Time Scales in Plasma Microturbulence Turbulence*

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Kinetic simulations of plasma microturbulence produce large data sets which can provide key information regarding the saturation of the underlying linear instabilities and details of the mechanism by which the plasma microturbulence produces turbulent transport. In previous work[1] we examined data from simulations of ion temperature gradient turbulence (electrostatic, gyrokinetic ions, adiabatic electrons), presented algorithms for extracting key timescales, including the eddy life-time, the eddy turn-over time, and the ExB shearing rate. Parameter scans demonstrated relationships among these turbulent timescales. In particular, the eddy life time was found to be proportional to the eddy turn-over time — suggesting that the saturation of the ITG turbulence is associated with $E\times B$ trapping of resonant particles. In many regimes the eddy life-time is also found to be proportional to the ExB shearing time. Taken together these two relations empirical relations imply a linear relationship between the intensity of the zonal flows, the intensity of the ITG turbulence, and the radial eddy width. Analysis of this simulation data revealed a relation, independent of the temperature gradient, between the anomalous heat transport and the ITG turbulence intensity. This relation, together with analytic estimates of the eddy life-time and the empirical relation between the eddy lifetime and the eddy turn-over time to develop an expression for the turbulent heat transport. This previous work will be extended to include the analysis of data from kinetic simulations of ETG and TEM turbulence in an effort to find more regimes in which $E\times B$ trapping is responsible for the saturation of plasma microturbulence.

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[1] W.M. Nevins, et al, "Timescales in ITG Turbulence", presented at the 2004 TTF Meeting.