The PPPL Highlights for the week ending April 5, 2013, are as follows:

U.S. ITER FABRICATION (D. JOHNSON):

A proposal for active water cooling of retroreflector housings for some of the Toroidal Interferometer/Polarimeter sampling chords was discussed with the designers of the blankets lining the duct of the ITER Heating Neutral Beams, where these housings will be located.

Comments from DOE were received for a Request for Proposal Package for "Physics and Engineering Design Support and Diagnostic Hall Instrumentation Development for ITER Low-Field-Side Reflectometry (LFSR) Diagnostic System". The Subcontract Evaluation Review Board met to formulate responses to these comments and make associated modifications to procurement documents.

A Panel Report was received from the Physics Risk Mitigation Review, which considered modifications proposed by US experts to simplify the front-end design of the LFS Reflectometer system by employing a monostatic approach - with one waveguide antenna used for both launch and receive functions. The Panel approved proceeding with the preliminary design with the new approach. One action was to consider a bistatic configuration for the doppler measurements. Another was to estimate the time needed to switch instrumentation from one monostatic antenna to another at a different z- position.

NSTX (M. ONO):

The paper "Disruptions, Disruptivity, and Safer Operating Windows in the High-Beta Spherical Torus NSTX", by S.P. Gerhardt (PPPL) et al., was published in Nuclear Fusion (S.P. Gerhardt et al 2013 Nucl. Fusion 53 043020). This paper describes disruption rate and disruptivity statistics for NSTX operations, and describes the operating conditions that minimized the disruptivity. This paper is the journal article associated with the 2012 IAEA Fusion Energy Conference.

A paper, “Reduced-Order Model Based Feedback Control of the Modified Hasegawa-Wakatani model” by Imene R. Goumiri (Princeton University) et al., has been published in Physics of Plasmas Vol. 20, 042501 (2013). The focus of this work is the development of model-based feedback control that stabilizes an unstable equilibrium for the Modified Hasegawa-Wakatani (MHW) equations, a classic model in plasma turbulence. First, a balanced truncation (a model reduction technique that has proven successful in flow control design problems) is applied to obtain a low dimensional model of the linearized MHW equation. Then, a model-based feedback controller is designed for the reduced order model using linear quadratic regulators. Finally, a

linear quadratic Gaussian controller which is more resistant to disturbances is deduced. The controller is applied on the non-reduced, nonlinear MHW equations to stabilize the equilibrium and suppress the transition to drift-wave induced turbulence.

Modeling Non-axisymmetric Control Coils in NSTX-U (Todd Evans and Wen Wu, General Atomics). A series of 36 NSTX-U equilibrium files were successfully tested for compatibility with GA's TRIP3D, TRIP3DGPU, PROBE_G and SURFMN codes. These files are being used to assess the spectral properties of various configurations of the proposed NSTX-U non-axisymmetric control coil (NCC) system using the SURFMN code and to carry out field line trajectory simulations with the TRIP3D and TRIP3DGPU over a range of pressure (beta) variations. The NSTX-U NCC models in the TRIP3D, TRIP3DGPU, PROBE_G and SURFMN codes have been compared to the coordinates of the NCC vertices used in the VALEN code and preliminary tests of these coil models have been run using the SURFMN code. The near term goal is to assess several partial NCC options being proposed in the NSTX-U five year plan. These options consist of 1 off-axis upper 1x12 in-vessel coil located either in from the primary of the secondary passive stabilizer plate along with several 2x6 coil options proposed at an NCC design meeting held at PPPL on January 22, 2013.

J. Menard (PPPL) attended the Research Council UK Fusion Advisory Board (FAB) meeting on April 4, held at the York Plasma Institute at the University of York, UK to provide the FAB a report on the outcome of the last MAST PAC meeting. He also participated in a tour of the research facilities at the York Plasma Institute, which was hosted by the director of the institute, Professor Howard Wilson.

R. Kaita (PPPL) gave a seminar entitled "Plasma-Facing Component Research on the National Spherical Torus Experiment-Upgrade - Addressing the Challenge of First Wall Materials for Magnetic Confinement Fusion" at the Department of Physics and Astronomy at Johns Hopkins University. It included a review of NSTX experience with lithium as a coating on carbon plasma-facing components (PFCs), and as a layer on a molybdenum (high-Z) substate on the Liquid Lithium Divertor (LLD). Plans were also presented for a phased implementation of high-Z PFCs on NSTX-U, and the development of a flowing liquid lithium divertor module.

There are two featured articles related to NSTX-U in the latest issue of eNews, the monthly newsletter of the US Burning Plasma Organization posted on the USBPO website at, http://burningplasma.org/enews.html which also provides links to higher-resolution versions.

Preparations of plasma operations in the NSTX-U configuration also continued with a successful review of the conceptual design for the new Stand Alone Digitizer (SAD) modules for the real time plasma control system.

ADVANCED PROJECTS (H. NEILSON):

Recent work on modeling the ITER 3D equilibrium with VMEC was presented by S. Lazerson to the ITPA MHD Working Group 12 concerning edge displacements and core instabilities. Axisymmetric free boundary ITER equilibria were generated with VMEC for the 15 MA scenario at the start of flattop (L-Mode) and at full burn (H-mode). The STELLOPT code was utilized to verify that the axisymetric equilibria were matched as closely as possible to the

axisymmetric separatrix as computed with transport models. The q profile and pressure profile were also matched to these scenario values. These equilibria then served as a starting point for calculation of edge response to the applied resonant magnetic perturbations for ELM control using a free boundary VMEC. In-vessel coil currents producing n=3 and n=4 modes indicate a maximum edge displacement of around 1 to 2 [cm] in the upper and lower outboard sections of the torus.

In the Wendelstein 7-X trim coil project, an order for five safety disconnect switches was placed with Filnor, Inc. of Alliance, OH. The switches, which provide a DC disconnect and safety grounding capability between the power supplies and the coils, are scheduled for delivery to the project's Greifswald, Germany site at the end of August.

PLASMA SCIENCE AND TECHNOLOGY (P. EFTHIMION):

Laboratory Astrophysics:

An informal gathering on magnetic reconnection in high energy density plasmas produced by high power lasers was held at PPPL on April 4-5. Two overview talks were given on the physics problems on flow-driven magnetic reconnection and current status of laboratory study of magnetically driven reconnection. Presentations were made by five groups in the world (one from Japan, one from China, one from France, and two from the US) on the subject of reconnection-motivated experiments using high power lasers. Presentations were also made on the magnetic field effects on inertially confined plasmas and magnetic bubble measurements during the evolution of Rayleigh-Taylor instability. Closely related experiments on the collisionless shocks were also summarized including their future prospects. Theoretical progress in understanding effects by a weak magnetic field on plasma dynamics and role of electron pressure anisotropy on reconnection have been discussed. Finally, discussions on possible future collaborations and coordination were discussed. From PPPL, three efforts are taking place in these areas: one on laboratory studies of reconnection extending from MRX, theoretical or numerical investigations of reconnection in HED plasmas, and new diagnostics based on X-ray crystal spectroscopy. All presentations are posted at http://mrx.pppl.gov/Meeting/Princeton-Apr2013/

Two important papers for space and solar physics have been recently published from the MRX group.

“Laboratory Study of Hall Reconnection in Partially Ionized Plasmas”, E. Lawrence, H. Ji, M. Yamada, and J. Yoo, Phys. Rev. Lett. v.110, 015001 (2013). In this paper, the effects of partial ionization on magnetic reconnection in the Hall regime have been studied systematically in the Magnetic Reconnection Experiment. It is shown that, when neutrals are added (up to 100 times to plasma density), the Hall quadrupole field pattern and thus electron flow are unchanged while the ion outflow speed is reduced due to ion-neutral drag. However, in contrast to theoretical predictions, the ion diffusion layer width does not change appreciably. It is also found that the total ion outflow flux and the normalized reconnection rate are reduced. The results of this paper will be compared with data from NASA's Solar Observation satellite (IRIS) to be launched next month.

"Experimental evaluation of common spacecraft data analysis techniques for reconnection region analysis in a laboratory plasmas": J. Yoo and M. Yamada, J. Geophys. Research-Space Phys. V.117: A12202 DOI: 10.1029/2012JA017742 Published: DEC 6 2012. A laboratory plasma is utilized to assess the effectiveness of several prominent spacecraft data analysis techniques. These include minimum variance analysis on the magnetic field (MVAB) and various boundary crossing time analyses (BCTA). For this purpose, the neutral sheet is swept, or jogged, by pulsed internal coil currents in a controlled manner with respect to stationary probes. Magnetic field data from measurement points that resemble the formation of multi spacecraft flying though a reconnecting current sheet is used to check MVAB and BCTA to deduce a proper normal vector. Based on the MRX observations, we proposes a unique procedure for MMS satellite to determine a local coordinate system for data from four space craft passing through a reconnecting current sheet.

ENGINEERING AND INFRASTRUCTURE (M. WILLIAMS):

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

Planning for machine startup has begun with the formulation of a PPPL Activity Certification Committee (ACC), which will report on the readiness of the project to begin operations. This report will be used as input to the DOE led Readiness Assessment (RA) review which will required prior to performing the ISTP testing. The project continues to be on track for a September 2014 CD-4.

Construction: Modification of all vacuum vessel leg mounts has been completed. The scaffold is being removed from the bay L area. The new PF4/5 mounts are being evaluated for modification. TF4 has been installed in position G and the 109' platform is being re-installed in that location. In-vessel cleaning, following the vessel cuts and welding at bays J, K and L, is in progress. In-vessel metrology indicates that the vessel work at bays J-L has not affected the bays F-G area. Six passive plates have been removed so two of them can be modified. Cable tray installations are in progress along the north wall and the NW labyrinth. The machining repair of TF12 continues in the south high bay. The upper umbrella arch reinforcements have been completed on the east side. The scaffolding has been removed from the east side of the machine. The welding of the OH winding fixture spool cart has been completed. The brazing of the neutral beam backing plates has been completed.

Center Stack Upgrade: The second TF Bundle quadrant went through a successful epoxy VPI during the week. The gel temperature was reached on Thursday without the incident and the coil is currently being ramped up in temperature to 170C. The coil will continue the oven cycle throughout the weekend and should be cool enough to be inspected on April 8. The OH Winding station and spool station fabrication continued throughout the week in RESA. The passive plates were removed from the vacuum vessel to implement the strap reinforcement design. The straps are now being fit up to the as-built condition of the plates. Nine bars are wrapped to complete the insulation for the third quadrant and wrapping of the fourth quadrant has commenced. The Inner PF Coils procurement was awarded to Everson and the OH Coil mold procurement was awarded to Martinez. Electron beam welds and sections were performed on samples sent to Sciaky. The welds appear to be of high quality. The samples are being sent back to PPPL for further testing. The vendor selection for the upper umbrella lid has been made and will be awarded shortly.

Installation of the PF 4/5 supports on the machine continued. Some interferences were discovered between MPTS and the column in BayK/L position. A work around has been identified and will be implemented once the personnel become available.

NBI Upgrade: A source access platform was removed from a TFTR BL and decon is in progress in TTC. This platform will be reused on BL2. Fabrication and leak checking of LHe cryo line continues in the NB shop. LHe cryogenics line installation and welding on the TFTR Test Cell South wall continues. HVE relocation preparations are underway in the TCB. Fabrication continues on the NB/TVPS duct components in the Tech Shop. The Armor backing plates were completed in the Braze Shop and leakcheck is in progress. An estimate of welding support required for upcoming work was prepared so work orders can be placed with the shop. Procurement held another pre-bid conference for the DI Water procurement. Decon of the BL2 lid has been completed. Decon of the BL2 surround and tools continued in order to make way for HVEs. BL2 Source platform supports were installed and secured to the NTC floor. Water manifold fit-up under the source platform is in progress. Work continued on the SOW and drawings for the power supply cable and tray subcontract requisition package.

Office of Project Management (T. Stevenson):

Work Planning system 6.1 was moved to the production area and some tests were performed. WP 6.1 is considered operational. This updated addressed some corrective actions including Lithium review. Requirements gathering for a Work Planning system upgrade continued. The COG/RLM online training package is with the Training Office for narration and release. ENG procedure and Engineering Standard reviews are ongoing.

Facilities and Site Services:

Engineering Services: The department gathered data, provided input and updated Section 6.0 Infrastructure /Mission Readiness part of the PPPL 2013 Business Plan to submit for review and approval by Mike Williams. Work continues on Chiller 701 with eddy current testing on the heat exchangers and Electrical testing on the motor completed this week. New isolation valves were installed for the chilled water supply and return pipes in the D-Site 138' Level MER.

Fire Protection: A second vendor meeting was held with fire protection vendors to discuss the bid for the five year internal inspections of the sprinkler systems. An appointment was scheduled for another candidate interview for FPE.

Energy: A meter operating at the low end of the scale was investigated in order to develop better energy use data for the areas it serves.
Material Services: Loan agreement for University of California at Davis was approved and items shipped. The set-up of Authorized Property Pass Approver's was initiated by Property Management for new Online Property Pass System that will be implemented in the near future.

BUSINESS OPERATIONS (E. WINKLER):

The Laboratory's Subcontract Auditor and Compliance Analyst issued final report for the review of the audit of Whitsons Food Service Corporation. The report, among other things, addresses

the findings in a previous audit completed by Baker Tilly, LLC and provides a recommendation to close out the Whitson's subcontract.

The Procurement Division compiled the Laboratory's cumulative small business subcontracting plan results through March 31. The results are: overall small business, 51.39% (goal 50.2%); disadvantaged business, 4.75% (goal 5.0%); women owned, 5.69% (goal 7.0%); HUBZon, 1.71% (goal 3.5%); service disabled veteran owned, 2.96% (goal 3.0%). Budget uncertainty is contributing to this year's very slow start against the Laboratory's small business goals. To the extent feasible, procurement will be putting additional emphasis on sourcing in all small business categories in the second half of the year; however, the anticipated award of numerous large dollar ITER Project procurements to other than domestic small business sources will make achievement of this year's small business goals especially challenging.

The Procurement Division responded to a request from the Office of Audit and Compliance regarding the number and dollar value of PPPL's sole source procurement awards during fiscal years 2011 and 2012. In FY 2011 the Division placed 107 sole source actions with an aggregate value of ~$3.3 Million. In FY 2012 the Division placed 90 sole source actions with a value of ~$3.5 Million.

The DOE Chicago Office competed its review of PPPL's costs for Laboratory Development R&D for FY2012. No exceptions were identified and, as a result, the DOE-ISC-CFO could certify that PPPL's LDRD costs and rates were appropriate.

L. Lauria and T. Bleach met with J. Graham and A. Morrison of the Best Practices Division to review and revise the Laboratory's travel guidelines, which will be converted to a Laboratory procedure.

ENVIRONMENT, SAFETY, HEALTH & SECURITY (J. LEVINE):

R. Sheneman attended the inaugural National Adaptation Forum, a gathering of environmental, resource management, planning, and disaster preparedness professionals focused on adapting both natural and human systems to the impacts of global climate change. DOE orders and guidance require that sites incorporate climate change adaptation into long-term planning and their Site Sustainability Plans

ESU Ambulance A166 responded to Plainsboro for four mutual aid assignments.

The ORPS (Occurrence Reporting and Processing System) Quarterly Performance Analysis Report for CY 2013 First Quarter was submitted to PPPL senior management and to DOE/PSO.

The Quarterly Report for PTENS (Princeton Telephone and E-Mail Notification System) was submitted to Business Operations.

PPPL Counterintelligence Officer P. Moskal visited the Laboratory April 2-4. Counterintelligence Officer M. DePhillips accompanied Moskal to the Laboratory.

SPD issued an all staff e-mail message providing planned emergency response actions during VPI Operations this week.

F. White, D. Stevenson, S. Shaw and M. Schaefer conducted a safety walkthrough of the ESU portion of the Emergency Services Building. Drivers R. Lamb and W. Foraker accompanied the group throughout the building.

C. De Zuani and A. Gondeck have joined the Site Protection Division as Emergency Services Officers. De Zuani is an active member of the Burlington City Fire Department. Gondeck is an active member of the Raritan Borough Fire Department and the 177 Fighter Wing, US Air Force in Egg Harbor Township. Both new ESOs have completed much of their required training and will begin staffing Booth 6 next week.

INFORMATION TECHNOLOGY (S. BAUMGARTNER):

The first set of overvoltage-protected termination panels have been shipped by the vendor. These will be used for NSTX-U CAMAC retirement efforts.

The expansion of the NSTX Diagnostics network has been scheduled for April 9. This will double the capacity to support up to 500 devices.

Two new systems have been added to the PPPL scientific computing cluster that contain Graphical Processing Units (GPUs). GPUs can often greatly accelerate parallel processing codes. The systems each contain 32 regular CPUs, and 448 Nvidia GPUs.

S. Baumgartner, J. Hirsch, H. Towner, P. Sichta and K. Silber received a demo from A. Dominguez of a new public web server which will allow the public to interact online with a DC Discharge Experiment (similar to the one in the LSB lobby). A camera will be setup, which will allow the public to view the results on the experiment after inputting parameters. The experiment, server and camera will be located in the Science Education Laboratory. Due to non-standard configuration requirements the server will be isolated from the domain.

OFFICE OF COMMUNICATIONS: (K. MACPHERSON):

C. Cane started a social media strategy document for PPPL. Cane covered a live event at the Young Women's Conference, highlighting a PPPL speaker using social media (twitter). He completed testing of live video streaming planned for PPPL events in the MBG auditorium, and also worked with PPPL and Princeton University IT personnel to improve the accuracy and transmission of People data submitted by PPPL'ers to the PPPL website.

Along with J. Greenwald, Cane also attended a monthly communications best practices meeting on main campus on April 5.

J. Jackson DeVoe, along with G. Czechowicz, edited, published and designed the PPPL Weekly featuring articles on a new outdoor Wi-Fi system for PPPL and positive results from the Safety Culture Survey.

A story on PPPL's WasteWise awards based on DeVoe's story was published in the Trenton Times (http://www.nj.com/mercer/index.ssf/2013/03/princeton_plasma_physics_labor.html). DeVoe attended a TED Conference on "Future Utopias: Realistic Ways to Better our Society," at Saint Peter's University in Jersey City, which featured PPPL's A. Zwicker leading a discussion titled: "Creating a Star on Earth: The Path To Fusion Energy" (tweeted live). TED talks will be posted next month.

J. Greenwald reviewed preliminary layouts for Quest, the PPPL magazine that is to be inserted into the Princeton Alumni Weekly in July, and discussed revisions with K. MacPherson, J. DeLooper, and members of the Director's Office. He assisted a reporter from the Daily Prince who was preparing a story on PPPL's WasteWise award. He posted several stories to the website, including an article on research at MIT.

K. MacPherson worked with representatives of PPPL's property management and IT group on March 20, to discuss a new communications plan to aid the rollout of a new process. She attended the Public Affairs Breakfast at Princeton University sponsored by the University's Vice President and Secretary on March 21. Along with C. Cane, she met with representatives of PPPL's IT group on March 20 to brainstorm solutions to data issues in systems supporting the Laboratory's website. She attended the National Labs' Chief Communications Officers meeting in Washington, D.C., on April 4, and gave a presentation on a national laboratory-wide collaboration with an entertainment company.

E. Starkman took the VPI group photo as well as photos for the Weekly and slide show, including the Princeton Art Students, K. Tafe, A. Borkar, T. Rothman, C.S. Chang and S. Galie. She also provided prints and digital files as requested and set up a photo gallery of the Epoxy work and the lift of the completed quadrant. In addition, she worked on updating the NSTX CAD drawing with new people images.

J. Jackson DeVoe organized the following tours:
A tour of approximately 50 Bergen County Community College STEM students was led by H. Carnevale, R. Sheneman and B. Ellis. The tour included the NCSX components, and the NSTX Control Room.

BEST PRACTICES & EXTERNAL AFFAIRS (J. DELOOPER):

On April 6, the Science Education department represented PPPL at the Cotsen Children's Library event, Princyclopedia.

DIRECTOR'S OFFICE (B. SOBEL):

S. Prager met with a working group from Best Practices on April 2.

On April 3, Dr. Roger Wiens, Los Alamos National Laboratory, presented a colloquium entitled "Exploring Mars with Curiosity and It's Laser".

On April 4, two trustees from Princeton University, Charlie Gibson, retired newscaster, and Pyper Davis, COO of the SEED Foundation, toured the Laboratory. Accompanying the visitors were S. Prager, A. Cohen, M. Zarnstorff, and J. DeLooper.

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