Visible Imaging of Edge Turbulence in NSTX

Stewart Zweben[1], Ricardo Maqueda[2], Kenneth Hill1, David Johnson[1], Stanley Kaye[1], Henry Kugel[1], Fred Levinton[3], Lane Roquemore[1], Steven Sabbagh[4], Glen Wurden[2]

[1] Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ USA
[2] Los Alamos National Laboratory, Los Alamos, NM USA
[3] Fusion Physics and Technology, Torrance, CA USA
[4] Columbia University, New York, NY USA

Initial measurements have been made of the edge density turbulence in NSTX by viewing the space-time structure of the visible light emitted by the edge plasma in various regimes. The 2-D patterns of light emission are imaged by a gated intensified CCD camera with a typical exposure time of 10 microsec and a framing rate of 1000 Hz; there are also three discrete fiberoptically coupled sightlines which view light fluctuations within a 5 to 15 cm diameter at the wall with frequencies up to 200 kHz. The edge is typically viewed in either deuterium H-alpha, HeI, or total visible light emission. A horizontal view of the 2-D poloidal vs. toroidal structure of the edge light emission near the outer midplane shows the typical "filamentation" characteristic of edge density turbulence [1-3]. These filaments are aligned nearly along the magnetic field line, which has an large angle of 20 to 45 degrees to the horizontal at the outer midplane of NSTX. The dominant poloidal wavelength is about 15 cm, corresponding to k(perp)rho(s)=0.2 at an assumed Te=25 eV. The frequency spectra obtained from the discrete sightlines has a typical edge turbulence shape[4], with a power law exponent of about 3 from about 1-100 kHz.The first results from a new &quotgas puff imaging" diagnostic set-up will be described. Here, the visible line emission from a helium gas puff near the outer wall was viewed from along the B-field direction at a 10 microsec exposure time to image the radial vs. poloidal structure of these edge turbulence filaments. A large variation in the shape of the HeI light emitted from the He puff was seen on successive frames separated by 1 msec, with significant variations both radially and poloidally over about a 10 cm spatial scale. Initial analysis of these images will be presented and compared with neutral gas penetration and excitation models to help understand the relationship of the light emission to the local density turbulence.

This work was supported by U.S. DOE Contract DE-AC02-CHO3073.

1) S. Zweben and S.S. Medley, Phys. Fluids B1, 2058 (1989)
2) M. Endler et al, Nucl. Fusion 35, 1307 (1995)
3) R. Maqueda and G. Wurden, Nucl. Fusion 39, 629 (1999)
4) M. Pedrosa et al, PRL 82, 3621 (1999)