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.