Anomalous transport scaling in the DIII-D tokamak matched by supercomputer simulation

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Abstract

Gyrokinetic simulation of tokamak transport has evolved sufficiently to allow direct comparison of numerical results with experimental data. It is to be emphasized that only with the simultaneous inclusion of many distinct and complex effects can this comparison realistically be made. Until now, numerical studies of tokamak microturbulence have been restricted to either (a) flux-tubes or (b) electrostatic fluctuations. Using a newly-developed global electromagnetic solver, we have been able to recover via direct simulation the Bohm-like scaling observed in DIII-D L-mode discharges, and also match within reasonable uncertainty (a factor of two) the measured energy diffusivities. In particular, we show quite convincingly that the gyroBohm scaling obtained from local simulations is reduced to a Bohm-type due to the stabilizing effects of sheared equilibrium $\mathbf{E} \times \mathbf{B}$ rotation.

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