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Search for Zonal Flow Associated with ITG Modes in CLM[1]
AMIYA SEN, VLADIMIR SOKOLOV, XIAO WEI, Columbia University — The basic physics transport experiments in the Columbia Linear Machine (CLM) have indicated inverse gyro-Bohm dependence of the ion thermal conductivity on the isotope mass. This paradox was explained by an unique 3-wave coupling of two ITG modes and an ion acoustic wave [1]. However, the competitive process of transport regulation via zonal flow [2] was not investigated. A series of basic experiments to detect any generation of zonal flow is now reported. Towards this end we have carefully examined the fine structure of the power spectrum and found two side bands with a shifts of about 3 kHz. An interpretation of this in terms of frequency modulation (FM) of ITG mode by a zonal flow appears plausible. Detailed cross correlation studies of two axially separated probes (one capacitive probe, the other ring probe) reveal two distinct modes (both m=0): one with $k_{//} \neq 0$, $\omega/2\pi \sim 2$ to 10 kHz ion acoustic wave, and the other with $k_{//} = 0$, $\omega/2\pi \leq 5$ kHz, possibly a zonal flow. A theory using reductive perturbation method has been developed for self coupling of ITG mode in conjunction with the 3- wave coupling of two ITG radial harmonics and an ion acoustic mode. The results agree with the experimental values within a factor of 2.
[1] V. Sokolov and A. K. Sen, Phys. Rev. Lett, **92**, 165002 (2004).
[2] P.H.Dimond, S.Champeaux, M.Malkov et al., Nucl.Fusion **41**, 1067 (2001).

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