Experimental study of turbulent fluctuations driven by the ETG mode in NSTX

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The objective of this proposal is the experimental study of turbulent fluctuations driven by the Electron Temperature Gradient (ETG) mode in the National Spherical Torus Experiment (NSTX). A strong motivation stems from recent numerical simulations indicating that the transport of energy in high-beta plasmas of NSTX could be significantly affected by the ETG turbulence. A unique feature of the proposed technique is the measurement of both the radial and poloidal spectra of turbulence, which is essential for assessing the effectiveness of ETG fluctuations since it depends on the existence of radially elongated eddies. To detect the predicted small level of density fluctuation, we propose to employ coherent scattering of electromagnetic waves with wavelength of ~1 mm, in combination with a state of the art detection system employing sensitive mixers and receivers with low conversion losses. The possibility of using 1D or 2D mixer arrays for the simultaneous measurement of fluctuations with many wave numbers and spatial locations will be investigated.

Development of the proposed diagnostic system will be a collaborative effort of PPPL and UC Davis. This collaboration will greatly facilitate the realization of the proposed program by utilizing the expertise on advanced turbulence diagnostic residing at the two institutions, and by the combination of experimental resources.