Progress on a Fully Gyrokinetic Transport Code*

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We report on the status and development of a prototype steady-state gyrokinetic transport code, TGYRO. This prototype is being developed as part of a SciDAC-funded project (partner to the larger FACETS project) to develop software to integrate micro-scale gyrokinetic turbulence simulations into a framework for practical multi-scale simulation of a burning plasma core. It is our intention to aggressively pursue the International Thermonuclear Experimental Reactor (ITER) as an eventual simulation target after a period of code validation. In this presentation we will focus on the project status from the physics rather than computational point-of-view.

The prototype code will be eventually be used to predict machine performance (the fusion energy gain, Q) given the H-mode pedestal temperature and density. At present, projections of this type rely on transport models like GLF23 [1], which are based on rather approximate fits to the results of linear and nonlinear simulations. The goal for TGYRO is to make these performance projections with precise nonlinear gyrokinetic simulations. The method of approach is to use a lightweight master transport code to coordinate multiple independent (each massively parallel) gyrokinetic simulations using the GYRO [2] code. This will substantially improve and generalize an initial proof-of-principle effort to use feedback methods with GYRO to predict steady-state profiles [3].

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