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Gyrokinetic Particle Simulation of Kinetic MHD ZHIHONG LIN, GE DONG, PENG JIANG, University of California, Irvine, GTC TEAM — The excitation and evolution of macroscopic magnetohydrodynamic (MHD) instabilities that limit the performance of fusion plasmas often depend on kinetic effects at microscopic scales as well as the nonlinear coupling of multiple physical processes. As the first step toward integrated simulation coupling multiple physical processes, effects of magnetic islands on neoclassical transport and microturbulence has been studied in GTC simulations. Simulations find that different toroidal modes are linearly coupled together and that toroidal spectra become broader when the island width increases. The real frequencies and growth rates of different toroidal modes approach each other with the averaged value independent of the island width. The linear mode structures are enhanced at the island separatrices and weakened at the island centers, consistent with the flattening of the pressure profile inside the islands. Furthermore, GTC simulations of neoclassical transport find that the balance between the perpendicular and parallel transport sets the density gradient inside the magnetic island. As a result, the radial distribution of the bootstrap current change significantly. The bootstrap current decreases dramatically inside the island. On the other hand, the steepening of the density gradient outside the islands leads to a larger bootstrap current in the vicinity of the separatrix. The volume averaged values of the bootstrap current does not change.

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