

# CHAIR'S REPORT: EPR 2013

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## 1. Summary

The Exploratory Plasma Research (EPR) community met in Fort Worth, TX February 12-15, 2013 for EPR 2013. There were 69 registered attendees, down from the 91 attendees for our 2011 meeting in Seattle. Nonetheless, it was a successful workshop with a enough attendees for spirited discussion in each session. The program committee established a theme for each day: Plasma-Boundary interactions on day 1, Validated Comparisons between Simulation and Experiment on day 2, 3D Magnetic Fields on day 3, and Improvements for Fusion Energy Science for day 4. In addition, there was a session day 1 Tuesday afternoon on merging plasmas, FRCs, and HEDLP. There were 31 invited talks, with approximately 6 in each session. We had 6 talks from student participants and two poster sessions on Wednesday and Thursday. There were two participants from Europe and two from Canada. We had a banquet Wednesday night with remarks from Sam Barish of OFES.

Sam Barish conveyed the support of OFES for EPR activities. Tentatively, there will be about \$10M available for EPR research in FY 2014 in the next solicitation (about \$6.7M for non-lab and \$3.3M for lab research). The issue date will be around April 1, 2013. Letters of intent will be due four weeks after the issue date and proposals due five weeks after that. Letters of intent are strongly encouraged. At the executive committee meeting, new bylaws were discussed including cycling two members off the committee and plans for elections.

## 2. Day 1: Plasma-Boundary Interactions

This session moved from the first few angstroms of the plasma-facing surface into the divertor and scrape-off layer. Predrag Krstic opened the session with a talk on the plasma facing surface, “where two worlds meet”. The edge plasma is the driver, implanting ions, electrons, and neutrons into a dynamical surface several angstroms thick. Plasma ions are slowed in the material to a few eV where chemistry takes over. Dick Majeski followed with a practitioner’s talk on the role of liquid lithium as a plasma-facing material in the LTX experiment. Lithium is a low Z, low density material, with a viscosity half that of water. Hydrogen is highly soluble in liquid

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lithium so the wall acts as a getter. Low recycling means high edge temperature. In addition, Lithium has the lowest secondary electron emission of any metal. Xianzhu Tang gave a talk that moved away from the wall into the boundary plasma, and focused on the plasma perspective. He pointed out that dust could migrate a long way away from its source and redeposit. Tang also suggested that an axisymmetric mirror machine could be a good test stand to study some of this physics. Mike Kotschenreuther gave the next talk on divertors: Super X, snowflake, and X-divertor. Sam Cohen discussed a flowing scrape-off layer and open divertor in an FRC.

### 3. Day 1: Merging

The afternoon of Day 1 featured talks on improvements and innovations in fusion energy science featuring merging and high energy density laboratory plasma physics (HEDLP). Presentations included improvements in the privately funded TriAlpha C2 merging experiment (lifetime of 5 ms), and the FRCHX implosion HEDLP experiment at LANL. There were two additional talks from the HEDLP community on merging studies of supersonic plasma jets (Elizabeth Merritt) and magnetic self-organization in laser-produced plasmas (Lan Gao).

### 4. Day 2: Validated Comparisons

This session moved from a discussion of the framework of validation and verification, to implementation in fusion energy sciences, and examples from plasma physics. William Oberkampf began with verification (tests a mathematical model) and validation (tests physics modeling fidelity against an experiment). A key to validated comparisons is to identify metrics that can be applied to some unit problem in an experiment. Marty Greenwald gave the perspective of validated comparisons in fusion energy sciences. Paolo Ricci gave a talk from a practitioner's perspective. He described electrostatic turbulence experiments on TORPEX, and comparisons to 2D and 3D models. He established metrics and uncertainties that enabled direct comparison between simulation and experiment in much the same way described by Oberkampf. Cihan Akhay gave some examples of validated comparisons from the EPR community and the Plasma Science and Innovation Center at U Washington.

### 5. Day 3: 3D Magnetic Fields

Three-dimensional magnetic fields have been a consistent component of the ICC/EPR community. EPR will continue to be the scientific home for stellarator, RFP, and spheromak physics in the US. David Anderson opened day 3 with a talk on opportunities in stellarator research. He discussed the large overseas stellarator projects (W7-X in Germany, and LHD in Japan) as well as the US university programs (HSX in Wisconsin, and CTH in Auburn). David Maurer and Mark Schlutt gave talks on

stellarator physics. Brett Chapman and Jay Anderson gave talks on RFP physics (specifically MST). Brian Victor and Tom Jarboe gave talks on spheromak physics (specifically HIT-SI).

#### **6. Day 4: Improvements for Fusion Energy Science**

The final day of the workshop featured a variety of talks on technological and physics improvements to the understanding of magnetically confined plasmas.

#### **7. Next meeting: EPR 2014 Madison**

At the executive committee meeting, we began planning EPR 2014 for August 2014 in Madison, WI. Efforts will be made to coordinate EPR 2013 with the US/Japan CT workshop (Brian Victor, US organizer). The Madison, WI venue will enable University of Wisconsin students at the MST RFP, HSX stellarator, and Pegasus ST to attend more easily. It appears that with \$10M being re-competed in a new competition for EPR in spring 2013, the community will remain viable. The EPR 2014 workshop will feature EPR activities, MST, and some HEDLP with a similar format to EPR 2013. A new program committee will be formed to plan EPR 2014.