Proposal and Attendance Form for NSTX Research Forum 2001

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Please write in the boxes below a one-page abstract of your proposal to be presented:

Title: Edge and SOL instability physics in NSTX

Abstract:

In order to understand the unstable spectrum and turbulence in the edge and scrape-off-layer (SOL) of NSTX, modeling has been carried out using a Braginskii model incorporated in the linear eikonal ballooning code BAL. The BAL code employs the same realistic geometry as the 3D turbulence code BOUT. From local inputs of the plasma parameters n, Te, Ti and the corresponding gradient scale lengths, we calculate the growth rate, frequency, phase velocity, poloidal wavenumber range and structure along the field lines of the most unstable modes. A major goal of this work is to identify key physics parameters for the NSTX edge and SOL, and dependences on the machine configuration (double null vs. inner wall limited). In particular we will report on several experimentally testable predictions of the model.

In general, the model can make detailed predictions for how the wavenumber and frequency of the spectrum should vary with plasma parameters and configuration. The main results that are specific to NSTX are as follows. (i) Drift-Alfvén instabilities are found to typically dominate curvature-driven instabilities in the edge plasma (just inside the separatrix). The low outboard magnetic field contributes to large drift frequencies which stabilize curvature modes and destabilize drift instabilities. (ii) We have found a promising stable regime for the NSTX edge that is compatible with robust edge pedestals and large edge gradients. Because ion finite-Larmor radius effects stabilize the curvature modes, the regime is dominated by drift-Alfvén instabilities. These modes are predicted to be stable at sufficiently high edge plasma beta such that the Larmor radius exceeds the electron skin depth. (iii) Interchange-curvature modes dominate the outboard SOL in the double null configuration. The plate boundary conditions in the SOL and the presence of only bad curvature in the outboard SOL are important, and as a result, (iv) the SOL in the inner-wall limited configuration is more stable than in double null.

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