

APR06-2006-000682

Abstract for an Invited Paper
for the APR06 Meeting of
the American Physical Society

Interpretation of frequency sweeping of $n = 0$ mode in JET

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Persistent rapid up and down frequency chirping modes with a toroidal mode number of zero ($n = 0$) are observed in the JET tokamak when energetic ions, in the range of several hundred keV, are created by high field side ion cyclotron resonance frequency heating. Fokker-Planck calculations demonstrate that the heating method enables the formation of an energetically inverted ion distribution which supplies the free energy for the ions to excite a global geodesic acoustic mode (GGAM). The large frequency shifts of this mode are attributed to the formation of phase space structures whose frequencies, which are locked to an ion orbit resonance frequency, are forced to continually shift so that energetic particle energy can be released to counterbalance the energy dissipation present in the background plasma.

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