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Self-consistent modeling of multiscale gyrokinetics and transport[1]

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In the core of tokamak plasmas, a separation of timescales between turbulence and transport makes direct simulation of both processes computationally expensive. A workable, practical method to exploit the separation of timescales will be a key component in enabling the self-consistent solution of macroscopic profiles of density and temperature. We report on progress to implement the LoDestro scheme [Shestakov et al., J. Comp. Phys. 185 (2003) 399] coupled with the gyrokinetic code GENE to perform for the first time coupled turbulence and transport simulations using a global gyrokinetic code. One of the advantages of the LoDestro scheme, which is essentially a method of solving an implicitly advanced nonlinear transport problem, is that it does not use Newton iteration and hence avoids difficulties that arise from calculating Jacobians or Jacobian-vector products in the presence of noisy fluxes. Instead, the implicit timestep equation is solved with an iteration scheme by representing the turbulent flux as the sum of diffusive and convective pieces, after which Picard iteration is used to converge to the self-consistent solution. Preliminary results will be presented.

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