Scrape-off-Layer ELM Heat Pulse Results from the Gkeyll Discontinuous Galerkin Kinetic Code*

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An electrostatic gyrokinetic-based model is applied to simulate parallel plasma transport in the scrape-off layer to a divertor plate. The authors focus on a test problem that has been studied previously[1, 2, 3], using parameters chosen to model a heat pulse driven by an edge-localized mode (ELM) in JET. Previous work has used direct particle-in-cell equations with full dynamics, or Vlasov or fluid equations with only parallel dynamics. With the use of the gyrokinetic quasineutrality equation and logical sheath boundary conditions, spatial and temporal resolution requirements are no longer set by the electron Debye length and plasma frequency, respectively, allowing the calculations to be orders of magnitude faster. This test problem also helps illustrate some of the physics contained in the Hamiltonian form of the gyrokinetic equations and some of the numerical challenges in developing an edge gyrokinetic code. These results are documented more fully in [4]. These calculations also serve as a test of the Gkeyll code, a new continuum gyrokinetic code being developed for the challenging edge region of fusion devices. It uses Discontinuous Galerkin algorithms for problems cast in a general Hamiltonian framework with Poisson brackets, plus additional collision/diffusion operators.

References

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