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Parameter Dependence of Drift Modes Associated with Turbulence in Tokamaks

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Abstract

The spectra of drift modes are investigated as a function of plasma parameters in order to improve our understanding of the models for transport driven by drift-mode turbulence. There is substantial evidence that most of the transport in tokamaks is driven by drift modes such as the Ion Temperature Gradient (ITG) and Trapped Electron Mode (TEM). Quasi-linear models of transport driven by drift mode turbulence provide the central part of the Multi-Mode [1] and GLF23 [2] transport models that are used in integrated modeling codes to predict temperature and density profiles in tokamaks. Drift mode transport is "stiff" ó th e transport increases rapidly with increasing temperature gradient, once the temperature gradient rises above a threshold value. The dependence of the threshold temperature gradient and the degree of stiffness are investigated as a function of parameters such as the poloidal wave number, magnetic shear, T_i/T_e, impurity concentration, collisionality, and beta. Integrated modeling simulations are used to provide the expected ranges of these parameters in different parts of the plasma (*i.e.,* near the center or near the edge) in a variety of tokamak discharges. Particular emphasis is placed on the regions with low magnetic shear in the deep core of the plasma and on the regions with relatively high magnetic shear closer to the edge of the plasma. The dependence of the threshold on wave number and plasma parameters is particularly important in the low shear region near the center of the plasma, because drift modes are generally close to their marginal point in that region.

[1] G. Bateman, A.H. Kritz, J.E. Kinsey, A.J. Redd and J. Weiland, Phys. Plasmas, **5** (1998) 1793.
[2] R.E. Waltz, G.M. Staebler, W. Dorland, G.W. Hammett and M. Kotschenreuther, Phys. Plasmas, **4** (1997) 2482.

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