USBPO U.S. BURNING PLASMA ORGANIZATION

eNews

April 15, 2011 (Issue 54)

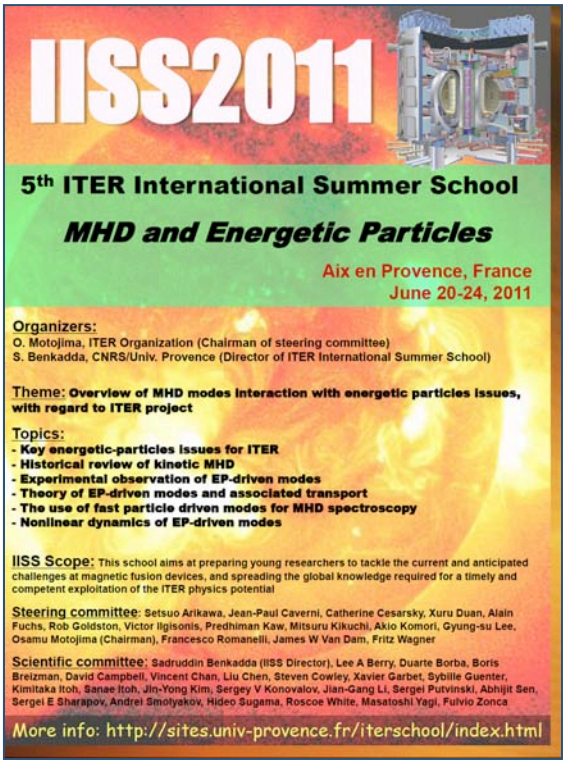
CONTENTS

Dear Burning Plasma Aficionados:

This newsletter provides a short update on U.S. Burning Plasma Organization activities. E-News is also available online. Comments on articles in the newsletter may be sent to the Editor (Tom Rognlien) or Assistant Editor (Rita Wilkinson). Thank you for your interest in Burning Plasma research in the U.S.!

Director's Corner by Jim Van Dam

USBPO Scholarships Awarded for ITER Summer School



In the previous two monthly issues of eNews and also by means of numerous emails, we had announced that the US Burning Plasma Organization would make available eight scholarships for US participants to this year's ITER International Summer School in Aix en Provence, France, June 20-24. By the deadline (Friday, March 26), 18 applications were received. The USBPO Council set up a small subcommittee of Council and Research Committee members to review the applications and make recommendations. I'd like to thank the members of that committee: Mike Mauel (committee chair and also Council chair), C. S. Chang, Don Spong, and Francois Waelbroeck. They worked assiduously over the weekend and presented their recommendations on Wednesday, March 30, in time for the USBPO Council meeting that afternoon. The awardees were notified on Thursday, and Rita Wilkinson, our USBPO administrator, had them all registered by the Friday, April 1, School deadline. The USBPO scholarships are intended to cover registration

fees and housing costs (paid directly by the USBPO, so no out-of-pocket expense for the awardees) plus round-trip airfare from US home airports to Marseille and back. We hope that local institutions will cover incidental expenses and per diem. All of the awardees will present posters about their work at the School.

The scholarship awardees are the following persons:

Aaron Bader (MIT)	Jonathan Koliner (Wisconsin)
Eric Bass (GA)	Matt Lanctot (LLNL)
Alex James (UCSD)	Chris Muscatello (UC Irvine)
Joshua King (UC Berkeley)	Jason Sears (LANL)

Four of the awardees are fairly advanced graduate students, and four are postdocs.

During the selection process, the review subcommittee became aware that two others of the applicant pool would be able to attend the ITER Summer School on funding provided by their local institutions. We applaud this generosity.

These scholarships should be a wonderful way to enhance the involvement and knowledge of our younger generation of scientists in ITER and burning plasma science.

USBPO Council Meeting

The Council held its first-quarter 2011 meeting on Wednesday, March 30. Mike Mauel (chair) and Michael Bell (vice chair) led the meeting. Here is a brief summary.

- I presented an update about activities of the USBPO. Council members discussed adjusting the wording of the USBPO Charter document so that retired fusion scientists can continue as members. There were also discussions about the meaning of the "pause" for the Fusion Simulation Program and about the possibility of the USBPO setting up a FaceBook page as a way to get students more involved and informed. (Note that students may become regular USBPO members.)
- Chuck Greenfield, USBPO deputy director, reported about the activities of the Research Committee. Two web seminars have been held (February 22 and March 29) with speakers reporting about ITPA Topical Group meetings and associated Joint Experiments. Both seminars had 20 ReadyTalk sites participating; if we estimate that each site represented three persons (the GA site actually had 20), then around 60 people attended each seminar. The Council commended these web seminars.
- It was noted that to replace Erol Oktay (recently retired) as the USBPO program manager on an interim basis, Steve Eckstrand will handle scientific issues and Al Opdenaker will handle administrative and financial issues. Steve reported that, based on recent discussions at Executive Committee meetings and contacts with individual scientists, he had submitted two nominations for new deputy leader of each of these three ITPA topical groups: Energetic Particles, Integrated Operation Scenarios, and Pedestal. The ITPA Coordinating Committee chair and official ITER Member contact persons will negotiate the final lineup of ITPA Topical Group leadership.
- Mike Zarnstorff reported about the progress of the International Collaborations Committee. The final report will be ready in a week.
- Mike Mauel reported about the Council's Nominations Committee, in the absence of Lee Berry, its chair. The announcement asking for nominations has been sent out, and several nominations have already been received. Let me encourage all USBPO members to provide qualified nominations.
- Mike Mauel then reported about the selection and awarding of eight scholarships to US graduate students and postdocs for the upcoming ITER International Summer School. An *ad hoc* Council review subcommittee had expeditiously handled the selection process. The Council discussed the possibility of broadening eligibility next year to

students and postdocs who are enrolled or employed at US institutions, but not necessarily US citizens.

- Mike Mauel reported about a proposal to organize a USBPO workshop next year, on the general subject of progress and plans in burning plasma science. This workshop would be intended to serve as a follow-up to the kick-off USBPO national workshop that was held at ORNL in 2005. Its goal would be to review progress since the previous workshop and to identify research that the US could perform over the next few years to advance burning plasma science and foster the development of increased collaboration between theory, modeling and experiments. The Council strongly supported this proposal. More details now need to be worked out.
- Finally, the Council commended the ITER Town Meeting and ITER contributed oral session(s) that the USBPO has organized at APS Division of Plasma Physics Annual Meetings in past years.

ITER Integrated Modeling Activities

ITER signed a three-year framework contract for Integrated Modeling Infrastructure on December 17, 2010, and the Task Order for Conceptual Design on December 20, 2010. The Task Order covers 15 months. Separate kick-off meetings for Administrative and Technical Issues were held in January (by means of remote participation). The first face-to-face meeting between ITER staff and the Integrated Modeling Design Team has also been held.

ITER will hold an Integrated Modeling Technology Workshop June 8-10 in Cadarache, France. The organizers are Wayne Houlberg and Frederic Imbeaux of the ITER Organization. Participants from the seven ITER Members will be asked to present and discuss candidate technologies that they have found useful in their own integrated modeling efforts to apply modern software technologies to fusion simulations. Later, ITER will hold the Integrated Modeling Expert Group Meeting October 25-27 at Cadarache. The two US representatives to this Expert Group are Don Batchelor (ORNL) and Lang Lao (GA).

Fusion Miscellany

Ned Sauthoff, Director of the US ITER Project Office, and Osamu Motojima, ITER Director-General, are featured in an interview about the continued promise of fusion energy.

The Max-Planck Institute for Plasma Physics offers nuclear fusion as an online "flip book". You are able to control a plasma discharge and construct a fusion device. The electronic thumb flicks, "Hot in here!" and "Complicated, but highly promising", show the course of a plasma discharge in IPP Garching's ASDEX Upgrade tokamak fusion device and the construction of IPP Greifswald's Wendelstein 7-X stellarator device. Here's how it goes: Open the pdf-files and quickly flick through the pages.

A newspaper editorial about fusion energy and the federal energy policy can be found here.

The lectures for the 2010 ITER International Summer School have been published in the April 2011 issues of *Fusion Science and Technology* (volume 59, number 3), which is edited by Nermin Uckan. The table of contents, preface, and abstracts of papers can be accessed by anyone. Online full-text access is available to individual and library subscribers.

And last but certainly not least, Mike Mauel, USBPO Council chair, is teaching a course on ITER physics during the Spring 2011 semester at Columbia University. His lectures are posted here.

Students, Arise!

This is a friendly reminder that students are eligible—and indeed welcomed—to join the US Burning Plasma Organization. Go to the USBPO web page and click on Topical Groups under Sign Up. It's painless. Be involved! Be informed! *You* are the "ITER Generation."

USBPO Topical Group Highlights

(Editors note: The BPO Confinement and Transport Topical Group works to facilitate U.S. efforts to understand plasma confinement via improved measurements and computational models for existing and future magnetic fusion devices [leaders are John Rice and George McKee]. This month's Research Highlight by Anne White et al., summarizes recent results of designing experimental campaigns and turbulence diagnostics using sophisticated plasma simulations. BPO members are welcome to propose future Research Highlight articles to the editor.)

Designing experiments and turbulence diagnostics with nonlinear gyrokinetic simulations

A.E. White (Massachusetts Institute of Technology); W.A. Peebles, T.L. Rhodes (University of California, Los Angeles); N. Howard, M. Greenwald (Massachusetts Institute of Technology); D.R. Mikkelsen (Princeton Plasma Physics Laboratory); G.R. McKee (University of Wisconsin); C. Holland (University of California, San Diego); J. Candy, R.E. Waltz (General Atomics)

It essential for the success of future burning plasma experiments that we further develop our understanding of energy, particle and momentum transport via detailed measurements, while improving our ability to make first-principles predictions of plasma confinement and performance. In the absence of magnetohydrodynamic instability-driven transport, the transport in tokamaks above the neoclassical levels from Coulomb collisions is described by nonlinear gyrokinetic theory [1], which can be used to calculate transport due to turbulence using advanced numerical simulations [2]. Theory-based transport models, such as the Trapped Gyro-Landau Fluid (TGLF) package [3], are used to predict confinement and performance in ITER and are calibrated by nonlinear gyrokinetic simulations. To improve our confidence in these predictions, the nonlinear gyrokinetic simulations underlying the theory-based transport models must be extensively validated. Validating nonlinear gyrokinetic simulations requires that code calculations of both turbulence fluctuation characteristics and transport levels be shown to simultaneously agree with experimental data [4].

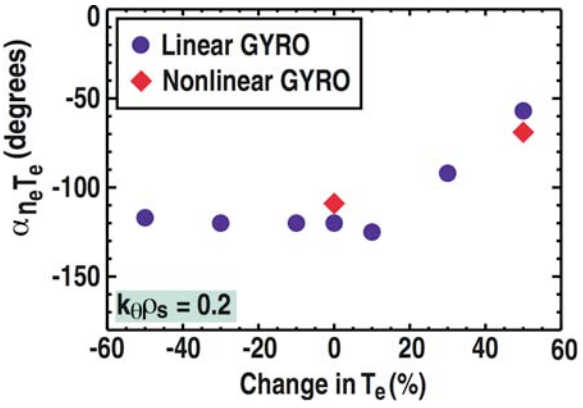


Fig 1. Predicted phase angle between long-wavelength δn_e and δT_e in the core plasma as a function of change in electron temperature away from a beam-heated L-mode base case [from Ref. 11, Fig. 1].

Typically in validation studies, nonlinear gyrokinetic simulations are run after an experiment and the results are compared to measured fluctuations and transport fluxes in detail [5, 6, 7, 8]. In these *a posteriori* validation studies, the code inputs are taken directly from the measured experimental profiles. Nonlinear gyrokinetic simulations are highly sensitive to the density and temperature gradients used as input to the codes [9], and the uncertainties in measured profiles makes it difficult to compare experiment and code results directly. A different approach is to use the experimentally inferred transport fluxes as inputs, and then determine the "transport solution" profiles needed to generate the input fluxes [10]. Yet another approach is to use *a priori* nonlinear gyrokinetic simulations run before the experiment in order to make *predictions* of trends and large changes in turbulence using realistic parameter scans [11]. Such scans are often used to predict trends in transport, but had not been used to

predict changes in *measurable* turbulence parameters. Comparing predicted changes in turbulence with the subsequent measurements eliminates the issues of profile uncertainty and code sensitivity, because the code result that is compared with experiment no longer depends on measured profiles as inputs. The use of gyrokinetic simulations before an experiment may be extended even further, and the codes can be used as part of diagnostic design and feasibility studies [12]. At both the DIII-D and Alcator C-Mod tokamaks, the use of *predictive* GYRO [13] simulations run *prior to an experiment* has enhanced experimental planning and diagnostic design and has provided new insight into the physics of core turbulence and transport.

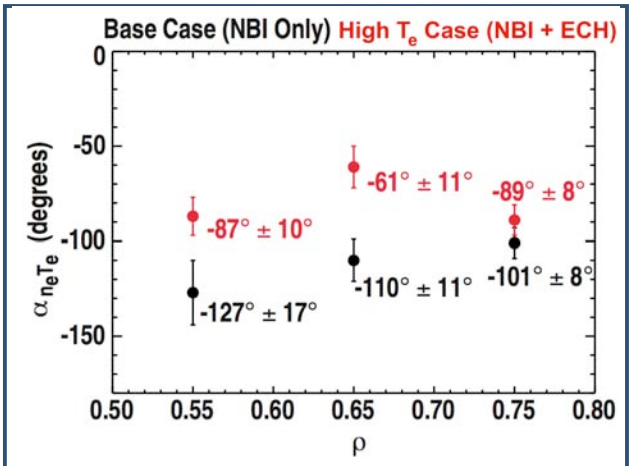


Fig. 2. Measured phase angle between long-wavelength δn_e and δT_e in the DIII-D core plasma as a function of normalized radius, ρ [from Ref. 11, Fig. 8; red is high T_e case].

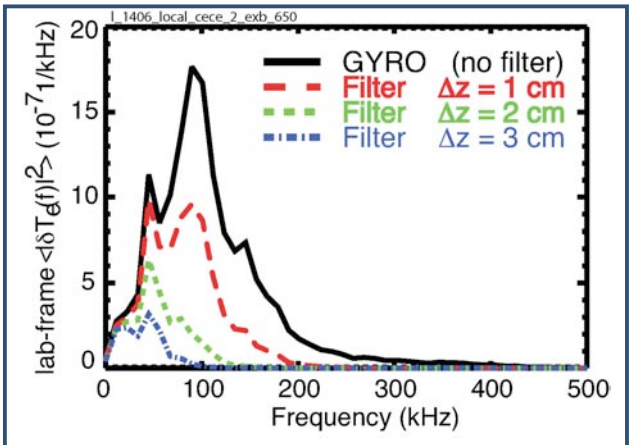


Fig. 3. GYRO predicted lab-frame cross-power spectrum of $\delta T_e/T_e$ at $\rho = 0.6$ as it would be measured with a CECE diagnostic at C-Mod. Scanning the vertical sample volume size is used to find the spot-size needed (red) for the new diagnostic [from Ref. 12, Fig. 9, (b)].

At DIII-D, the phase angle between density fluctuations, δn_e, and electron temperature fluctuations, δT_e, has been measured for the first time in the core of a tokamak using coupled fluctuation reflectometer and radiometer diagnostics [11]. Using GYRO simulations, a new experiment was designed to exploit this unique measurement capability [11]. Full-physics, nonlinear GYRO simulations were used to predict *prior* to an experiment how the phase angle between long-wavelength δn_e and δT_e in the core plasma is expected to respond to a realistic changes in the electron temperature, T_e, profile (see Fig. 1). The parameter scan in the simulation mimicked changes in T_e when electron cyclotron heating (ECH) is added to a neutral-beam-heated low-confinement L-mode plasma. Nonlinear GYRO simulations predicted that if T_e and ∇T_e were increased 50% in a typical beam-heated L-mode plasma (shot 128913, time = 1500 ms, at normalized radius $\rho \approx 0.55$), then the phase angle between δT_e and δn_e at $\rho \approx 0.55$ should decrease 30-50% and electron temperature fluctuation levels will increase a factor of two more than density fluctuations. After the experiment was performed, the changes in turbulence measured at $\rho \approx 0.55$ were found to be consistent with the GYRO predictions. Additionally, the values of the phase angle between δn_e and δT_e, not just the change in value, were also correctly predicted within error bars at $\rho \approx 0.55$ and $\rho \approx 0.56$ (see experimental data in Fig. 2). Validation work continues in order to understand the radial variations in the phase angle response. Interestingly, the phase angle measured near $\rho \approx 0.75$ showed no change with ECH, but no predictions for the change at this radius were available because of large differences between measured turbulence and transport reported previously in this "transition zone" radial region [5]. The new δn_e-δT_e relative phase-angle measurements will help contribute to understanding

turbulent-transport in this radial region. Development of validation metrics [14] is an essential part of these *a posteriori* comparisons.

At the Alcator C-Mod tokamak, a combination of nonlinear GYRO simulations and synthetic diagnostics have been used as part of a feasibility study for a new, proposed core turbulence diagnostic. Presently at Alcator C-Mod, the only measure of core fluctuations is from Phase Contrast Imaging [8], which provides excellent information on the wavenumber spectrum of density fluctuations, but is a line-integrated measurement. Local turbulence measurements are desired in order to better test and validate the gyrokinetic codes. For this reason, a new Correlation Electron Cyclotron Emission (CECE) diagnostic is being designed with the aid of nonlinear GYRO simulations [12]. A CECE diagnostic is used to measure long wavelength, turbulent electron temperature fluctuations [6]. By applying synthetic CECE diagnostic models [5] to a variety of experimentally realistic GYRO simulations, the feasibility of the new CECE diagnostic for C-Mod can be assessed. Specifically, the design of the quasi-optical focusing system and microwave radiometer receiver are constrained based on GYRO predictions for wavenumber spectra, power spectra, fluctuation levels, and correlation lengths of temperature fluctuations. Using nonlinear GYRO runs in the design study was required because δT_e measurements were attempted at C-mod previously, but no T_e fluctuations were measured, and the reason for this was not understood [15]. Because of the gyrokinetic simulation results, we now have confidence that core turbulence in a typical C-Mod L-mode plasma is long-wavelength, ion-mode turbulence with a peak in the poloidal wavenumber spectrum near $k_\theta \rho_s = 0.4$, where ρ_s is the ion gyro-radius evaluated using the ion-acoustic speed. Synthetic diagnostic modeling shows that the normalized fluctuation amplitude, $\delta T_e / T_e \sim 1\%$, at $\rho \approx 0.6$ can be clearly measured as long as the vertical dimension, Δz, of the sampled volume is reduced to less than 1 cm. GYRO therefore indicates why the previous C-Mod attempts at CECE did not work; it was because the Δz =3 cm spot-size of the old system was too large, giving a very weak signal (see Fig. 3, blue curve). The new CECE diagnostic at C-Mod will be built to GYRO specifications and attempts to measure turbulence will be made in the type of L-mode plasmas used in the design simulations. When the CECE diagnostic comes online and makes (or fails to make) core turbulence measurements, we will already know a great deal about the accuracy of GYRO predictions for core fluctuations in C-Mod. If successful, this test will provide a great deal of confidence in applying the GYRO code to predict turbulence and transport in other tokamaks and burning plasma experiments where local, core fluctuation measurements have not yet been made.

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ITPA Reports

Summary of the 6th Meeting of the ITPA Topical Group on MHD Stability at Ahmedabad, India

Abhijit Sen (Institute for Plasma Research, India), Edward Strait (General Atomics), and Yuri Gribov (ITER Organization)

The ITPA Topical Group (TG) on MHD Stability held its sixth meeting at the Pride Hotel, Ahmedabad, India, during March 1-4, 2011. The meeting was kindly hosted by the Institute for Plasma Research, Bhat, Gandhinagar, India. There were 47 participants (3 from the ITER Organization [IO], 1 from Japan (remote participation), 10 (6 of them remote participants) from the EU, 25 from India, 1 from Korea (remote participation), and 7 (with 3 remote participants) from the US). The scientific program of the meeting was devoted to addressing key magnetohydrodynamic (MHD) stability topics for ITER such as plasma disruptions, magnetic error-field correction, resistive wall mode (RWM) stability, neoclassical tearing mode (NTM) stability and sawtooth control**.** The meeting also reviewed the progress of the various joint experiments and the activities of the working groups and further considered suggestions for new joint experiments and working groups. The next meeting of the TG will be held in Padua, Italy (tentatively scheduled during October 4-7, 2011) and will be hosted by the Consorzio RFX, Associazione EURATOM-ENEA per la fusione. The Spring (2012) meeting will be held in Toki, Japan jointly with the 16th US-Japan workshop on active MHD control. We give below a brief summary of the proceedings.

Disruptions

The topic of disruptions received major attention at this meeting with nearly 40% of the presentations devoted to it. An IO presentation emphasized the need for better modeling of halo currents, in particular the halo current width, halo temperature and the time evolution of the halo current. It is also not clear at this time as to what contributes most to a halo current when it peaks at a particular toroidal location – a higher halo current density or a wider halo wetted area? The IO requested the TG to provide physics guidelines to such critical questions with the help of further detailed analysis of the disruption database supplemented by modeling efforts. A presentation on disruption prediction based on discriminant analysis of data from a large number of tokamaks reported >90% accuracy in predicting edge cooling disruptions. It was also shown that for predicting this type of disruption, it was possible to work with a fewer number of input variables for the discriminant analysis. Experimental observations of negative loop voltage spikes followed by positive ones during minor disruptions in ADITYA tokamak were attributed to loss of a runaway electron beam induced by MHD fluctuations. In the area of modeling/theory, progress was reported on the continuing effort to compare the results of the TSC and DINA simulation codes of vertical displacement events (VDEs). For the fast current quench cases in ITER it was shown that the simulation of halo currents from both codes were in close agreement. Further validation against experimental results from present day tokamaks remains to be done. A theoretical model for VDEs based on the destabilization of a m/n = 2/1 kink mode predicted the excitation of large surface currents comparable in magnitude to observed halo currents, which could provide a mechanism for toroidal asymmtries. Here m/n is the ratio of poloidal to toroidal harmonic mode numbers. A new working group (WG-10) on halo current modeling was proposed and is now being formed.

On the subject of disruption mitigation, an IO presentation highlighted the inputs that are needed urgently for finalizing the specifications of the rapid shutdown systems for ITER. These

include information on the radiation asymmetry as well as profile and time evolution by end of 2011 in order to help finalization of port allocation for gas injection. The minimum amount of material injection for heat load mitigation and confirmation of runaway electron suppression by repetitive gas injection are needed by April 2013. Disruption and disruption mitigation issues were also discussed in the various working groups and investigated in several joint experiments.

Error Field Correction

An IO presentation emphasized the need for development of suitable criteria for low-n error-field tolerance in ITER during low and high β operations. There should also be well defined algorithms for fiducial ITER plasmas (15MA inductive and 9MA steady state), which could be used by engineers in analysis of error fields expected in ITER and in analysis of the capability of ELM coils and Correction coils to reduce error fields to the acceptable level. A new working group (WG-9) was formed to carry out modeling of possible error fields and braking effects, modeling of error field correction with ITER's coils and further do validation with experimental data. The advanced modeling effort would focus on multi-mode, multi-coil error field correction. A comprehensive presentation discussed various plasma-based approaches to error-field measurement and their correction in low β ITER plasmas by considering nonlinear magnetic plasma response and braking of plasma rotation (β is the ratio of plasma to magnetic pressure). The talk also considered the capability of plasma-based measurements to identify individual sources of error field.

Resistive Wall Mode Stability

The principal areas of further analysis and study associated with RWM control by edge localized mode (ELM) coils in ITER are assessment of effect of plasma disturbances on RWM stabilization, assessment of the capability of ELM coils to stabilize RWMs during steady state operation, and testing and validation of RWM feedback models by comparison with experiments. Some of these issues are the subject of study in the joint experiment MDC-2 and will also be addressed in a new working group WG-7. Experimental results from the RFX-Mod machine operating in the tokamak mode were presented demonstrating successful feedback stabilization of RWM at (magnetic safety factor) $q_a \sim 2$ with the help of the 192 coil active feedback coil system of the machine. Progress on active and passive RWM stability in DIII-D was also reported with a detailed comparison of the technical and physics issues associated with these two approaches. It was suggested that a combination of the two approaches which would exploit (passive) kinetic stabilization effects in conjunction with (active) direct feedback control of transient RWMs might be the most effective method.

Neoclassical Tearing Mode Stability

No new experimental results on NTM stabilization were reported since the last meeting but several tokamaks (e.g. DIII-D, ASDEX-Upgrade and FTU) discussed plans for developing real-time control of ECCD mirrors for tearing mode control in the course of this year. Theoretical/modeling efforts are continuing to understand the role of plasma rotation on the stability properties of NTM. Modeling results obtained from the NEAR code using experimental data from JT-60 predicts a stabilizing effect of rotational shear that seems to agree with observations. However the underlying physics of this stabilization is not yet properly understood and remains an open problem.

Sawtooth Control for NTM avoidance

New experiments to explore the link between sawtooth (ST) period and the triggering of tearing at the sawtooth crash have started at the TCV tokamak and some early results were presented at the meeting. These results show that sawteeth can be triggered by turning off the stabilizing power such as from electron cyclotron current drive or heating (ECCD/ECH). This

suggests a possible new approach to real time control of sawtooth period, namely, by stabilizing the sawtooth first, then periodically destabilizing it while briefly applying ECCD to pre-emptively stabilize the 2/1 NTM.

Axisymmetric Control

A new joint experiment on axisymmetric control (MDC-18) was proposed, and is now being organized.

Progress of Working Groups

The six short-term working groups formed in 2009 are reaching completion, and reports have been written or are in preparation. The topics of these groups include current waveforms for error-field correction, guidelines for distribution of ferritic inserts, power requirements for ECRH and ICRF control of sawteeth, diagnostic requirements for MHD stability control, halo current fraction and peaking factor, and sideways forces during disruptions. As noted above, new groups are beginning work on resistive wall mode feedback control, radiation asymmetry during massive gas injection, error field control, and halo current modeling.

Announcements

Submit BPO-related announcements for next month's eNews to Tom Rognlien.

Upcoming Burning Plasma Events

2011 Events

April 20-22, 2011 abstract deadline closed
2011 IEA Fusion Modeling Workshop on Materials
Lawrence Livermore National Laboratory, Livermore, CA

May 2-4, 2011 abstract deadline closed
2011 International Sherwood Fusion Theory Conference
Austin, TX USA

May 9-13, 2011
13th International Workshop on Plasma-Facing Materials and Components for Fusion Applications (PFMC-13) and 1st International Conference on Fusion Energy Materials Science (FEMaS-1)
Rosenheim, Germany

May 15-19, 2011
15th International Conference on Emerging Nuclear Energy Systems (ICENES)
San Francisco, CA USA

May 16-19, 2011
ITPA SOL and Divertor Topical Group Meeting
Helsinki, FINLAND

May 23-26, 2011
ITPA Diagnostics Topical Group Meeting
FOM, NETHERLANDS

June 1-3, 2011
19th Topical Conference on Radio Frequency Power in Plasmas (CK Phillips and JR Wilson PPPL)
Newport, RI USA

June 20-24, 2011
ITER International Summer School on MHD and Energetic Particles
Aix en Provence, FRANCE

June 26-30, 2011
38th IEEE International Conference on Plasma Science (ICOPS) and the 24th Symposium on Fusion Engineering (SOFE)
Chicago, IL USA

Jun 27-Jul 1, 2011
38th European Physical Society Conference on Plasma Physics
Strasbourg, FR EPS

Fall 2011
ITPA Diagnostics Topical Group Meeting
CHINA

Sep 5-7, 2011 UPDATED
IAEA Technical Meeting on Theory of Plasma Instabilities
Austin, TX USA

Sep 8-10, 2011 UPDATED
IAEA Technical Meeting on Energetic Particles in Magnetic Confinement Systems
Austin, Texas USA

TBA---tentatively scheduled
ITPA MHD Topical Group Meeting
Padova, ITALY

Sep 11-16, 2011
10th International Symposium on Fusion Nuclear Technology
Portland, Oregon USA

Sep 19-21, 2011
13th International Workshop on Plasma Edge Theory in Fusion Devices
South Lake Tahoe, California USA

October 5-7, 2011
ITPA Transport & Confinement Topical Group Meeting
Cadarache, FRANCE

October 5-7, 2011
ITPA Pedestal and Edge Topical Group Meeting
York, UNITED KINGDOM

October 10-12, 2011 NEW
13th International Workshop on H-mode Physics and Transport Barriers
Oxford, UK

Oct 16-21, 2011
15th International Conference on Fusion Reactor Materials (ICFRM-15)
Charleston, SC USA

October 18-21, 2011
ITPA Integrated Operational Scenarios Topical Group
Kyoto University, JAPAN

Nov 14-18, 2011
53rd APS Division of Plasma Physics Annual Meeting
Salt Lake City, Utah USA

December 2011 or January 2012
ITPA Divertor and SOL (PSI Selection Committee) Topical Group Meeting
Jüelich, GERMANY

December 12-15, 2011
ITPA CC & CTP-ITPA Joint Experiments Meeting
Cadarache, FRANCE

Directories of Other Plasma Events

IEEE Directory of Plasma Conferences
Fusion Ignition Research Experiment (FIRE) Physics Meetings

Please contact the administrator with additions and corrections.