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Electron Temperature Gradient Turbulence: Validation in the Columbia Linear Machine Experiments XIANGRONG FU, WENDELL HORTON, University of Texas at Austin, AMIYA SEN, Columbia University, New York, YONG XIAO, ZHIHONG LIN, University of California, Irvine — The electron temperature gradient (ETG) mode, which is a dominant mechanism for turbulent electron thermal transport in plasmas, is produced and verified by a recent experiment conducted in the Columbia linear machine[1]. They report modes at $\sim 0.3 - 0.5$ MHz, with azimuthal wave numbers $m \sim 14 - 16$ and parallel wave number $k_{\|} \sim 0.003$ cm^{-1}. We study these results using a gyro-fluid simulation code DTRANS and a gyro-kinetic simulation code GTC[2]. The results show that in the linear phase, the dispersion relation is consistent with kinetic theory for a slab ETG model and the radial structure of the fluctuation agrees with the experiment. We also investigate the saturation of ETG mode using the $\mathbf{E} \times \mathbf{B}$ turbulent mixing and coupling to low frequency modes. It turns out that low frequency drift-ion acoustic waves as in [1] interact with high frequency ETG modes to extract energy and saturate the ETG fluctuations.

[1] X. Wei, V. Sokolov, and A. K. Sen, Physics of Plasmas 17, 042108(2010).
[2] I. Holod, W. L. Zhang, Y. Xiao, and Z. Lin, Physics of Plasmas 16, 122307(2009).

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