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Effect of Magnetic Island on ITG driven Turbulence

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Aiming at understanding the cross-scale interaction among multi-scale plasma fluctuations such as the MHD, ion and electron scale turbulence, here, we numerically investigate the ion temperature gradient mode (ITG) instability in the presence of a magnetic island (mITG [1]) using a gyro-kinetic simulation code.
Previously, we showed that the inclusion of a static magnetic island induces a poloidal coupling, by which unstable modes can dissipate energy through stable modes. This poloidal mode-mode coupling strength increases with increasing magnetic island width. However, for a large magnetic island, new rational surfaces may appear, which destabilized the system again. While stabilizing effects are dominating for small islands, destabilizing effects are dominating for large islands [2].
In this work, we including kinetic electrons and confirm previous linear results, where only adiabatic electrons were assumed. Further, we also present non-linear simulations - which are not possible to perform with adiabatic electrons due to the difficulty to calculate the flux averaging term - and investigate the effect of the magnetic island on ITG saturation level, turbulence structure, zonal flow strength, and the corresponding heat and particle fluxes.

[1] Z.X.Wang, J.Q. Li, Y. Kishimoto, J.Q. Dong (PoP, 2009)
[2] P.Hilscher, K.Imadera, J.Li, K. Takaki, Y.Kishimoto (JSPF, 2011)