

Plasma Science: Subtopical Discussion Groups

John Cary and Arnold Kritz, Co-Chairs

Convenors: P. Drake (U Michigan)

G. Hammett (PPPL)

M. Peng (ORNL)

M. Rosen (LLNL)

V. Chan (GA)

W. Tang (PPPL)

Four Subtopical Discussion Groups

Wave and Particle Interactions

D. Batchelor and W. Kruer

Turbulence and Transport

G. Hammett

Plasma Boundaries and Interfaces

G. Porter and B. Lipshultz

(Magneto-) Hydrodynamic and
Beam Equilibrium and Stability

J. Manickam and R. Betti

Wave and Particle Interactions

D. Batchelor and W. Krueer

R. Nazikian, C. Phillips, M. Tabak

Goal for Snowmass — To address and answer four questions

Participants to answer questions by participating in sessions that consider issues in three broad topical areas

Position papers in preparation for each topical area

To be ready 1 week before Snowmass

Questions: *Wave and Particle Interactions*

1. What are the most critical wave physics issues/opportunities impacting the chances for realizing attractive fusion reactors — This would include theoretical, experimental, and technological issues. We will need a clear statement as to why they are critical to attractive fusion reactors.
2. What could be done to address these issues — What is an optimal research program for addressing the issues over the next decade? What theories or codes are needed? What experiments need to be done? What technology needs to be developed? Where do we want to be in 5 yr or 10 yr?

Questions: Wave and Particle Interactions

3. How should existing facilities be employed and what new facilities are needed to carry out the research program described in question 2?
4. What overlap/connections are there in the various research areas — We should identify commonality across different MFE devices or IFE concepts and commonality between fusion and other branches of science.

Topical Areas: Wave/Particle Interactions

- Use of injected waves for plasma heating and control
 - plasma production, heating, current drive, flow drive, plasma stabilization – [C. Phillips](#)
- Plasma generated waves and interaction of energetic particles with waves — Alfvén eigenmodes and energetic particle instabilities, fishbones, phase space engineering of particles (alpha channeling)
 - [R. Nazikian](#)
- Description of IFE topical area under development
 - [M. Tabak](#) and [W. Krueer](#)

Tentative Agenda: Wave/Particle Interactions

Session 1 (Tuesday, July 13) - Identifying the critical issues impacting the chances for realizing attractive fusion reactors

- Invited overview talks based on white papers – followed by discussion
- Brief contributed talks (1 viewgraph each)
- Summary of session – Compilation of list of critical scientific issues/opportunities. Discussion of rest of week's activities. Possible writing assignments

Tentative Agenda: Wave/Particle Interactions

Session 2 (Wednesday, July 14) — What research is needed to address the issues previously identified?

- Recap – Discuss and possibly amend issues list. Discuss possibly modify remainder of week's activities
- Breakout sessions on needed research and development in each topic area
- Plenary summary of day. Initial report from each of the working groups

Tentative Agenda: Wave/Particle Interactions

Session 3 (Thursday, July 15) - Completion of analysis of needed research. Begin discussion of roles of existing and new facilities

Session 4 (Friday, July 15) - Discussion of roles of existing and new facilities to carry out needed research program. Initial discussion of areas of overlap and connections to other branches of science

Turbulence and Transport

G. Hammett, Paul Terry, Bruce Cohen, John De Groot,
Martin Greenwald, Ed Synakowski, Richard Town

- Invited Speakers to Provide Overview of Topics
 - Two MFE and Two IFE Talks (30 minute talks followed by 20 minute discussion/question periods)
- Shorter contributed talks on Wednesday and Thursday with a format that allows extensive discussion
 - Committee will attempt to choose talks that emphasize broad-based strategic issues

Turbulence and Transport

Committee seeking Broad Community Input

Two main broad questions to be addressed

1. What are the outstanding scientific issues in the turbulence and transport subtopical area of plasma science?
2. What can we do over the next decade to address these issues?

Three to six bullets responding to each question

Turbulence and Transport

Those asking to make presentations are being asked to provide:

- Title of contributed presentation
- What would be the three or four main conclusions

Submitted titles and conclusions will be used in organizing the order of speakers and discussion topics

Focus on broader scientific issues than MFE Concepts sessions on transport and turbulence

Plasma Boundaries and Interfaces

B. Lipshultz, G. Porter, J. Albritton, R. Cohen,
M. Fenstermacher, M. A. Mahdavi, R. Mainigi, M. Peng,
T. Rognlien, D. Ryutov, M. Ulrickson, S. Allen, J. Drake,
S. Krasheninnikov, A. Leonard, S. Lund, P. Mioduszewski,
S. Pitcher

First conference call June 10.

Discussed topics for both Boundary subgroup/MFE
concepts and Boundary subgroup/Plasma Science

Plasma Boundaries and Interfaces

Boundary subgroup/MFE concepts:

1. Heat removal
2. Helium pumping
3. General impurity and density control
4. Lifetime issues
5. Effect of boundary physics on core confinement

Boundary subgroup/Plasma science:

1. Atomic Physics and radiation transport
2. Plasma-neutral interactions
3. Plasma-material interactions
4. Turbulence and instabilities and
resulting effects on performance

Plasma Boundaries and Interfaces

Tuesday afternoon:

Atomic physics and radiation transport

Jim Albritton will help coordinate this session, with help from someone from the MFE community (possibly S. Krasheninnikov)

Suggested that this topic be planned in coordination with the discussions of plasma-neutral interactions since they are intimately entwined.

Plasma Boundaries and Interfaces

Wednesday afternoon:

Plasma-neutral interactions

A. Mahdavi agreed to help coordinate this session with help from P. Mioduczewski.

Thursday afternoon:

Plasma materials interaction

Mike Ulrickson will coordinate this session. Phil West might be a useful resource for these discussions since he is very interested and knowledgeable about carbon production from the walls in DIII-D.

Plasma Boundaries and Interfaces

Friday afternoon:

Turbulence and instabilities

There was concern about whether there was adequate interest in this area to devote a full session. However, since this is one of the major outstanding issues in the edge physics area, it seems crucial to have adequate discussion to reach consensus. It was suggested that J. Drake would be a valuable asset here. R. Cohen offered to assist.

G. Porter will contact J. Drake to explore ways to strengthen the session.

(Magneto-) Hydrodynamic and Beam Equilibrium and Stability

J. Manickam, R. Betti, J. Barnard, J. Callen, A. Friedman,
S. Lund, E. Strait, H. Strauss

This group has fallen behind

We are restructuring the group

Add a few organizers to Committee

Add to leadership

TO DO LIST

- Get M/HD and Beam group moving
- Reconvene science committee to discuss treatment of
 - Overarching issues
 - * Computation
 - Coordination issues
 - * Common meetings for overlapping science issues
- Continue oversight of working processes
 - Ensuring schedule details are established
 - Ensuring white papers are completed
 - Ensuring speakers are chosen