

## NSTX-U Weekly Report (August 23, 2013)

### **NSTX-U is in the Upgrade Project outage in FY 2013**

The paper "Progress in simulating turbulent electron thermal transport in NSTX" by Walter Guttenfelder (PPPL) et al. was published in Nuclear Fusion 53, 093022 (2013) (<http://iopscience.iop.org/0029-5515/53/9/093022>). The paper summarizes the progress in running electromagnetic nonlinear gyrokinetic turbulence simulations based on realistic equilibrium and measured profiles from NSTX. Different microinstabilities are predicted to be unstable depending on experimental parameters. In particular, results were shown from microtearing turbulence (at high beta and high collisionality), electron temperature gradient (ETG) turbulence (at low beta), and kinetic ballooning mode (KBM) turbulence (at high beta and low collisionality). Numerical challenges associated with the simulations are discussed, as well as predictions of transport and scaling with parameters (such as collisionality) that may be used to distinguish the mechanisms experimentally. (W. Guttenfelder)

Three physicists, Ron Parker, Greg Wallace and Syun'ichi Shiraiwa from MIT visited PPPL on Monday August 19 attend a meeting to discuss collaboration opportunities on the development of an ECH system, and associated physics modeling and diagnostics, for NSTX-U. The PPPL participants included Bob Ellis, Elmer Fredd, Stefan Gerhardt, Nevell Greenough, Joel Hosea, Jon Menard, Masa Ono, Cynthia Phillips, Gary Taylor and Ernie Valeo. Presentations were made on the overall system by Nevell Greenough, the MIT HV power supply by Greg Wallace, on ECH/EBW scenarios and modeling by Gary Taylor, and on collaboration opportunities for MIT by Ron Parker. The meeting was very informative and there were several areas which can benefit from collaboration between MIT and PPPL including: (1) system development and design, (2) power supply system, (3) launcher development and design, (4) modelling and scenario development, and (5) diagnostics. We are looking forward to this collaboration and will work together to clearly define workscopes and to integrate them between PPPL and MIT. (J. Hosea, PPPL)

Walter Guttenfelder (PPPL) visited MAST (Aug. 12-20) to lead an experiment on momentum transport using resonant magnetic field perturbations (RMP) to alter toroidal rotation. The experiment (part of ITPA task TC-15) was operationally successful, with small but observable toroidal rotation perturbations occurring coincident with application of short RMP coil current pulses in both H-mode (using  $n=4$ ) and L-mode (using  $n=3$ ). The decay of the perturbations upon RMP turn-off will be used in an attempt to infer momentum diffusivity and convection, similar to analysis performed for NSTX H-modes by W. Solomon & S. Kaye. Additional run time may be given to attempt NBI modulation experiments to provide further constraint on the inferred momentum transport. (W. Guttenfelder)

This week (from Monday, August 19 to Friday, August 23) N. Bertelli (PPPL) visited ORNL to collaborate with E. F. Jaeger (ORNL). The purpose of his visit to ORNL is to work with Fred on the full wave code AORSA in order to try to understand the RF edge losses in NSTX from the modeling point of view including a proxy artificial damping such as collisional damping. The magnitude of the edge collisional losses is being evaluated as a functions of the antenna phases (or the toroidal mode numbers) and the minimum density in front of the antenna. Moreover, the magnitude of the edge collisional losses can be used to evaluate possible potential damping mechanisms in the SOL. Several runs with a single dominant mode have been performed and

analyzed with Fred. In addition, 3D Aorsa runs have been performed in order to reconstruct the full antenna spectrum. Finally, several useful and productive discusses about this work has been held with the ORNL RF researchers including Lee Berry, David Green, and Phil Ryan. (N. Bertelli)

### **Engineering Operations (A. von Halle, C. Neumeyer)**

NSTX Upgrade construction activities continued with the matching up of the four TF inner quadrants in the taping area for measurements and the subsequent ground wrapping and final vacuum impregnation with epoxy. In the test cell, the welding of the in-vessel J-K stiffeners and the S-flip diagnostic reinforcements continues, as does the installation of the upper outer TF support ring.

Preparations for plasma operations in the NSTX-U configuration also continued with the ongoing maintenance of the power supply and distribution equipment for the neutral beams. The retro-fitting of the new firing generators in their final positions in the field coil power conversion (FCPC) system rectifiers continues.

Access to the NSTX test cell will be available only through previous arrangement with the Upgrade Work Control Center.