



The PPPL Highlights for the week ending August 15, 2014, are as follows:

NSTX (M. ONO):

A paper entitled "Reduced model prediction of electron temperature profiles in microtearing-dominated NSTX plasmas" by S.M. Kaye (PPPL) et al. was published online in *Physics of Plasmas* 21, 082510 (2014). The paper studies a representative H-mode discharge from the National Spherical Torus Experiment (NSTX) in detail as a basis for a time-evolving prediction of the electron temperature profile using an appropriate reduced transport model. The time evolution of characteristic plasma variables such as electron beta and collisionality, the MHD alpha parameter and the gradient scale lengths of T_e , T_i and n_e were examined as a prelude to performing linear gyrokinetic calculations to determine the fastest growing micro instability at various times and locations throughout the discharge. The inferences from the parameter evolutions and the linear stability calculations were consistent. Early in the discharge, when beta and collisionality, were relatively low, ballooning parity modes were dominant.

The NSTX-U Team Meeting was held on August 15. The presentation slides are available at http://nstx.pppl.gov/DragNDrop/NSTX_Meetings/Team_Meetings/2014/08_15_2014/.

R. Kaita (PPPL) gave two tutorial lectures last week at the Fourth Graduate Summer Institute on Complex Plasmas at Seton Hall University. The first talk was entitled "A Historical Introduction to Magnetic Confinement Fusion," and included the advantages of the low aspect ratio approach being explored in NSTX-U. The second talk was entitled "The 'Complexity' of the First-Wall Challenge in Magnetic Confinement Fusion," with examples from lithium plasma-facing component research on NSTX-U.

ITER AND TOKAMAKS DEPARTMENT (R. HAWRYLUK)

DIII-D (R. Nazikian):

E. Kolemen implemented an upgraded snowflake control system to achieve a range of snowflake configurations on DIII-D. The snowflake configuration uses the poloidal field coils close to the divertor to introduce a secondary X-point in order to more broadly spread the heat load. The two main parameters of the snowflake configuration are theta (the angle connecting the two X-points) and rho (the separation of between the X-points). Both theta and rho were controlled over a range of values illustrating the effectiveness of the control system.

The Lithium Granule Injector fabrication is nearing completion and the project is on track for testing and training users of the system at the end of August. A. Nagy is working on the vessel interface design. Vacuum gauges have been received and the vacuum pump system will be delivered in August. Calibration of the LGI using lithium granules at General Atomics is planned for the week of Sept. 8. Installation will start on September 26.

A purchase order for CER cameras for B. Grierson's Early Career Award has been placed this week. The currently proposed delivery date is December 15 for the first two units. All ten units will be delivered by June 2015.

A. Nagy held a meeting this week to discuss the DIII-D TF bus design. Neway Atnafu from PPPL will arrive the week of August 18 to assess the project and develop a cost estimate that will be useful for FWP planning later in the year.

C-Mod (L. Delgado-Aparicio):

N. Pablant and Luis F. Delgado-Aparicio (PPPL) visited the Alcator C-Mod facilities on August 4-8 at the Plasma Science and Fusion Center (PSFC) at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts. They discussed the implementation of a novel multi-energy SXR camera with physicists, engineers and technicians, completed the diagnostic installation and took preliminary data in Ohmic H-modes. Time history profiles of X-ray brightness at various energy ranges were obtained the very first day of operation and more tests at C-Mod are currently underway. The goal is to acquire data under various plasma conditions including impurity injections and heating and current drive scenarios.

Delgado-Aparicio worked with Linda Sugiyama (MIT) and finalized the details of two papers they will submit to Physics of Plasmas on the Destabilization of Internal Kink by Suprathermal Electron Pressure. Delgado-Aparicio also presented a mini-proposal (MP) on locked-mode avoidance and recovery without external momentum input in support of the DOE JRT2014 on MHD effects of 3D fields.

In his second week at the Institute Delgado-Aparicio presented a talk entitled "Multi-energy X-ray imaging tests in Alcator C-Mod" showing their first results and discussing the opportunity for the installation of a novel multi-energy SXR CdTe camera. This camera will be able to contribute to RF power deposition studies using Lower Hybrid Current Drive (LHCD) as well as study production of anisotropic hard X-ray distributions during electron runaway generation and its mitigation.

THEORY (A. BHATTACHARJEE):

The theory seminar on August 14 was presented by Professor James Cho from Queen Mary, University of London and Harvard University, entitled "Dynamics of Close-In Extrasolar Planet Atmospheres". The abstract of the talk is "Extrasolar planets present a tremendous opportunity for enriching our understanding of atmospheric dynamics of planets -- as well as of brown dwarfs and stars. A large number of the extrasolar planets are subject to an unusual

forcing condition (1:1 spin-orbit synchronization), and the dynamics on them may be unlike that on any of the Solar System planets. Characterizing the flow pattern, temperature distribution, and intrinsic variability on them is necessary for reliable interpretation of data currently actively being collected and for guiding future missions. In this talk, several fundamental concepts from atmospheric dynamics, likely to be central for characterization, are discussed. Some theoretical issues that need to be addressed in the near future are also highlighted."

Physics Today published an article about an innovative Gas Switch project at GE for AC/DC power conversion equipment.

<http://scitation.aip.org/content/aip/magazine/physicstoday/news/10.1063/PT.5.5022>. PPPL researchers (A. Khrabrov, J. Carlsson, and I. Kaganovich) provide modeling support for this project.

COMPUTATIONAL PLASMA PHYSICS GROUP (S. JARDIN):

M. Parsons presented his work on "A Computational Study of Plasma Transport in NSTX at the Science Education Poster Session". He implemented new features into the GTC-NEO code including a restart function and Sauter's formulae for modeling the bootstrap current. In his numerical study he implemented a collision multiplier term to see the effects of timescale on the computational stability of the simulation. He also added new plotting capabilities to apply colormaps over the entire time or radial domain. Parsons is a Drexel co-op student in the DOE Science Undergraduate Laboratory Internship program. He was supervised by S. Ethier and E. Feibush.

It was announced this week that M3D-C1 and XGC1 will be two of the twenty codes that NERSC has selected into the Exascale Science Applications Program (NESAP). As part of this program the two code groups will receive guidance from NERSC, Cray and Intel staff to help them prepare their applications for NERSC's next supercomputer, Cori, which will include the many core Intel Knights Landing architecture. They will also have access to early prototype Knights Landing hardware and have early access to the full Cori system in 2016. As part of NESAP, NERSC will hire eight postdoctoral scholars who will be assigned to the application teams.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

NSTX Upgrade (R. Strykowski, E. Perry, L. Dudek, T. Stevenson):

Construction: Welding of the PF1B coil to the centerstack casing has been completed. PF1B upper has been installed and it will be welded to the casing when a two-day window of no NB moves through the south high bay can occur. This welding needs to be completed before tiles can be installed on the casing. The bus fabrication, trial fit-ups, and insulating continues to make good progress. The centerstack lift fixture load test was successfully completed. Trial fit-ups of upper TF flex bus and lead extension mock-ups have been started. The lower centerstack ceramic break is being assembled with new o-rings so it can be leak checked.

CS Upgrade: The TF and OH coil were successfully retested after a 100C bake. The Machine Shop is fabricating a fixture to aid in the drilling of the holes in the G10 crown. The fixture will be ready for use early during the week of August 18. At Martinez and Turek the hold point for first two lead extensions was approved last week and production has begun. As of August 11, fifteen additional parts have already been EB welded. The beam weld shop had a production slot open up and will squeeze our work in the opening. This means that there will be additional parts EB welded ahead of schedule. Good progress was made on the PF1C coil can this week. The can cover was trimmed to even it up and the flange was fit up and tack welded in place. Welding of the flange to the cover is in process. The wire for the coil TCs was received and fabrication of the TCs were completed. Installation of the TCs on the coil will commence the afternoon of August 15.

NBI Upgrade: Ion Source relocation continued this week. The B position was filled and the C position attempted and rail adjustments were required and performed. TVPS fore line and exhaust line installation continues. TVPS installation continues. BL Platform designs were evaluated for fabrication and installation and drawings are in progress. NB Controls fabrication and installation cabling work on rack connections, cable runs, and BL wiring continued in NTC and gallery. Telemetry fiber optics end-to-end testing and rework continues in NTC and new tooling for polishing terminations works well. Activities preparatory to reactivation of the NBPS switchyard, surge room, and modulator/regulator are in progress. Additional NB installation procedures are in development and review. The NBI Cryogenics effort has started to pump down cryogenic lines for upcoming operations.

Digital Coil Protection System: DCPS software efforts include investigatory work with concurrent support for tracing race conditions on the watchdog timer feature and bug. Additional problems and issues have been found and also discussed. A problem with the Autotester was found, fixed, and returned to service. The junction area rack preparation continues for DCPS computer and hardware in conjunction with the real time system reconfigurations.

OFFICE OF COMMUNICATIONS (K. MACPHERSON):

B. Quirke of DOE and K. MacPherson co-led a Media Training Seminar, held at the Friend Center on Princeton's main campus. Participants included: C. Cane, A. Capece, Luis Delgado-Aparicio, A. Diallo, S. Ethier, K. Fischer, E. Gilson, P. Gangemi, S. Gerhardt, J. Menard; S. Raftopoulos, S. Sabbagh, M. Dikieakos, and K. Tresemer. R. Torraca organized the event and C. Scimeca and R. Fowler provided video services.

J. Greenwald received SC clearance for a news release about a paper on MRX findings to be published in *Nature Communications*, and worked with the Engineering and Technology Transfer departments to complete a nominating form for PPPL to be designated a historic landmark site by the American Society of Mechanical Engineers.

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

On August 13, the Science Education Department hosted its annual Student Poster Session. Approximately 35 students presented work and progress on their summer projects. New Jersey Assemblyman Daniel Benson was in attendance and presented a legislative proclamation in recognition of a student in his district.

OFFICE OF ACADEMIC AFFAIRS (N. FISCH):

On August 12-14, N. Fisch served on the External Review Committee for the Space Research and Space Technology Focus Area of NRL.

DIRECTOR'S OFFICE (C. AUSTIN):

On August 13, A. Cohen participated in an infrastructure strategic planning development meeting with DOE in Washington, D.C.

PUBLICATIONS:

Kaye, S.M.; Guttenfelder, W.; Bell, R.E.; Gerhardt, S.P.; LeBlanc, B.P.; and Maingi, R., "Reduced Model Prediction Of Electron Temperature Profiles In Microtearing-Dominated NSTX Plasmas" *Physics of Plasmas* 21, 082510 (2014)

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