Development of magnetic stochasticity due to subdominant modes

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In recent years various researchers have employed gyrokinetic simulations to study electromagnetic effects in plasma microturbulence. It has been found that magnetic stochasticity is ubiquitous in such simulations even in parameter regimes where the driving instabilities are not characterized by tearing parity (parallel mode structures which are odd about the outboard midplane for the electrostatic potential and even for the magnetic vector potential). In this work the mechanism for this magnetic stochasticity is explored. Linear analysis reveals the existence of subdominant modes with tearing parity in the linear eigenmode spectrum. Analysis of nonlinear simulation data demonstrates that subdominant modes with tearing parity are excited in the nonlinear fluctuation spectrum. For each independent perpendicular wavenumber, a hierarchy of these modes is excited which is characterized by a broad range of scale lengths in the parallel direction. It is shown that these subdominant modes are the major cause of magnetic stochasticity as quantified by a magnetic diffusion coefficient.