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Simulation of cross-separatrix edge plasma transport with the continuum gyrokinetic code COGENT

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Axisymmetric (4D) simulations using the finite-volume code COGENT are performed to explore the role of ion kinetic effects in tokamak edge plasmas. The simulation model solves the long wavelength limit of the full-F gyrokinetic equation for ion species coupled to the 2D quasi-neutrality equation for electrostatic potential variations, where a fluid model is used for an electron response. The ion-ion collisions are described by the nonlinear Fokker-Plank operator and the effects of anomalous transport are included via a radial diffusion model. Coupling to the 2D fluid code UEDGE is explored in order to improve the electron and neutral models used in COGENT. Illustrative simulations are performed for the parameters of the DIII-D tokamak and compared with the experimental data.

The development of 5D COGENT for edge plasma turbulence modeling is also reported. To that end, the slab-geometry 5D version has been developed and successfully verified in simulations of the collisionless drift-wave instability that involve gyrokinetic equations for both ion and electron species coupled to the long-wavelength limit of the 3D gyro-Poisson equation. Recent work is focused on extending the 5D code to include the effects of a tokamak edge magnetic geometry.

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