NSTX-U Weekly Report (July 10, 2015)

NSTX-U is in the Upgrade Project outage in FY 2015

The paper, "Coupling of Neutral-Beam-Driven Compressional Alfvén Eigenmodes to Kinetic Alfvén Waves in NSTX Tokamak and Energy Channeling" by E. V. Belova (PPPL) et al., was published in Phys. Rev. Lett. **115**, 015001 (2015). An energy channeling mechanism is proposed to explain flattening of the electron temperature profiles at high beam power in beam-heated National Spherical Torus Experiment (NSTX). Results of first self-consistent simulations of neutral-beam-driven compressional Alfvén eigenmodes (CAEs) in NSTX demonstrate strong coupling of CAE to kinetic Alfven wave (KAW) at the Alfven resonance location. Three-dimensional, nonlinear hybrid MHD-particle simulations for the H-mode NSTX discharge (shot 141398) show unstable CAE modes for a range of toroidal mode numbers, n=4-9, and frequencies below the ion cyclotron frequency. It is found that the essential feature of CAE modes in the NSTX is their coupling to kinetic Alfven wave (KAW) that occurs on the high-field side at the Alfven resonance location. Nonlinear simulations demonstrate that CAE can channel significant fraction of the beam power, up to P=0.4MW, to the location of the resonant mode conversion at the edge of the beam density profile, modifying the energy deposition profile. (E.V. Belova)

The paper, "Impact of ELM filaments on divertor heat flux dynamics in NSTX" by J-W. Ahn (ORNL) et al. was published in Journal of Nuclear Materials 463 (2015) 701 – 704 (http://www.sciencedirect.com/science/article/pii/S002231151400926X). This paper describes findings in the behavior of wetted area (A_{wet}) and peak heat flux (q_{peak}) of divertor heat flux, induced by naturally occurring ELMs in NSTX. More ELM filaments in the heat flux profile are found to lead to larger A_{wet} and lower q_{peak}. The typical number of filaments observed in NSTX is 0–9, while 10–15 are normally observed in other machines such as JET, and the ELM contracts heat flux profile when the number of filaments is less than 3–4 but broadens it with more of them. The smaller number of filaments in NSTX is attributed to the fact that NSTX ELMs are against kink/peeling boundary with lower toroidal mode number (n = 1–5), while typical peeling–ballooning ELMs have higher mode number of n = 10–20. For ELMs with less filaments, relative A_{wet} change is rather constant and q_{peak} change rapidly increases with increasing ELM size (total power ejected by the ELM), while A_{wet} change slightly increases leading to a weaker increase of q_{peak} change for ELMs with more filaments. (J-W. Ahn)

R. Maingi (PPPL) presented a science demonstration at the Lenape Day Camp in Plainsboro, NJ on 7/7/15. The three topics included 1) making electromagnets using a battery connected to wire coiled around a conducting solid; 2) using UV lamps to excite fluorescence in NJ minerals; and 3) examining the effects of liquid nitrogen on everyday objects. The demonstration was enthusiastically received by 130 grade school campers and 20 teenage and adult counselors. (R. Maingi)

Experimental Research Operations (S. Gerhardt, R. Kaita)

Ed Magee from Lawrence Livermore National Laboratory visited NSTX-U this week for the installation of LLNL extreme ultraviolet spectrometers. Two of the three spectrometers (XEUS, X-ray and Extreme Ultraviolet Spectrometer and MonaLisa, Metal Monitor and Lithium Spectrometer Assembly) have been installed. The third spectrometer (LoWEUS, Long

Wavelength Extreme Ultraviolet Spectrometer) will be installed in the coming weeks. The LLNL on-site staff (Michael Weller and Vlad Soukhanovskii) assisted in installation. The three spectrometers provide simultaneous spectral coverage for low-Z, medium-Z and high-Z impurity studies and wall condition monitoring in NSTX-U. (V. Soukhanovskii, LLNL)

Welding of the Divert or Tangential Imaging assembly is complete, and leak checking is in progress. Outer TF Rogowski coil supports are complete and have been successfully test fit to the Rogowski coil. G-10 and aluminum components for the Bay H IR Camera bracket are complete. Stainless steel components are in final machining. (R. Ellis, PPPL)

Alignments of the Multi-Pulse Thompson Scattering (MPTS) diagnostic flight paths continued, and details of the two respective Nd:YAG focii have been recorded via video. Fibers for the Beam Emmission Spectroscopy (BES) diagnostic are being assembled in their holders. (B. Stratton, PPPL)

Engineering Operations (A. von Halle, P. Titus)

OH system rework and machine reassembly activities continued this past week. Installation of upper and lower TF flex bus and potting of TF fingers continues along with the associated resistance checks. Joint resistance measurements are being compared to ANSI models as appropriate. The OH coil coax connection will be installed and potted early next week. A final design was reviewed and a procedure generated to provide high-pressure braided hose to allow for both the cooling and baking of the PF1B coils. This installation will begin immediately.

Access to the NSTX-U Test Cell is expected to be available this coming week. Access must be arranged through Work Permits approved by the D-Site Shift Supervisors.