Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Axisymmetric Bernstein modes in a finite-length non-neutral plasma: simulation and kinetic theory. GRANT HART, BRYAN G. PETERSON, ROSS L. SPENCER, Brigham Young Univ - Provo — We are using a 2-D PIC code to model high-frequency (near the cyclotron frequency) axisymmetric oscillations in a finite-length pure-ion plasma. We previously modeled these modes for infinite-length plasmas, where they are not detectable in the surface charge on the walls because of axisymmetry and lack of z-dependence. This is not true in a finite-length plasma, however, because the eigenfunction of the oscillation has to have nodes a short distance beyond the ends of the plasma. This gives the modes a $\cos(k_z z)$ or $\sin(k_z z)$ dependence, with a k_z such that an integral number (approximately) of half-wavelengths fit into the plasma. This z-dependence makes the mode detectable in the surface charge on the walls. The modes also have r-dependence. The radial-velocity eigenfunctions of the modes behave as $\mathrm{J}_1(k_r r)$. We have simulated the plasma with different k_z and k_r values and find that increasing k_z introduces a small frequency shift, either upward or downward depending on which mode is measured. The damping of the modes also increases as k_z or k_r increases. We are developing an appropriate kinetic theory of these modes that will include both the finite-Larmour-radius effects and the axial bouncing motion of the particles.

Grant Hart
Brigham Young Univ - Provo

Date submitted: 14 Jul 2016 Electronic form version 1.4