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Validation of Drift Turbulence Simulations with Laboratory Plasma Experiments GEORGE TYNAN, CHRISTOPHER HOLLAND, JONATHAN H. YU, UCSD, TROY CARTER, UCLA, LINCAN YAN, UNM — First-principles simulations of drift turbulence are being developed with the intention of predicting the rates of turbulent transport in magnetic confinement systems. The underlying physics is expected to exhibit complex dynamics, including the formation of a saturated turbulent state from given free energy sources and dissipation mechanisms, the development of a self-regulating balance between turbulence and organized structure formation via nonlinear turbulence/structure interactions, and bifurcations between states of turbulent transport. Thus experiments that examine aspects of these complex dynamics in isolation can be useful in validating turbulence simulations. Here we provide detailed comparisons of drift turbulence-zonal flow interactions in the CSDX laboratory plasma device with similar interactions that occur in a two-field fluid collisional drift turbulence simulation. Experiment and simulation show strikingly similar shear layer formation mechanisms, supporting the basic theoretical picture of zonal flow formation via a nonlinear transfer if kinetic energy to large spatial scales. We also provide initial comparisons of drift turbulence measurements and simulation from the larger LAPD plasma device, and we discuss future plans for simulation validation efforts using this approach.

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