Energy transfer of trapped electron turbulence in tokamak fusion plasmas

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The first principle gyrokinetic simulations[1,2,3] of trapped electron turbulence in tokamak fusion plasmas demonstrate the energy transfers from the most linearly unstable modes at high $k_\theta \rho_i \sim 1$ to intermediate k_θ via parametric decay process in a short period of linear-nonlinear transition phase. Dominant nonlinear wave-wave interactions occur near the mode rational surface $m \sim nq$. In fully nonlinear turbulence, inverse energy cascade occurs between a cutoff wave number k_c and $k_\theta \rho_i \sim 1$ with a power law scaling $|\phi(k_\theta)|^2 \propto k^{-3}$, while modes with $k < k_c$ are suppressed. The numerical findings show fair agreement with both the weak turbulence theory[4,5] and realistic experiments on Tore Supra tokamak[6].

References

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