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Gyrokinetic simulation study of BAE and LFM properties in DIII-D plasma

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We present results of simulation study of low-frequency Alfvenic modes in sub-TAE (Toroidal Alfven Eigenmodes) range in DIII-D, in particular, BAE (Beta-induced AE) and LFM (low-frequency mode) [1-3]. Using the Gyrokinetic Toroidal Code (GTC) [4], we have performed gyrokinetic simulations of BAE and LFM in DIII-D plasmas and identified LFM by comparing its properties to those of BAE [5]. Fast ion density scan has revealed a continuous change rather than a sudden transition from LFM to BAE with increasing fast ion density. We also have found that LFM linear dispersion has a non-monotonic dependence on radial shift of thermal pressure, implying that the relative position of qmin with respect to the pressure gradient peak contributes to the appearance of the mountain peak in the observed LFM activities [1]. GTC isotope study have yielded a robust 1/mi1/2 scaling of BAE and LFM linear dispersions for different thermal ion mass mi [3]. Note that both modes appear to have wide ranges of toroidal mode number n=3˜9 with similar linear growth rates. Results of nonlinear BAE simulations motivated by this finding will be presented. This work was supported by DOE SciDAC ISEP and used computing resources at ORNL (DOE Contract DE-AC05-00OR22725) and NERSC (DOE Contract DE-AC02-05CH11231), and experimental data from DIII-D National Fusion Facility (DOE Contract DE-FC02-04ER54698).

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