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Finite temperature m=0 upper-hybrid modes in a non-neutral plasma, theory and simulation. GRANT W. HART, M. TAKESHI NAKATA, ROSS L. SPENCER, Brigham Young University — Axisymmetric upper-hybrid oscillations have been known to exist in non-neutral plasmas and FTICR/MS devices for a number of years[1,2]. However, because they are electrostatic in nature and axisymmetric, they are self-shielding and therefore difficult to detect in long systems. Previous theoretical studies have assumed a zero temperature plasma. In the zero temperature limit these oscillations are not properly represented as a mode, because the frequency at a given radius depends only on the local density and is not coupled to neighboring radii, much like the zero temperature plasma oscillation. Finite temperature provides the coupling which links the oscillation into a coherent mode. We have analyzed the finite-temperature theory of these modes and find that they form an infinite set of modes with frequencies above $\omega_c^2 - \omega_p^2$. For a constant density plasma the eigenmodes are Bessel functions. For a more general plasma the eigenmodes must be numerically calculated. We have simulated these modes in our $r - \theta$ particle-in-cell code that includes a full Lorentz-force mover[3] and find that the eigenmodes correspond well with the theory.

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