Gyrokinetic Edge Turbulence and the Edge/Core Transition

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The gyrokinetic model for low frequency turbulence in magnetized plasmas is applied to the tokamak edge. This steep-gradient region is sufficiently nonlinear that the turbulence has its own properties distinct from linear instabilities, which are found by computational diagnosis of the fully developed turbulence. The computational model is a 5-D phase-space grid representation of the gyrokinetic distribution function of each species, with field equations for the electrostatic and magnetic potentials arising from the field Lagrangian. Full energetic self consistency is assured. The transition from the edge region into the core shows clear effect of the changing collisionality and perpendicular/parallel scale length ratios, not least in the distribution of contributions to the turbulent flux in velocity space. The onset of effect due to trapped electrons following the decrease of collisionality is properly captured by the model and leads to a gradual change from fluidlike to a more kinetic "weak turbulence." Energetic pathways from gradient to thermal disturbances to E-cross-B eddies to parallel currents and to dissipation reveal the corresponding change in mode structure and dynamical character. Progress in modelling of experimentally measured tokamak edge phenomena, including the existence of pedestal structures in the temperature and density profiles, will be reported at the conference.