Weekly HIGHLIGHTS

PPPL PRINCETON PLASMA PHYSICS LABORATORY
U.S. DEPARTMENT OF ENERGY

The PPPL Highlights for the week ending August 4, 2018, are as follows:

NSTX-U RECOVERY AND RESEARCH (J. MENARD)

Recovery:

Magnets — The Sigma Phi prototype PF1A coil has been shipped by the vendor and is expected to arrive at PPPL the week of August 6. Vacuum pressure impregnation (VPI) of the Tesla Engineering prototype PF1A coil began on August 1.

Machine Re-Assembly — A preliminary design review (PDR) was held for the NSTX-U machine re-assembly on August 1. Areas covered by the PDR included initial positioning of the pedestal, installation of the first tiles on the center stack, and installation of the stack into the vessel. The review was deemed successful pending resolution of chits.

Polar Region — A day-long PDR was held on August 2 that re-assessed the development of NSTX-U polar region systems, structures, and components presented at a conceptual design review last year. The PDR covered flanges, O-rings, insulators, polar region design, and supports in the upper and lower polar regions. The review was deemed successful pending resolution of chits.

Central Instrumentation & Control — The final drawings for CAMAC (Computer Automated Measurement and Control) Replacement, Phase 2 have been signed and submitted.

U.S. ITER FABRICATION (H. NEILSON)

The low-field-side reflectometer (LFSR) system instrumentation and control (I&C) diagrams including the piping and Instrumentation diagram (P&ID), process flow diagram (PFD), and single line diagram (SLD) have been finalized after extensive coordination with subcontractor General Atomics (GA), the PPPL I&C team, and the ITER Central Team. Particularly important was to reflect in the design and operation logic the many safety requirements and secondary barrier functions of the transmission line penetration through different building zones.

ITER & TOKAMAKS (R. NAZIKIAN)

The director of KSTAR, S.-W. Yoon, together with H. Park (UNIST) and J.-M. Kwon (NFRI) visited PPPL to discuss progress and new opportunities in KSTAR collaboration with PPPL

researchers. Various topics were discussed, including TRANSP development, plasma control, wall conditioning and divertor design, and high-beta access.

DIII-D (B. Grierson):

A paper by R. Nazikian, et al., titled "Grassy-ELM regime with edge-resonant magnetic perturbations in fully noninductive plasmas in the DIII-D tokamak," has been published online in the journal *Nuclear Fusion* (https://doi.org/10.1088/1741-4326/aad20d).

A paper by S. Haskey, et al., titled "Main ion and impurity edge profile evolution across the L- to H-mode transition on DIII-D" has been accepted for publication in the journal *Plasma Physics and Controlled Fusion*.

A. Ashourvan traveled to PPPL and presented a joint talk with W. Guttenfelder at the PPPL Physics Meeting on recent simulations of DIII-D H-mode pedestals using the CGYRO gyrokinetic code. Ashourvan and Guttenfelder are examining the dominant linearly unstable modes in both conventional low q95 inductive scenario DIII-D pedestals with type-I ELMs, as well as steady-state scenarios with grassy ELMs and wide pedestals (in the Nazikian paper mentioned above). The pedestal structure of the type-I ELMy H-mode displays a transition from ITG at the pedestal top to ETG in the steep gradient region. Measured electron temperature profiles display a normalized inverse scale length that closely follows the ETG linear threshold. Steady-state scenario pedestals at higher q95 display a mix of instabilities including ITG, TEM, ETG and MTM (microtearing modes).

International PMI (R. Maingi):

R. Maingi, J. Canik (ORNL), E. Gilson, R. Lunsford, Z. Sun, K. Tritz (JHU), and A. Devitre (PU student) participated via ZOOM in two ELM control experiments on EAST on two different shifts/days. Lithium granules were injected from the low-field side and also dropped in from the upper X-point region to test ELM pacing in discharges with 70 Hz natural ELM frequency. The lithium granule dropper resulted in ELM elimination and progressive recycling reduction, as also observed with lithium powder injection in previous experiments. Experiments on ELM triggering with a deuterium pellet injector and mitigation with neon and boron injection with the supersonic molecular beam injector were also initiated. The researchers onsite at PPPL used the B205 remote control room to participate in the experiments, which were conducted in the mornings in the US and the evenings in China. The ASIPP team for this experiment was led by J. Hu and supported by the wall conditioning group.

R. Maingi and M. Jaworski conducted a collaboration discussion with R. Dejarnac from COMPASS on liquid metal divertor exposure experiments planned for 2019. COMPASS plans to conduct experiments with a capillary porous system infused with liquid lithium in February or March 2019. A wider discussion with other members from the U.S. liquid metal community is being planned.

International Long Pulse (F. Poli):

The department welcomes W. Choi to join the EAST collaboration as an Associate Research Physicist. Choi brings expertise on magnetohydrodynamics and lock-mode analysis and he will be working on understanding how to best leverage the available heating and current drive actuators to optimize long pulse operation.

ITER-JET (F. Poli):

The department welcomes A. Teplukhina to join the JET collaboration as an associate research physicist. Anna brings expertise on control-oriented simulations, applied to the optimization of the current ramp-down phase. She will be working with the team on the modeling of JET plasmas for projection to deuterium-tritium operation.

ADVANCED PROJECTS (H. NEILSON)

Stellarators (D. Gates):

S. Lazerson conducted experiments recently to assess divertor heat load symmetrization on W7-X using the trim coil system. These experiments varied the amplitude and phase of the n=1 trim coil fields in the standard and high mirror configurations. Both configurations rely on a n/m=5/5 island chain and require n=1 error field correction to prevent overloading of the divertor modules. Additionally, Lazerson oversaw six experimental sessions as a task force leader, overseeing the organization of each run day.

THEORY (A. BHATTACHARJEE)

Physicist I. Dodin gave a talk titled, “Inhomogeneous drift-wave turbulence as an effective quantum plasma,” at the 11th Plasma Kinetics Working Meeting held at the Wolfgang Pauli Institute in Vienna, Austria. In this talk, Dodin presented his recent research on drift-wave turbulence and zonal flows done together with Y. Zhu (PPPL) and Princeton graduate student H. Zhu.

COMMUNICATIONS (L. BERNARD)

The Office of Communications posted one press release to the PPPL website. It focused on the sixth annual Theory and Simulation of Disruption Workshop, which was organized by PPPL Theory Department head A. Bhattacharjee and took place June 16-19. Topics discussed during the three-day event covered theoretical and experimental research on issues ranging from runaway electrons to machine-learning software for predicting disruptions in ITER in time to tame them. The story was also posted to the *Newswise* and *EurekAlert!* press release distribution services.

DIRECTOR'S OFFICE (S. COWLEY)

On August 2, the PPPL Office of the Vice President and the Director's Office hosted a visit for Chris Fall, who has been nominated by President Trump to lead the Department of Energy, Office of Science. Fall was provided with an overview of PPPL, talked with early-career awardees, postdoctoral associates, and graduate students, and was given a tour of various PPPL facilities.

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