

Welcome and Introduction to the Workshop

Opportunities and Directions in Fusion Energy Science for the Next Decade

Snowmass, CO July 11-23, 1999

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- History and Goals
- Scientific and Technical Organization
- Announcements and Comments

The Fusion Summer Study has Developed During Recent Efforts to Build a Basis for Consensus in Two Key Areas

- Pursuing a Major Next-Step (Magnetic) Fusion Energy Experiment
 - **Oct97 - Jan98:** FESAC Grunder Panel, calling for “design efforts on lower cost fusion energy producing” experiments and broad community input to consider options.
 - **Apr98:** Forum on Major Next-Step Fusion Experiments (Madison).
 - **Jun98 - Jul98:** NSO Workshop (UCSD) and Community Report.
 - **Nov98:** NSO design study initiated. ITER-RC design activities. Initial NSO (FIRE) design report released, **Jul99**.
- Building a Common Framework for Fusion Concept Development including both MFE and IFE Approaches
 - **Apr98:** 2nd ICC Workshop (PPPL).
 - **Sep98:** MFE-IFE Technical Workshop (PPPL).
 - **Aug98 - Nov98:** Draft MFE/IFE Roadmap, released at APS-DPP.
 - **Mar99 - Jun99:** Community presentations to FESAC, SEAB, NRC. Initial FESAC and SEAB documents released, **Jun99 - Jul99**.

The Timeline for the 1999 Fusion Summer Study

- **Mar98: Proposal presented to APS-DPP Executive Committee**

“There is debate in the community as to the appropriate next-steps in fusion research. . . . Now is the right time to assess the outstanding scientific and technological issues in fusion energy science and reach a better understanding of the facilities and programmatic elements needed to resolve them.

“This meeting would be the first broad-based meeting of knowledgeable scientists from all parts of the fusion community, including MFE and IFE, for the shared purpose of developing a common framework for the overall development of fusion energy science.”

- **Jun98 - Aug98:** Organizing Committee and Working Group Convenors recruited: 55 scientists and engineers representing all parts of the US program begin to define scientific organization.

Snowmass site selected.

- **Nov98: 1999 Fusion Summer Study officially announced at APS-DPP.**

- **Jan99 - Jul99:** Working groups and subgroups prepare Workshop programs. Fusion community revises and prepares concept and issue white papers.

Opportunities and Directions in Fusion Energy Science for the Next Decade

The results of world-wide fusion research during the last decade indicate that fusion can be an energy source. A key challenge for fusion energy science research in the next decade is to optimize the science and technology to make fusion practical and affordable.

To address this objective, the U.S. fusion program is pursuing a variety of research programs including new facilities and facility upgrades and collaboration on both existing and new facilities overseas. These programs will evaluate attractive new approaches to fusion energy, continue the exploration of advanced toroidal concepts with higher plasma pressure and reduced transport, develop innovative technologies, and establish the physics of new fusion concepts.

The U.S. fusion energy community is now developing a coherent plan for the next decade. This plan will include paths for both energy and science goals, address the needs for both magnetic and inertial fusion options, and take into account related international programs.

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Opportunities and Directions in Fusion Energy Science for the Next Decade

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To provide input to this plan, individuals involved with fusion research are **invited to come together to interact with each other** and to **develop a scientific and technical basis for consensus** on:

- The **key issues** for plasma science, technology, and energy and environment for fusion energy development.
- The **opportunities** and potential contributions of existing and possible future facilities and programs to reduce fusion development costs and achieve attractive economic and environmental features.

The workshop will be **open to all members of the international fusion science and technology community** including experts in all approaches to magnetic and inertial fusion energy.

Scientific and Technical Organization

The work of the Fusion Summer Study is organized into two types of working groups:

- **Fusion concept working groups** (meeting in the mornings).
 - Magnetic Confinement Fusion Concepts
 - Inertial Confinement Fusion Concepts
 - Emerging Fusion Concepts
- **Cross-cutting issues working groups** (meeting in the afternoons).
 - Technology Issues
 - Plasma Science
 - Energy Issues

Subtopical Discussion Groups

- **Magnetic Fusion Concepts**
 - Transport in MCC
 - Pursuing Burning Plasmas in MCC
 - MHD Stability in MCC
 - Achieving Steady State Operation
 - Plasma Boundary and Particle Control
 - MFE Concept Integration and Performance Measures
- **Inertial Fusion Concepts**
 - Targets
 - Drivers and Standoff
 - Inertial Fusion Power Plant Concepts
 - IFE Metrics and Development Paths
- **Emerging Fusion Concepts**
 - Reactor Issues Subgroup
 - Physics Issues Subgroup
 - Next Step Issues Subgroup
 - Technical Opportunities Subgroup
- **Plasma Science Issues**
 - Boundary Sciences Subgroup
 - MHD/Beam Science Issues Subgroup
 - Wave/Particle Interaction Subgroup
 - Turbulence/Transport Science Subgroup
- **Technology Issues**
 - Chamber Technology Subgroup (including Liquid Walls, Solid Walls, Reliability/Maintainability, Testing Facilities, Waste Minimization)
 - Plasma Technology Subgroup (including Tritium, Materials Advances, Profile Control, Magnets, IFE Targets)
- **Energy Issues**
 - Long Term Visions for Fusion Power Applications
 - Range of Steps Along Development Paths, Options, Directions, Accomplishments, and Decision Criteria

The Results of the Workshop are Produced by the Subgroups and the Working Groups

Each subgroup and working group is asked to “Develop a scientific and technical” understanding of:

- Some of the “Key Issues” of fusion research.
- Some of the “Opportunities” to address these issues.

By the end of Snowmass, we should be able to explain technically to the general fusion community:

- **Why these issues are “key” and “important”?**
- **How resolution of these key issues will advance fusion energy science?**
- **How “existing and possible future facilities and programs” can address the key issues?**

Organizing Committee

Working group coordination and workshop logistics.

Mohamed Abdou	UCLA	Technology Issues
Dan Barnes	LANL	Emerging Fusion Concepts
John Cary	UColorado	Plasma Science Issues
Rich Hawryluk	PPPL	Co-Chair
Arnold Kritz	Lehigh	Plasma Science Issues
Grant Logan	LLNL	Co-Chair
Mike Mauel	Columbia	Co-Chair
Farrokh Najmabadi	UCSD	Energy Issues
Craig Olson	SNL	Inertial Fusion Concepts
Tony Taylor	GA	Magnetic Fusion Concepts
John De Looper	PPPL	<i>Workshop Secretariat</i>

Working Group Convenors

Scientific and Technical Program; Recruiting Subgroups; Workshop Reports and *Proceedings*.

Magnetic Fusion Concepts

H. Berk (UT)	J. Drake (UMaryland)	R. Fonck (UWisc)
M. Greenwald (MIT)	D. Hill (LLNL)	B. Rice (LLNL)
J. Sarff (UWisc)	R. Taylor (UCLA)	T. Taylor (GA)
M. Zarnstorff (PPPL)		

Inertial Fusion Concepts

J. Barnard (LLNL)	J. Lindl (LLNL)	C. Olson (SNL)
S. Payne (LLNL)	K. Schultz (GA)	J. Sethian (NRL)
R. Spielman (SNL)		

Emerging Fusion Concepts

D. Barnes (LANL)	D. Hill (LLNL)	A. Hoffman (UWash)
J. Kesner (MIT)	J. Perkins (LLNL)	M. Yamada (PPPL)

Plasma Science Issues

J. Cary (ColoU)	V. Chan (GA)	P. Drake (UMich)
G. Hammett (PPPL)	A. Kritz (Lehigh)	M. Peng (ORNL)
S. Prager (UWisc)	M. Rosen (LLNL)	W. Tang (PPPL)

Technology Issues

M. Abdou (UCLA)	R. Mattas (ANL)	S. Milora (ORNL)
J. Minervini (MIT)	R. Moir (LLNL)	D. Petti (INEL)
J. Santarius (UWisc)	D. Swain (ORNL)	M. Tillack (UCSD)
M. Ulrickson (SNL)	K. Wilson (SNL)	R. Woolley (PPPL)
S. Zinkle (ORNL)		

Energy Issues

J. Freidberg (MIT)	W. Meier (LLNL)	F. Najmabadi (UCSD)
J. Navratil (Columbia)	W. Nevins (LLNL)	J. Perkins (LLNL)
N. Sauthoff (PPPL)	R. Stambaugh (GA)	D. Steiner (RPI)

Workshop Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
11 Opening Reception	12 Opening Plenary	13 Concept WGs Issue WGs	14 Concept WGs Issue WGs	15 Concept WGs Issue WGs	16 Concept WGs Issue WGs	17 Hike to Top of Mountain
	Social Hour FireWorks	Social Hour	Rodeo	Social Hour	Social Hour Skit	
18	19 Status Reports	20 Concept WGs Issue WGs	21 Concept WGs Issue WGs	22 Open Discussion of Draft Sum. Reports	23 Summary Reports	24
	Social Hour	Social Hour	Social Hour	Closing Reception		

Workshop Resources

- Workshop Office
 - Staffed and Open 24 hours a day from noon, Sunday, July 11, through noon Friday, July 23.
 - Xerox machine, supplies.
 - Messages and Workshop phone and fax.
- Computer Center
 - Open 24 hours from noon, Sunday, July 11, through noon Friday, July 23.
 - Adjacent to Workshop Office in the Incline Store Front.
 - T-1 internet and V.90 modem access.
 - 8 Macs, 7 PCs, 10BT hubs, one color laser printer, two black and white.
- Working Group Poster Boards
- Community white papers; online reference library
- “Chit” Forms

Transportation

- Two Village Shuttle Busses will operate continuously **exclusively for Fusion Summer Study participants** from 7:30 AM – 7:30 PM, Monday through Friday.
- Village Shuttle bus runs from 7:00 AM to Midnight, daily. Call 923-3500 for pickup.
- Your lodging properties have drivers and vans for your use.

Meeting Rooms

- 21 meeting rooms to accommodate plenary sessions, subtopical discussions, and smaller break-out discussions.
- Signs and “arrows” will be setup to help you find the meeting rooms. Nevertheless, at first, they may be hard to find.
- Some rooms may be crowded.
- For the first few days, **try to get to your room early**. Also, consider having a second choice in case you can not squeeze into a discussion session.

Proceedings of the Workshop

The *Proceedings* will consist of:

- Written summaries of the working groups, authored by the working group convenors,
- Written summaries of the subtopical discussion groups, authored by the contributing participants,
- Contributed reports, authored by individuals and groups.

The audience for the *Proceedings* is the fusion community itself; however, working group reports will be readable by the general scientific community

The *Proceedings* will be published on a CD-ROM and the WWW as a collection of papers in PDF format.

**The deadline for submission of the proceedings articles is
September 10, 1999.**

Closing Comments

The 1999 Fusion Summer Study will be our first two-week, open meeting to discuss options for the future directions of our research. It will also be a workshop unlike any other that we have participated as a group.

With three simultaneous independent working groups in the morning and three in the afternoon, Snowmass may at times seem intense and intellectually challenging.

You should keep your sense of humor and remember our goal of working together to understand the key issues and opportunities for fusion.

We should listen to our colleagues and keep our own comments candid and constructive.

At two consecutive weeks, Snowmass will be our longest fusion workshop. **We need to pace ourselves! And take the time to enjoy informal discussions with your colleagues.**