Study of Parametric Dependence of High-k Turbulence with Microwave Scattering on NSTX

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A comprehensive understanding of plasma turbulence and its relation to electron transport requires measurements of both large and small wavenumbers. Due to its low toroidal field and low aspect ratio, the National Spherical Torus eXperiment (NSTX) provides a unique laboratory to study the short-wavelength, electron-scale (high-k) turbulence and its relation to electron transport in the finite β regime. High-k turbulence is studied on NSTX using a unique, microwave scattering diagnostic capable of measuring the turbulence spectrum as a function of radial wavenumber with high radial localization. Recent improvements in the scattering configuration and an upgraded microwave source allow the simultaneous measurement of more wavenumbers than were measured before, which makes more detailed comparisons with gyrokinetic simulations possible. Here we present a study of the parametric dependence of high-k turbulence on density gradient and collisionality. It is found that high-k turbulence is stabilized by large density gradient induced by an ELM event, and a simultaneous factor of two decrease in the plasma effective thermal diffusivity is observed. This observed stabilization is found to be in good agreement with linear GS2 predictions. In the study of the collisionality dependence, the measured spectral power of high-k turbulence is found to decrease as ν_e^* is increased by a factor of about three with ρ_e, β_e and q kept approximately constant. Comparison with non-linear gyro-kinetic simulations will be presented. Work supported by US DOE Contracts DE-AC02-09CH11466 and DE-FG02-99ER54518.