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TH/P4-06: Eulerian Simulations of Neoclassical Flows and Transport in the Tokamak Plasma Edge and Outer Core

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The delta f code NEO is used to study the neoclassical transport for parameters relevant in the plasma edge and outer core. NEO includes multiple ion species, general geometry, and rapid toroidal rotation. It has recently been upgraded to include the full linearized Fokker-Planck collision operator, using novel numerical schemes which can accurately treat the disparate scales that arise in the case of multi-species plasmas, thus providing an exact solution for the local neoclassical transport. Comparisons are been made between the NEO neoclassical simulations and experimental measurements of the deuterium parallel velocity profiles and carbon impurity flow profiles in the edge for DIII D L mode discharges. Emphasis is made on understanding how the flows of the different ion species are correlated in the edge region. Extensions of these studies further into the tokamak boundary region are explored via comparisons with COGENT, a full f Eulerian code describing both closed and open field-line regions. With COGENT, the generation of intrinsic plasma flows due to neoclassical particle losses in the tokamak edge, e.g. from thermal ion orbit losses and x-point losses, are investigated. Comparisons are also made with UEDGE, a 2D fluid code with a neoclassical transport model for both closed and open field lines allowing general collisionality, to assess the adequacy of the fluid transport model and provide a target for the kinetic codes in the collisional regime. Extensions of the NEO algorithm for use in gyrokinetic stability calculations of the highly collisional plasma edge are also explored.
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