Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

Linear theory of n=0 geodesic acoustic mode[1] T. ZHOU, H.V. WONG, H.L. BERK, University of Texas at Austin — The n=0 geodesic acoustic mode (GAM), observed in JET and D- III D is frequently accompanied by fast frequency chirping. A numerical investigation on CASTOR revealed that a global GAM mode arises if the continuum geodesic frequency vs. radius has a local maximum. The global GAM properties are characterized by: a small upward frequency shift from the continuum, radially localized electrostatic components with poloidal numbers m=0,1 and magnetic coupling to a nonlocalized to m=2 component. Here we develop an analytic MHD theory of this n=0 global GAM in a toroidal plasma with r/R and beta small. We choose to start from the MHD quadratic form (with inertial terms). We find the GAM eigenmode is characterized by a radially localized density perturbation and a one order smaller magnetic perturbation that extends throughout the plasma. Its verified that mode existence requires that the continuum GAM profile has a maximum as a function of radius. An asymptotic matching technique shows that the eigenmode frequency shifts from the maximum continuum proportional to the square of the local beta.The asymptotic method agrees precisely with the numerical results.

[1]supported by DOE grant DE-FG02-04ER5474.

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Date submitted: 25 Jul 2007 Electronic form version 1.4