Welcome to PPPL and WOPA

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Background

Plasma astrophysics, including space and solar plasma physics, is rapidly growing in opportunity

- Maturation of plasma theory and computation
- Sophistication of experimental techniques and diagnostics
- Broad availability of *in-situ* data of planetary magnetospheric and heliospheric plasmas
- Surge in remote-sensing data from ground-based or space-borne observatories

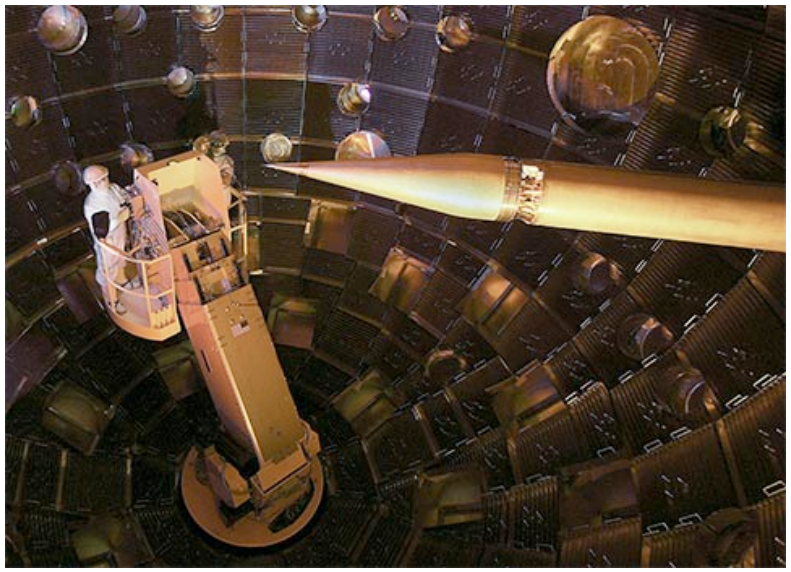
Diverse Components of Plasma Astrophysics

- Analytic theory,
- Fluid and kinetic computation,

- Observations from electron diffusion scales in Earth's magnetosphere to cosmological scales in clusters

- Magnetized basic plasma experiments,
- High energy density experiments,
- Liquid metal experiments,
- Aspects of fusion experiments.

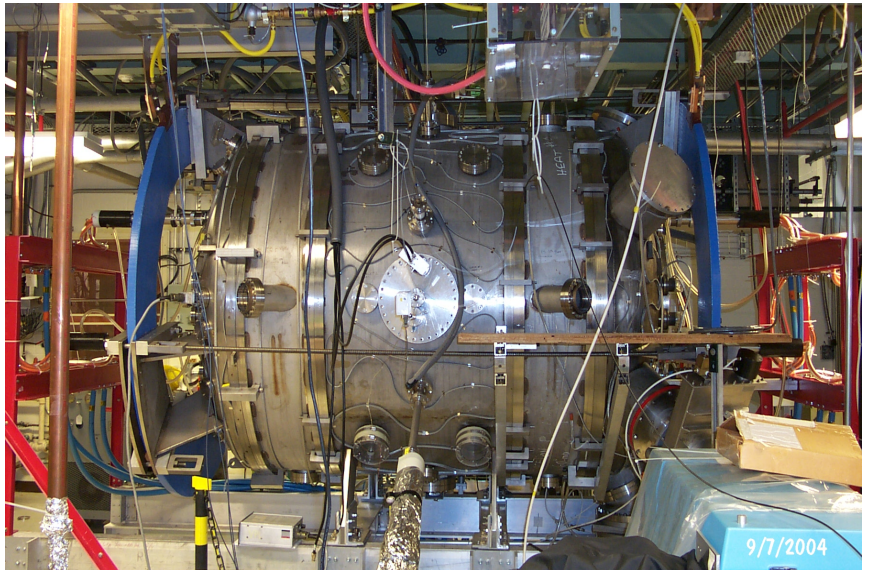
Experimental Facilities



National Ignition Facility (LLNL)

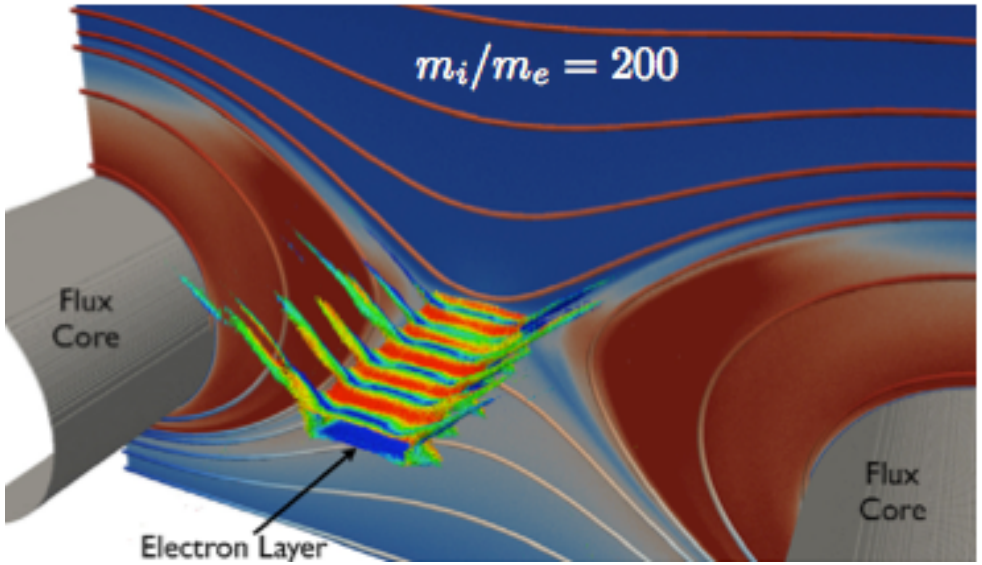
Large Plasma Device (UCLA)

DIII-D Tokamak (GA)

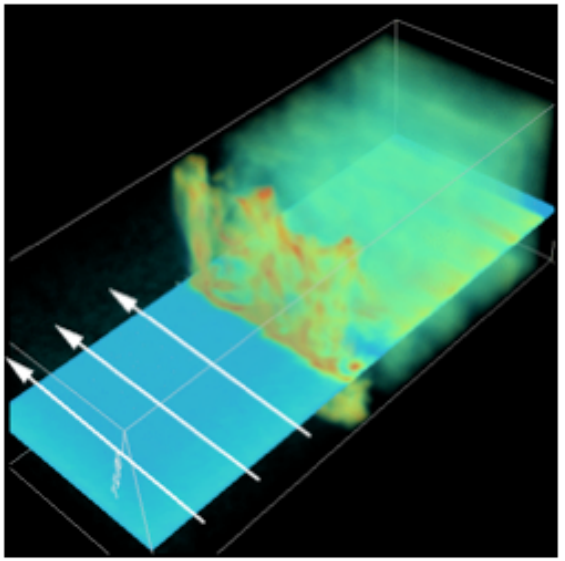


Magnetic Reconnection Exp (PPPL)

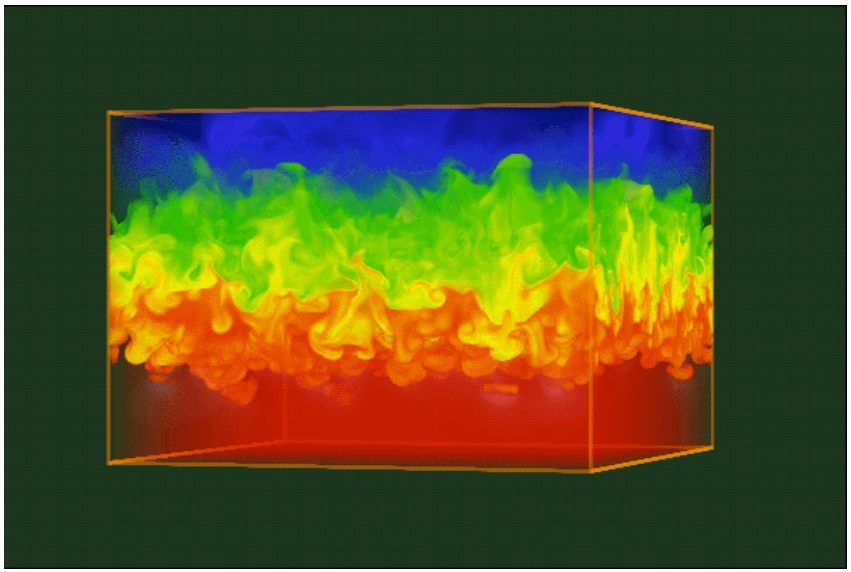
Numerical Simulations



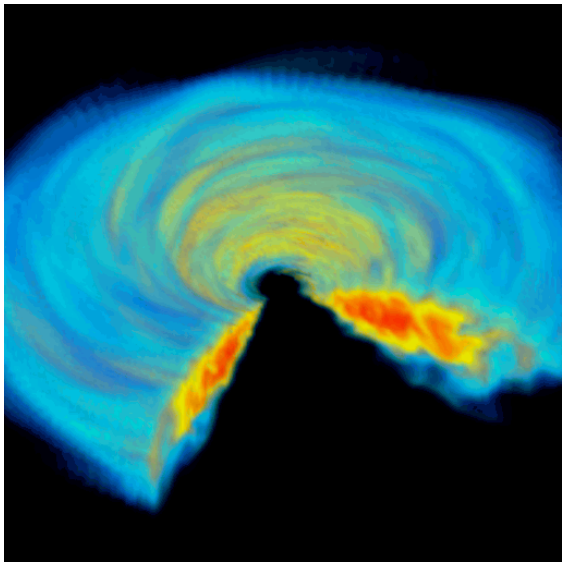
Magnetic Reconnection



Collisionless Shock

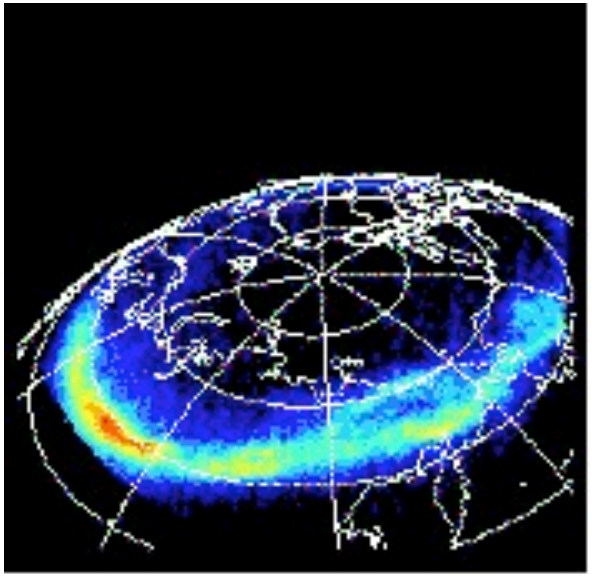


Rayleigh Taylor Instability

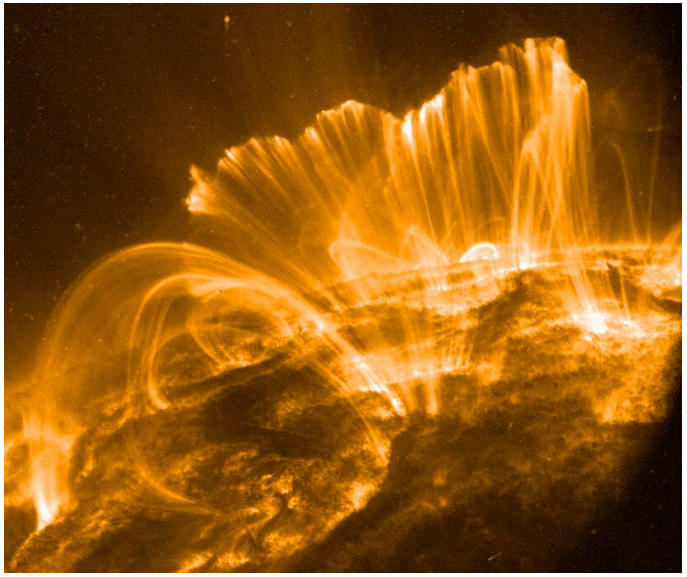


Accretion Disk

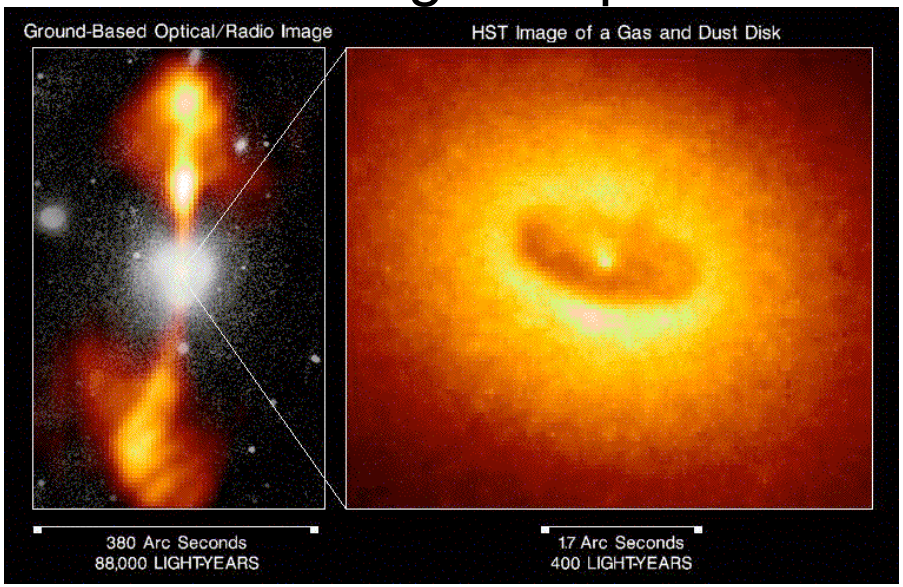
Observations



Earth's Magnetosphere



Solar Flare



Galaxy and Jets

Pulsar Wind

But, the diversity can eclipse

- the unity of the field,
- the commonality of the physics problems,
- the new scientific opportunities,
- the long-term funding stability.

The goals of the workshop:

- Articulate a unified set of major challenges (plasma physics and astrophysical objects)
- Generate new experimental, observational, theoretical and computational opportunities
- To explore commonalities and synergies between different opportunities

Report will be generated for communication with scientific community (plasma physics, astronomy) and funding agencies

Support, Interests and Endorsement

- DOE Office of Fusion Energy Sciences
- NASA Space Physics and Astrophysics
- NSF Plasma Physics, Astronomy, Space Physics

- APS Topical Group on Plasma Astrophysics (GPAP)
- APS Division of Plasma Physics (DPP)

- Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas (CMSO)

Format

- The first three days are organized by topics, and within each topic, presentations are devoted to
  - the major challenges and
  - the full diversity of approaches to meet the challenges
  - with enough discussion times
- Public commenting session near the end of each day
  - Please let the public comment session chairs (Masaaki Yamada, Greg Hammett, and Jay Johnson) know your intention by the noon each day.
- Breakout discussions at end of Monday and Wednesday for each topic
  - Please let topic leads know your intention by noon of that day

Topics Covered

1. Magnetic Reconnection (J. Drake, Maryland)
2. Waves and Turbulence (A. Bhattacharjee, New Hampshire, S. Bale, Berkeley)
3. Collisionless Shocks and Particle Acceleration (M. Lee, New Hampshire)
4. Magnetic Dynamo (E. Zweibel, Wisconsin, F. Cattaneo, Chicago)
5. Interface and Shear Instability (D. Ryutov, LLNL)
6. Momentum Transport (E. Quataert, Berkeley)
7. Magnetized Dusty Plasma (E. Thomas, Auburn)
8. Radiative Hydrodynamics (B. Remington, LLNL)
9. Relativistic, Ultra-strongly Magnetized, and Pair Plasmas (E. Liang, Rice)
10. Jets and Outflows Including Structure Formation (H. Li, LANL)
11. Cross-cutting issues, tool development, and topics not covered

Working Group Members

- Distributed between
  - Laboratory plasma physics, space physics and astrophysics
  - Theory/numerical physicists and experimental/ observational physicists
  - Institutions

– Some members contributed significantly but cannot not attend

– Valuable contributions also from non-members

topic										
	lead									
Magetic Reconnection	J. Drake Maryland	S. Antiochos GSFC	W. Daughton LANL	J. Egedal MIT	A. Lazarian Wisconsin	R. Lin Berkeley	T. Phan Berkeley	D. Uzdensky Colorado	M. Yamada PPPL	
	lead	***co-lead***								
Colliionless Shock and Particle Acceleration	M. Lee New Hampshire	R. Jokipii Arizona	T. Bell Oxford, UK	D. Burgess Queen Mary,	R. Cowsik Washington,	T. Intrator LANL	R. Lin Berkeley	C. Niemann UCLA	A. Spitkovsky Princeton	
	lead									
Radiative Hydrodynamics	B. Remington LLNL	J. Bailey SNLA	P. Hartigan Rice	R. Heeter LLNL	P. Hoeflich Florida State	J. Hughes Rutgers	J. Krolik JHU			
	lead									
Momentum Transport	E. Quataert Berkeley	M. Browning CITA (Toronto)	G. Hammett PPPL	M. Nornberg Wisconsin	J. Stone Princeton					
	lead	***co-lead***								
Magnetic Dynamo	E. Zweibel Wisconsin	F. Cattaneo Chicago	E. Blackman Rochester	C. Forest Wisconsin	G. Novak Chicago	A. Pouquet NCAR	J. Sarff Wisconsin			
	lead	***co-lead***								
Interfacial & Shear Instabilities	D. Ryutov LLNL	M. Pound Maryland	C. Kuranz Michigan	I. Mann Alberta, Cana	A. Miles LLNL	U. Shumlak U Washington				
	lead									
Magnetized Dusty Plasma	E. Thomas Auburn	L. Matthews Baylor	R. Merlino Iowa	M. Rosenberg UCSD	P. Song UML					
	lead	***co-lead***								
Waves & Turbulence	A. Bhattacharjee New Hampshire	S. Bale Berkeley	S. Boldyrev Wisconsin	T. Carter UCLA	S. Cranmer CfA	P. Diamond UCSD	B. Dorland Maryland	P. Goldreich IAS	W. Matthaeus Delaware	
	lead									
Jets, Outflow & Structure Formation	H. Li LANL	P. Bellan Caltech	J. Eilek NM Tech	T. Jones Minnesota	J. Kasper CfA	P. Kronberg LANL	S. Lebedev Imperial Coll	R. Lovelace Connell	S. Matt Virginia	M. Velli JPL
	lead									
Relativistic, ultra-strongly magnetized, pair plasmas	E. Liang Rice	J. Arons Berkeley	M. Baring Rice	C. Dermer NRL	M. Hoshino Tokyo	K. Krushelnic Michigan	Y. Sentoku U Nevada	L. Silva Lisbon		

Format (cont'd)

- The Thursday morning will report on a synthesis of the first three days,
  - What are major opportunities?
- Discussions of cross-cutting issues
  - Cross-cutting physics themes
  - Cross-cutting research tools
  - Topics not covered
- Discussions on next steps
  - Commitment to a follow-on meeting to further refine ideas
  - Articulation of workshop results to relevant funding agencies and other interested organizations.
  - …

Workshop Report (contents, format, and length)

- Contents: for both agencies and general physicists at “Physics Today” level
  - Should contain convincing, clear messages based on science
  - What are major challenges and opportunities?
  - Converge to ~3 major opportunities per topic?
  - Total ~10 major opportunities for the whole field?
  - What is the total magnitude of these opportunities?
  - What are their impacts on astronomy, physics, and science in general?

Workshop Report (cont'd) (contents, format, and length)

- Format: uniformity between topics preferred for easy reading

- Length:
  - Executive summary (<5 pages?)
  - Main texts (<50 pages?)

Thank your for your hard work!