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Coupled neoclassical-MHD simulations of Ohmic current penetration in an axisymmetric torus[1] B.C. LYONS, S.C. JARDIN, PPPL, J.J. RAMOS, MIT-PSFC — We self-consistently solve for the current induced by a boundary loop voltage in an axisymmetric, low-collisionality toroidal plasma using a new drift-kinetic equation (DKE) solver coupled to the M3D-C1 magnetohydrodynamics (MHD) time evolution code. A time-dependent DKE is solved for the non-Maxwellian electron distribution function using the full, linearized Fokker-Planck-Landau collision operator. We work in a 4D phase space (R, Z, v, χ), where R is the major radius, Z is the vertical distance, v is the magnitude of the random velocity, and χ is the pitch angle in the mean flow reference frame. Coupling with M3D-C1 is achieved primarily through the collisional friction force, represented as a velocity moment of the non-Maxwellian electron distribution function. For the initial work, flat temperature and density profiles are assumed and we use the reduced, two-field MHD equations. Results are compared to theoretical models of the neoclassical conductivity reduction in the banana regime. The algorithms used to solve the DKE are thoroughly discussed. Future extensions of this work will lead to a hybrid neoclassical-MHD solver capable of studying core plasma instabilities, such as sawtooth modes and neoclassical tearing modes.

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