency. Most of the modes occur near the Doppler-shifted upper-hybrid frequency, called the vortex frequency. In cylindrical geometry for a constant-density initial plasma, the perturbed velocity goes as $J_1(kr)$. For any given k there are two modes, one upshifted from the vortex frequency and one downshifted. The boundary condition which determines the allowed values of k is that the perturbed pressure must go to zero at the boundary. There is also another mode that does not follow this rule, however. This mode is very near the vortex frequency (0.1% - 1% frequency difference) and the pressure does not contribute significantly to the dynamics of the mode. This mode is most fruitfully treated as a small pressure perturbation of the upper-hybrid oscillation. The pressure causes a small upward frequency shift, which creates a small deviation from a self-similar velocity profile and therefore a non-zero k. The simultaneous solution of the perturbed dynamics and the dispersion relation allows the frequency and k to be calculated.

Grant W. Hart
Brigham Young University

Date submitted: 16 Jul 2012 Electronic form version 1.4