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Study of nonlinear interplay between drift wave and zonal flow[1]

ZEHUA GUO, LIU CHEN, University of California, Irvine — The size scaling of confinement properties in magnetized plasmas is one of the important and challeging problems of fusion research. In the present work, we both numerically and analytically investigate the nonlinear dynamics of drift wave turbulent transport, adopting the coherent drift wave-zonal flow modulation interaction model [Chen et al., Phys. Plasmas 7, 3129 (2000)] and the slab geometry for simplicity [Guzdar et al., Phys. Plasmas 8, 459 (2001)]. Our model allows both temporal and spatial variations of the turbulence radial envelope. The results demonstrate that the linear drive/damping together with the turbulence spreading, due to finite linear group velocity and nonlinear coupling between the drift wave and zonal flow, cause the device-size dependence of the saturated turbulence intensities and transport coefficients. The coherent and chaotic behavior of the dynamical system are also discussed.

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