Comparison of Gyrokinetic Simulation Against Core Turbulence Fluctuation Measurements via Virtual Diagnostics*

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Validation of plasma turbulence simulations requires extensive direct comparisons against experimental measurements, taken under conditions for which the simulation model is believed to be accurate. Recent upgrades to the beam emission spectroscopy (BES) system on the DIII-D tokamak now allow for spatio-temporally resolved measurements of core turbulence measurements, where the gyrokinetic equation is believed to be an accurate description of small-scale drift-wave turbulence. Equally important advances in numerical algorithms and available computing power now make physically realistic gyrokinetic simulations feasible for times long enough to allow for meaningful comparisons against the measurements. Utilizing these advances, we have begun a comprehensive program of direct comparison between BES measurements and results from the gyrokinetic code GYRO, and will describe initial results from the modeling of a slowly evolving L-mode discharge. Comparisons of fluctuation amplitudes, frequency spectra, correlation times and lengths will be presented, in addition to turbulent fluxes. An important component of this process is the use of a "virtual diagnostic" [1] which describes the inherent spatial sensitivity of the BES system (including realistic geometry, optics, and neutral beam characteristics), as well as the fact that the BES system measures light intensity fluctuations, rather than the density and temperature fluctuations that are the "canonical" variables of plasma turbulence models. The impact of these effects is also discussed.

[1] R.V. Bravenec and W.M. Nevins, Rev. Sci. Inst. **77**, 015101 (2006).

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