Modeling of a tokamak edge plasma with the COGENT code*

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The edge of a tokamak is distinguished by a wide range of collisionality regimes and short radial length scales for density and temperature variations comparable to particle drift orbit excursions. Additional challenges are provided by the presence of the divertor magnetic geometry affecting ion orbit loss and introducing sources of impurities and hydrogen particles via sputtering and recycling at bounding material surfaces. In order to investigate the transport properties of a tokamak edge, an advanced continuum gyro-kinetic code COGENT is being developed by the Edge Simulation Laboratory collaboration.

The present version of the COGENT code models a nonlinear axisymmetric 4D gyrokinetic equation coupled to the long-wavelength limit of the gyro-Poisson equation. COGENT has also a number of increasingly detailed options for collision models including the full nonlinear Fokker-Plank operator. The code exploits advanced numerical methods from the fluids community, and it is distinguished by a fourth-order finite-volume (conservative) discretization combined with arbitrary mapped multiblock grid technology (nearly magnetic-field-aligned blocks) to handle the complexity of tokamak divertor geometry with high accuracy.

The present work describes the progress with COGENT including a summary of comprehensive verification studies and the resent results of cross-separatrix neoclassical transport simulations.

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