



Update from NSF

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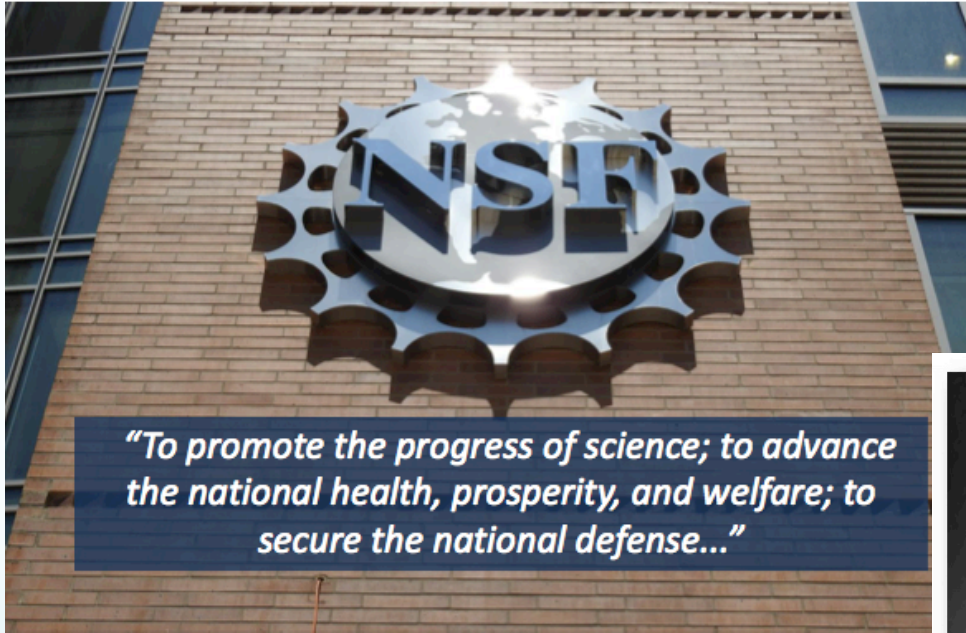


Plasma 2020 Decadal Committee Meeting
March 11, 2019





NSF Mission



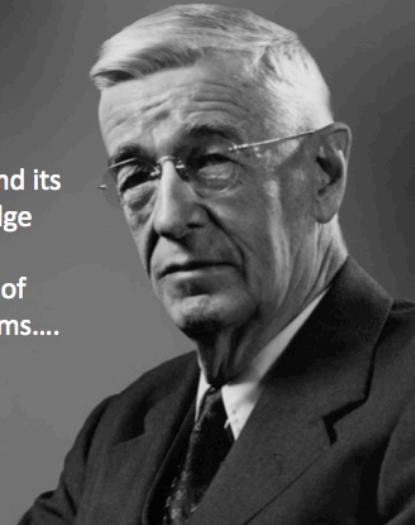
"To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..."

Photo Credit: Maria Barnes

Since 1950...

Basic research ... results in general knowledge and an understanding of nature and its laws. This general knowledge provides the means of answering a large number of important practical problems....

- Vannevar Bush





Plasma Science @ NSF over the Past Decade

- The Plasma 2010 Decadal had little noticeable impact at NSF due, in large part, to the content of the document.
 - Plasma 2010 did not identify a unique leadership role for NSF to "promote the progress of science" in the broad context of plasma science & engineering
- Nevertheless, over the past decade, NSF has acted to increase support for and recognition of plasma physics as a discipline:
 - Several mid-scale basic plasma physics experimental facilities across the spectrum of subfields (magnetized plasmas, dusty plasmas, laser-plasma interactions, high energy density plasmas) have been or are being built/upgraded via the NSF MRI program
 - NSF/Physics now has a full-time on-site program director for the Plasma Physics program. This has helped to strengthen Plasma S&E partnerships across and increase the visibility of Plasma Physics within NSF
 - Existing inter-agency partnerships (e.g., with DOE) have been strengthened and new ones (e.g., with NASA) established, with more inter-agency discussions taking place



NSF Priorities for this Decadal Committee

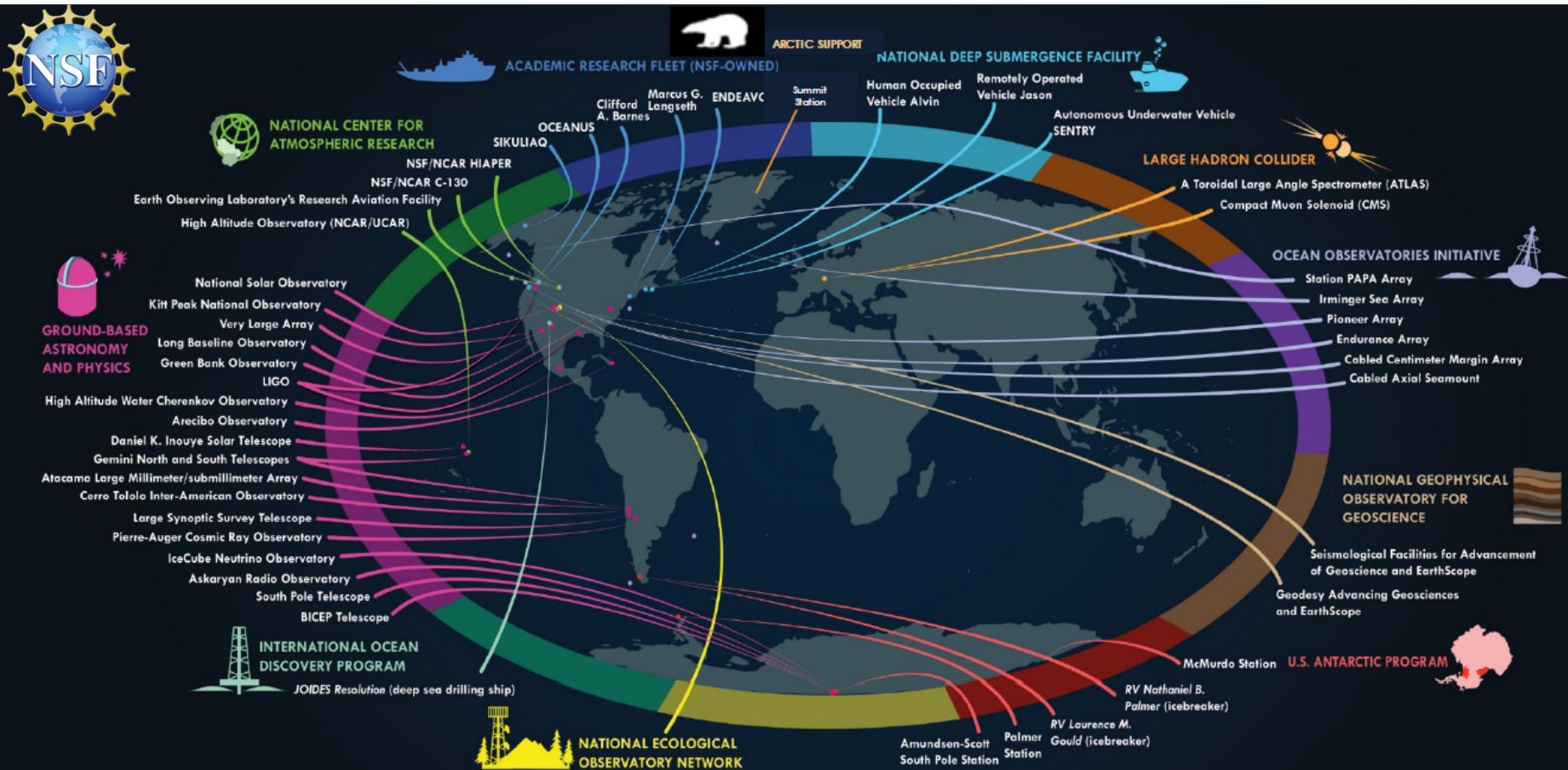
- Fully address the Statement of Task
 - Identify and highlight *major scientific questions* in plasma physics & its applications
 - Discuss opportunities for *universities in the national landscape* of plasma science research
 - Assess whether *the demographic profile* of the plasma science workforce is commensurate with future workforce needs
 - Assess the *complementary nature* of support for plasma physics & applications across the federal agencies and the private sector
- Bring your expertise *to contribute* to the big picture, *not to defend* your own interests
- Get to know *the other* plasma science sub-communities
- Look for the next discovery, an emerging subfield of plasma science
- But remember: “It’s difficult to make predictions, especially about the future”



Workshop on Opportunities, Challenges, and Best Practices for Basic Plasma Science User Facilities



NSF Supports Scientific Facilities Around the World





Workshop on Opportunities, Challenges, and Best Practices for Basic Plasma Science User Facilities • May 20-21, 2019

Co-chairs: Howard Milchberg (UMd) and Earl Scime (West Virginia U.)

Workshop goals:

- Identify and discuss compelling topics in plasma physics that require facilities larger than typically operated by single-PI groups.
- Discuss lessons learned from the operation of open user facilities, collaborative facilities, user networks, and larger single/few PI facilities in the plasma physics and related scientific communities. Extract from the discussion guidance to be offered to potential future facilities, NSF, and other agencies regarding what works well.
- Discuss advantages and disadvantages for investments in user facilities under constrained resources.



Workshop on Opportunities, Challenges, and Best Practices for Basic Plasma Science User Facilities • May 20-21, 2019

Co-chairs: Howard Milchberg (UMd) and Earl Scime (West Virginia U.)

Topic areas and leads:

- **Quantum properties of dense plasmas:** Gilbert Collins (U. Rochester), Sam Vinko (Oxford U.)
- **Plasma in super-critical fields:** Alec Thomas (U. Michigan), Stepan Bulanov (LBNL)
- **Single component plasmas, dusty plasmas, and matter-antimatter plasmas:** Joel Fajans (UC Berkeley), Eve Stenson (Max Planck)
- **Laboratory astrophysics:** Carolyn Kuranz (U. Michigan), Petros Tzeferacos (U. Chicago)
- **Relativistic laser- and beam-plasma interactions:** Felicie Albert (LLNL), Warren Mori (UCLA)
- **Coherent structures and energy dissipation in plasmas:** Jim Drake (U. Maryland), Mike Brown (Swarthmore C.)
- **Controlled production of chemical reactivity:** Mark Kushner (U. Michigan), Steve Shannon (NCSU)



BRIGHTEST LIGHT INITIATIVE WORKSHOP

A workshop for the future of intense ultrafast lasers in the U.S.

Workshop supported by

- NSF/Physics
- DOE/SC
- DOE/NNSA

Menu

Location:

The Optical Society (OSA)
2010 Massachusetts Ave NW
Washington, DC 20036 USA

Date: 27–29 March 2019

Onsite participation of this workshop is by invitation only.

In 2017 the National Academy of Sciences (NAS) released its report "*Opportunities in Intense Ultrafast Lasers: Reaching for the Brightest Light*" concluding that the U.S. has fallen behind in this important scientific and technical capability.

Roger Falcone

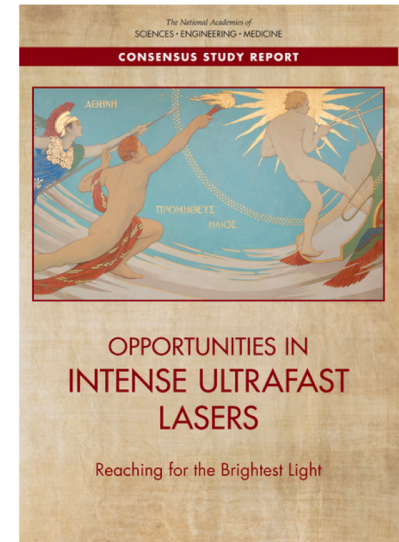
Chair, BLI Workshop

Félicie Albert, Farhat Beg, Siegfried Glenzer

Science co-chairs, BLI Workshop

Todd Ditmire, Constantin Haefner, Jon Zuegel

Technology co-chairs



[Read 2018 NAS report here](#)



2018 Nobel Prize in Physics

Welcome to CUOS

See: <https://cuos.engin.umich.edu/>

CONGRATULATIONS TO PROFESSOR GÉRARD MOUROU FOR BEING THE RECIPIENT OF
THE 2018 NOBEL PRIZE IN PHYSICS



- First NSF award to Gerard Mourou: 1981 -- “Acquisition of Equipment For Development of Subpicosecond Biological Physics Facility”, U. Rochester
- Center for Ultrafast Optical Science (CUOS) – NSF Science and Technology Center at U. Michigan (1990 – 2001)
- Frontiers in Optical Coherent and Ultrafast Science (FOCUS) – NSF Physics Frontiers Center at U. Michigan (2001 – 2010)

Some of the other NSF laser infrastructure investments:

- Engineering Research Center for Extreme Ultraviolet Science and Technology, CSU – NSF ERC Program (2003-2014)
- Development of a high average power table-top extreme ultraviolet/soft x-ray laser beam line for science at the nanoscale, CSU – NSF MRI Program (2010-2013)
- High-Power Laser Science Collaboratory, U. Nebraska-Lincoln – NSF ARRA (2010-2013)
- HERCULES Laser Upgrade, U. Michigan – NSF MRI Program (2017 – 2019)



Plasma Physics Program

- ▣ Participate in NSF and PHY-wide funding opportunities:
 - Mid-Scale, MRI, CAREER, CDS&E, CSSI, WoU-MMA, PFC, STC, IRES, EPSCoR, etc
 - 17 CAREER awards since 2005
 - 12 MRI awards (5 over \$1M) since 2005
- ▣ NSF/DOE Partnership in Basic Plasma Science & Engineering
 - First MOU signed Dec 1996, renewed through Dec, 2021
 - NSF: MPS (Physics & Astronomical Sciences), GEO (Geospace), ENG (Chemical, Bioengineering, Environmental, & Transport Systems; and Electrical, Communications & Cyber Systems)
 - DOE: SC (Fusion Energy Sciences)
- ▣ Partnerships and cooperation with NASA, DOD, and DOE/NNSA
- ▣ Conference/Workshop grants; REU supplements



NSF/DOE Plasma Partnership

- From the FY17-19 NSF/DOE Partnership in Basic Plasma Science and Engineering solicitation:

“Plasma Physics is a study of matter and physical systems whose intrinsic properties are governed by collective interactions of large ensembles of free charged particles. 99.9% of the visible Universe is thought to consist of plasmas. The underlying physics of the collective behavior in plasmas has applications to space physics and astrophysics, materials science, applied mathematics, fusion science, accelerator science, and many branches of engineering.

...

The foci of the initiative are to generate an understanding of the fundamental physics principles governing the collective interactions of large ensembles of free charged particles, as well as to improve the basic understanding of the plasma state as needed for other areas or disciplines of science and engineering. ”



NSF/DOE Plasma Partnership

- ▣ NSF/DOE Plasma Partnership supports basic plasma physics projects covering areas roughly categorized as
 - Low temperature plasmas & plasma material interactions
 - High energy density plasmas & laser-plasma interactions
 - Turbulence, waves, magnetic reconnection and other magnetized plasma phenomena
 - *Projects focused on fusion energy studies are not considered*
- ▣ NSF/DOE Partnership encourages proposals from university PI's to perform basic plasma physics research at user facilities (including DOE facilities) designed to serve the needs of the broader physics community.



Many Topically Broad Funding Opportunities

- Physics Frontier Centers (PFCs)
- Science and Technology Centers (STCs)
- Engineering Research Centers (ERCs)
- Major Research Instrumentation (MRI)
- Mid-scale Research Infrastructure (MsRI)
- International Research Experience for Students (IRES)
- Established Program to Stimulate Competitive Research (EPSCoR): Research Infrastructure Improvement Program
- Emerging Frontiers in Research and Innovation (EFRI)
- Cyberinfrastructure for Sustained Scientific Innovation (CSSI)
- Windows on the Universe: The Era of Multi-Messenger Astrophysics (WoU-MMA)
- Harnessing the Data Revolution: Institutes for Data-Intensive Research in S&E
- Faculty Early Career Development (CAREER)
- NSF Graduate Research Fellowship (GRFP)
- NSF Research Traineeship (NRT) Program
- Etc, etc...