Reduced model (SOLT) simulations of neutral-plasma interaction

DAVID RUSSELL, JAMES MYRA, Lodestar Res Corp — The 2D scrape-off-layer turbulence (SOLT) code has been enhanced by the addition of kinetic-neutral physics. Plasma-neutral interactions include charge exchange (CX) and ionization (IZ). Under the assumption that the CX and IZ collision rates are independent of the ion-neutral relative velocity, a 1D (radial: x) Boltzmann equation has been derived [1] for the evolution of the \((v_y,v_z)\)-averaged neutral distribution function \((G)\), and that evolution has been added to SOLT. The CX and IZ rates are determined by the poloidally (y) averaged plasma density and temperatures, and \(G = G(x,v_r,t)\). Results from 1D simulations that use diffusion as a proxy for turbulent transport are presented to illustrate the capability, including the approach to a steady state driven by sustained neutral injection in the far-SOL and source-driven heating in the core. Neutral density and energy profiles are obtained for the resulting self-consistent equilibrium plasma profiles. The effect of neutral drag on poloidal ExB mean flow and shearing rate is illustrated. Progress on 2D turbulence (blob) simulations is reported. [1] J. R. Myra and D. A. Russell, Transport Task Force Workshop, Williamsburg, Virginia, April 25-28, 2017, poster B23.

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