SIMULATION OF DRIFT WAVE TURBULENCE: TRAPPED STRUCTURES AND A NEW NONADIABATIC ELECTRON MODEL

by

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Submitted to the Department of Nuclear Engineering on March 15, 1989, in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Abstract

The development of trapped structures in decaying and saturated drift wave turbulence is studied via computer simulation. A two-dimensional electrostatic fluid model is used. The turbulence which evolves in the pure decay runs (no nonadiabatic electrons) is characterized by tightly bound monopole vortices and a very narrow frequency spectrum. These results are qualitatively similar to results found in two dimensional Navier-Stokes simulations. For the studies of saturated turbulence, rather than simply introducing the linear growth rate, a new nonadiabatic electron model is used. This model takes into account the effects of broadening and shifting of the frequency spectrum which results from the strongly nonlinear character of the problem—effects which are found to be very important in the turbulent states which are studied. These states are characterized by broadened frequency spectra, with strong damping on the nonadiabatic electrons at high-\(k\) and along the \(k_x\)-axis. Trapped structures are observed in many of the saturated simulations, even in the presence of moderately broad frequency spectra. The extent of the trapping varied dramatically, becoming a much stronger effect as the RMS electric field increased.

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