The PPPL Highlights for the week ending September 25, 2015, are as follows:

NSTX (M. ONO):

Young-Seok Park and Steve Sabbagh of Columbia University visited the National Fusion Research Institute in Daejeon, South Korea and ran two experiments MP2015-06-02-037 to determine n = 1 error field thresholds at high normalized beta, and MP2015-05-23-001 to isolate and measure the neoclassical toroidal viscosity (NTV) profile for various 3D field spectra in the KSTAR superconducting tokamak in the past two weeks. High normalized beta plasmas were created and extended to 10 second pulse duration, and n = 1 error field thresholds were determined. In the NTV experiment, a large database was created by leveraging the long pulse capability (20 second plasma duration) and the new (for 2015) fast power supply capability (IPS) of the device. Several key plasma parameters were varied in the study including the applied 3D field strength, q95, plasma collisionality, Ti, ne, and plasma rotation speed and profile. Six different 3D field spectra were run, which included n = 2, n = 1 field pitch-aligned, and n = 1 field pitch-non-aligned configurations. Resonant MHD modes were absent and the new IPS capability in combination produced excellent signal to noise for the NTV profile measurement. Along with charge exchange spectroscopy diagnosis of the plasma rotation and Ti profiles, new profile diagnostic data including motional Stark effect (magnetic field pitch angle) and Thomson scattering were collected for this experiment.

Joon-Wook Ahn (Oak Ridge National Laboratory) visited KSTAR and participated in 3D TF experiments from September 14 to 21. He led two experimental sessions, one for the effect of plasma response on separatrix splitting and the other for ELM suppression with high plasma density. Divertor IR camera and LP data have been taken during the experiments to monitor divertor plasma conditions. Pitch angle alignment was varied both by q95 scan and by changing spectrum of applied RMP fields. Experiments were performed for n=1 and n=2 and both configurations were able to produce ELM mitigation. It was found that n=2 at 90o phasing was very resonant and produced strong density pump-out and reduction in Ti and Vt. Surprisingly, n=2 0o phasing, mostly non-resonant, produced the strongest ELM mitigation even with no density pump-out. Data analysis is in progress to find best conditions for ELM control in future experiments.

ITER & TOKAMAKS (R. HAWRYLUK):

DIII-D (R. Nazikian):

D. Eldon, working with E. Kolemen (Princeton University), has recently developed a real time

calculation of the optimal phase angle between upper and lower I-coils for simultaneous error field correction and RMP ELM suppression. The algorithm uses SURFMN to estimate the angle for maximum or minimum kink response based on vacuum field results. In addition, progress is being made with real time kinetic EFIT reconstructions. A significant step has been taken with the new prototyped real time CER analysis of ion temperature, density, and rotation.

W. Solomon visited PPPL this week to present a seminar on the development path for steady state research on DIII-D. He also met with lab scientists to discuss progress on projects involving PPPL theory and modeling applied to DIII-D data.

The LGI upgrade and reassembly is in progress with completion of the electric motor conversion and testing. Presently the FDR is in preparation. Reassembly of the LGI unit is underway, setting up for testing the combined operation of lithium and carbon granules using the same gate and aperture positions.

A. Nagy worked with the GA investigative team to understand the root cause of the switch gear arc flash failure last week. Review of the damage with close inspection of failed parts dominated the task.

International (F. Poli):

F. Poli visited the ITER Organization during the week of September 21. She worked with Sun Hee Kim on the implementation of TRANSP in the ITER Modeling and Data Suite (IMAS). The second part of the translator, from TRANSP output to the ITER Data Structure, has now been implemented as an “actor” in the Kepler workflow.

ADVANCED PROJECTS (H. NEILSON):

The Laboratory has led the design, construction, and installation of an x-ray imaging crystal spectrometer (XICS), a key U.S. contribution under its collaboration with Germany's Wendelstein 7-X stellarator project. This week PPPL and the host laboratory—the Max Planck Institute for Plasma Physics (IPP)—completed final project tasks. The U.S.-built instrument was installed on W7-X several weeks ago, and IPP reported that service connections for vacuum pumping and for water cooling are now also complete. PPPL’s lead engineer on the project, M. Mardenfeld, transmitted a package of up-to-date drawings, providing IPP with a now complete documentation package for the project. With the completion of these tasks, the project is now formally closed. Most importantly the XICS, which will be used to make high-resolution plasma temperature and velocity profile measurements on W7-X, is now ready for operation in the first W7-X plasma operating campaign.

THEORY (A. BHATTACHARJEE):

On September 25, Mirjam Schneller (Max Planck Institute for Plasma Physics) presented a theory seminar on nonlinear energetic particle transport in the presence of multiple Alfvénic waves in ASDEX Upgrade and ITER: “As future fusion devices will exhibit large fractions of highly energetic particles (EP), the interplay of fast ions with Alfvénic instabilities is an

important topic in fusion research. Strong EP transport might reduce the heating and current drive efficiencies, while losses could even damage the first wall. The aim of the here presented work is to enhance the understanding of interaction mechanisms between EP and multiple Alfvén waves in a realistic ITER case. The focus lies on the 15 MA baseline scenario, where a 'sea' of small-amplitude perturbations is expected to be marginally unstable. Based on quasi-linear estimates, the EP transport would be rather low. The question of interest here is whether the EP population will drive linearly stable or weakly unstable modes nonlinearly unstable. As a consequence, domino-like transport can occur. Such behavior has been found already in realistic ASDEX Upgrade double-mode simulations, which could explain experimentally found EP losses. Basis of the simulations is a nonlinear hybrid model, the drift-kinetic HAGIS code. As crucial new elements of a realistic scenario, the perturbation structures, frequencies and damping rates are taken as obtained from the gyrokinetic eigenvalue solver LIGKA."

DIRECTOR'S OFFICE (C. AUSTIN):

On September 21, A. Cohen attended an Accelerator Safety Workshop at Brookhaven National Laboratory, in Upton, New York.

On September 21, Dr. Bart De Pontieu, Solar and Astrophysics Laboratory, Lockheed Martin, Inc., presented a colloquium entitled, "Toward a Better Understanding of the Solar Atmosphere: Combining Observations and Numerical Modeling".

On September 23, Professor Suzane Staggs, Princeton University, presented a colloquium entitled, "Probing the History and Dynamics of the Universe with Polarized Signatures in the Cosmic Microwave Background".

This report is also available on the following web site:
http://www.pppl.gov/publication-type/weekly-highlights