LaserNetUS: Advancing Inertial Fusion Energy

Fostering Collaboration and Driving Innovation

C. B. Curry
LaserNetUS Coordinator

44th Annual Meeting and Symposium
Fusion Power Associates

December 20, 2023

LaserNetUS

U.S. DEPARTMENT OF ENERGY | Office of Science

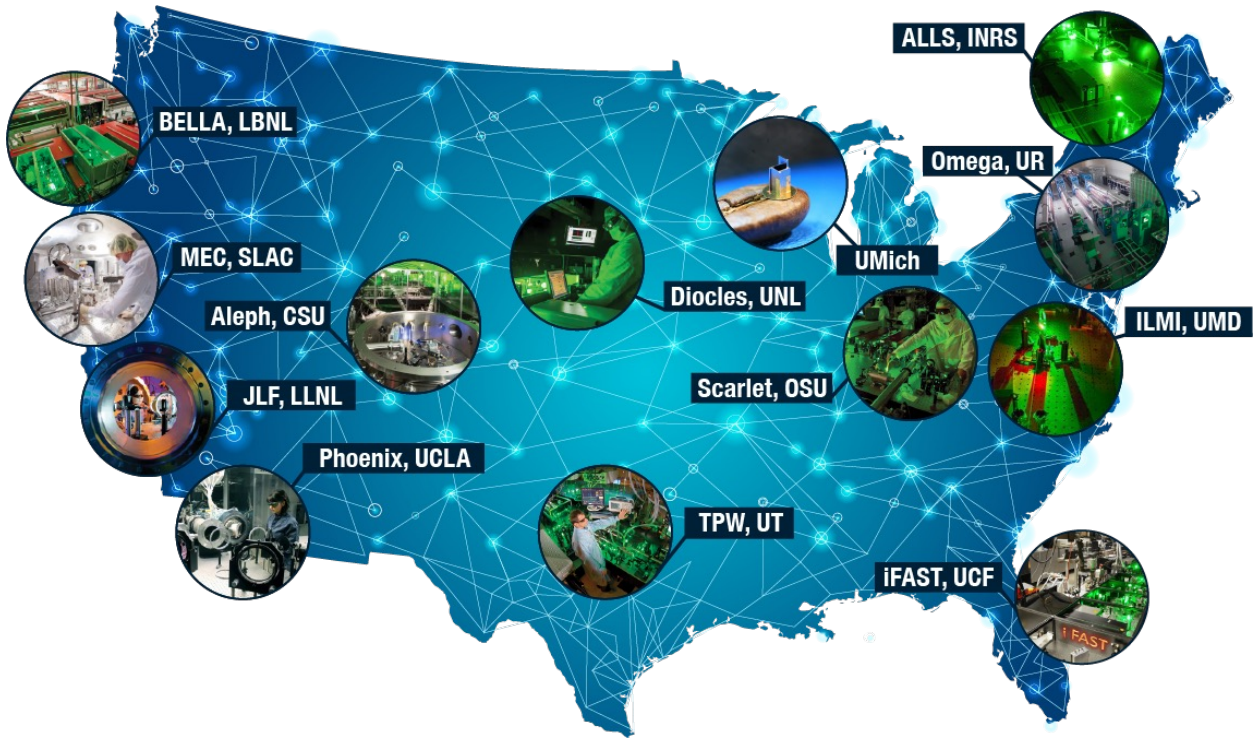
OUTLINE

1. LaserNetUS Overview
2. Update on Summer Undergraduate Program
3. Highlights from CY 2023

OUTLINE

1. LaserNetUS Overview
2. Update on Summer Undergraduate Program
3. Highlights from CY 2023

THE **LASERNETUS** NETWORK



Our mission is to advance the frontiers of high-power laser science and applications by:

- Supporting cutting edge research with high-power lasers
- Providing access to unique facilities and enabling technologies
- Fostering collaboration among researchers around the world
- Providing training and leadership opportunities for students and early career researchers

U.S. DEPARTMENT OF ENERGY | Office of Science

THE FIRST FIVE YEARS OF LASERNETUS

Scientific Advisory Board forms under Dr. Sean Finnegan

Formation of the LaserNetUS Committees

i-USE: intense-light USers Engagement, Diagnostics and Data Committee, and Simulations Committee

2018: Prof. Jorge Rocca became the first Chair of LaserNetUS

First meeting in Lincoln, NE

2020: LaserNetUS was renewed

2023: DE-FOA-0002982: LaserNetUS For Discovery Science And Inertial Fusion Energy

Established by DOE FES in 2018

LaserNetUS looks forward

Dr. Kramer Akli DOE FES

Dr. Tammy Ma developed the Proposal Review Process

Dr. Félicie Albert became the second Chair of LaserNetUS

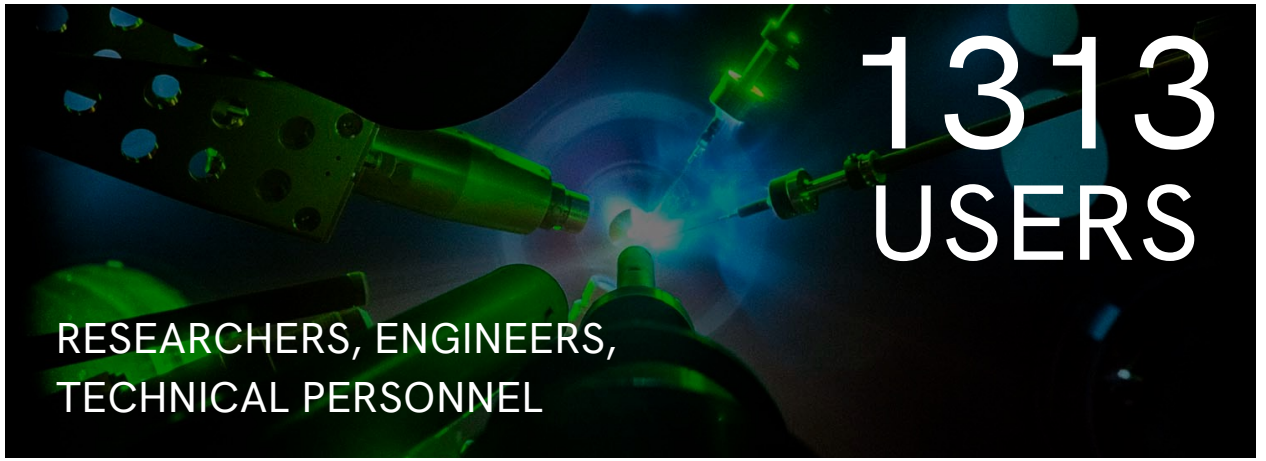
2021: Prof. Douglass Schumacher and Dr. Mingsheng Wei become Chair and Vice-Chair of LaserNetUS. Dr. Chandra Breanne Curry is appointed as the LaserNetUS Coordinator by DOE FES.

12
HIGH-POWER LASER FACILITIES

ACROSS NORTH AMERICA

75+
EXPERIMENTS

SINCE THE PROGRAM WAS ESTABLISHED IN 2018



1313
USERS

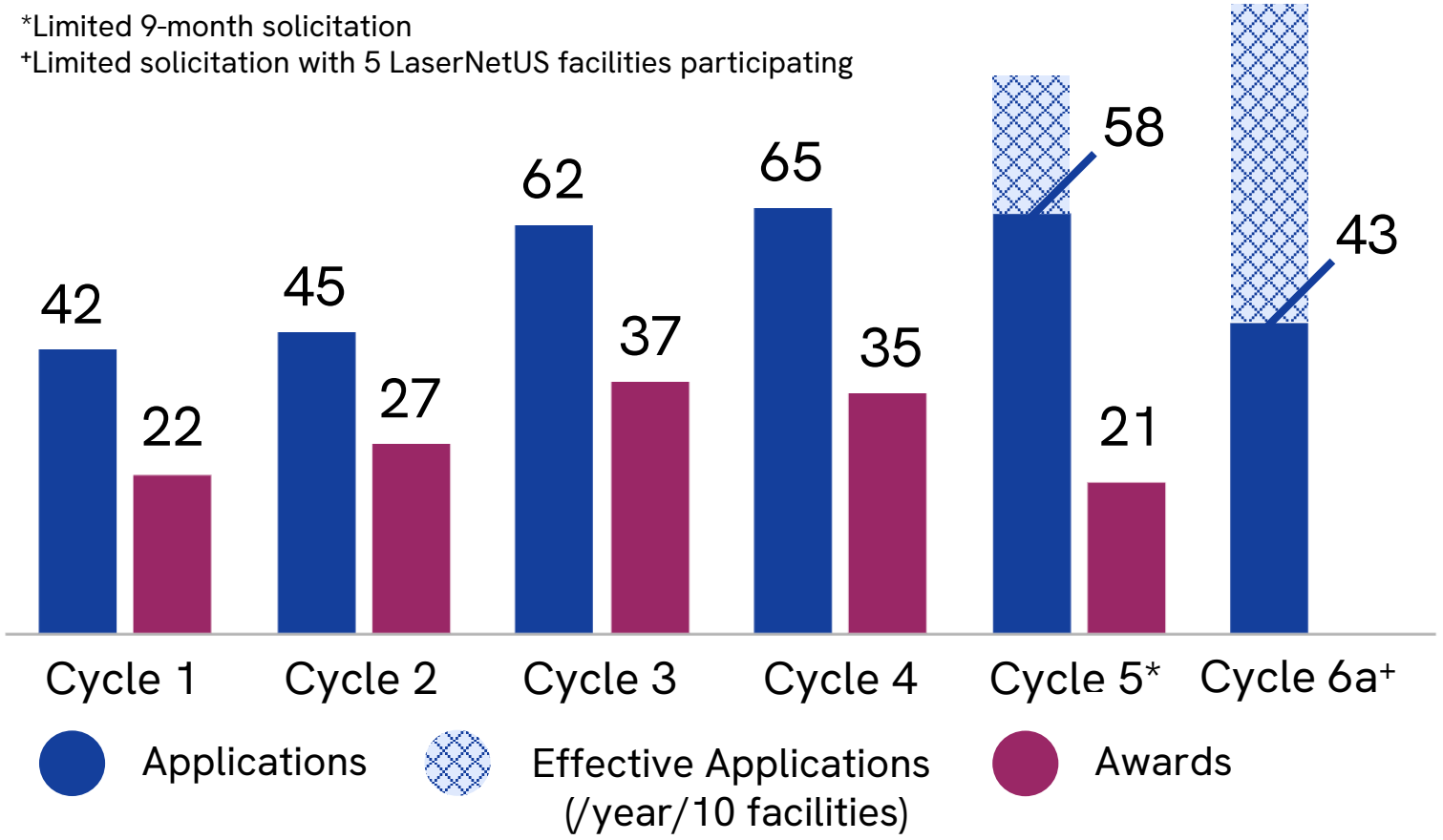
RESEARCHERS, ENGINEERS,
TECHNICAL PERSONNEL

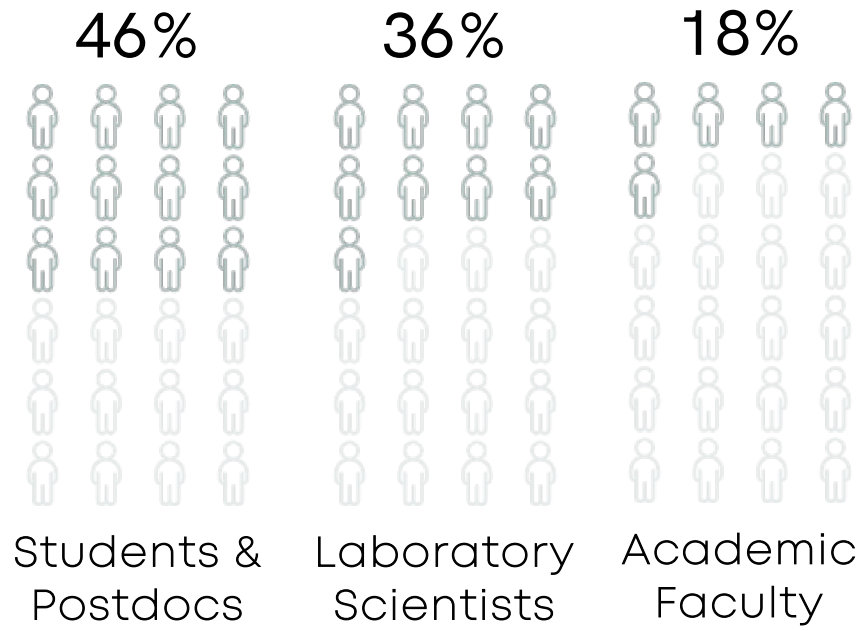
40+
PUBLICATIONS

IN PEER REVIEWED JOURNALS

LaserNetUS by the numbers: proposals and participants

*Limited 9-month solicitation
⁺Limited solicitation with 5 LaserNetUS facilities participating

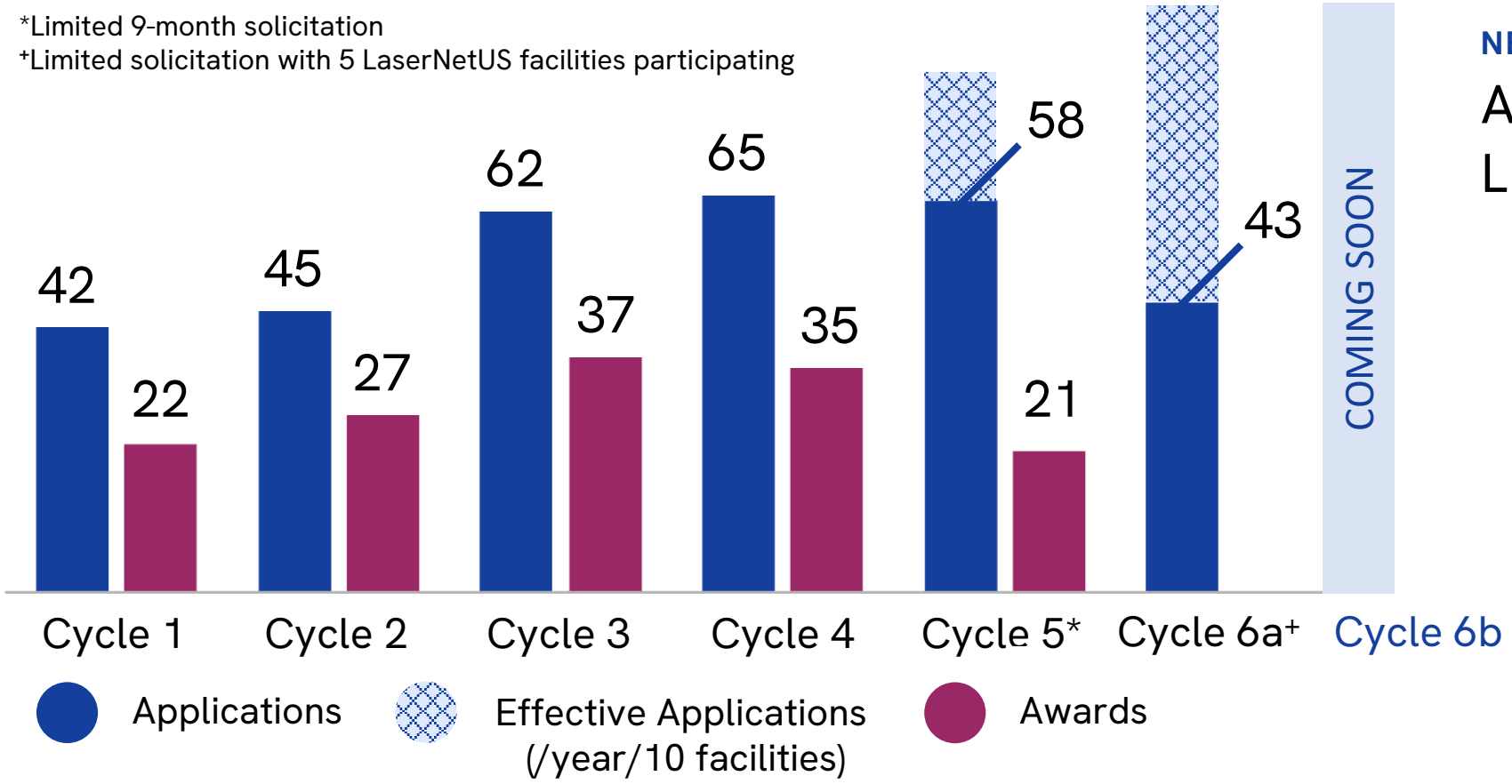




U.S. DEPARTMENT OF ENERGY | Office of Science

LaserNetUS by the numbers: proposals and participants

*Limited 9-month solicitation
⁺Limited solicitation with 5 LaserNetUS facilities participating



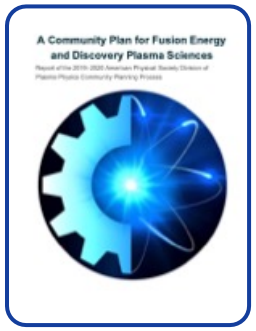
NEW SOLICITATIONS

Additional calls in LaserNetUS Cycle 6

1. **IFE-relevant experiments** utilizing the X-ray + Optical Lasers at the Matter in Extreme Conditions instrument at LCLS
2. Joint Facility Initiatives

ENDORSEMENTS &

COMMUNITY SUPPORT

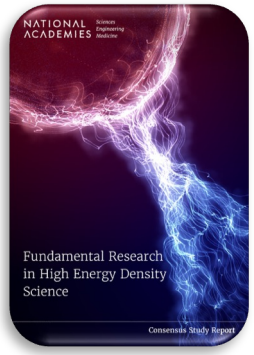


"Improve and upgrade existing LaserNetUS facilities..."

Community Plan for Fusion Energy and Discovery Plasma Sciences

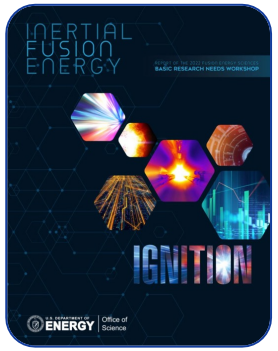
"Increase operations support and aggressive upgrades to the LaserNetUS network to expand the base of users while allowing for a diverse set of capabilities that maintain US competitiveness."

A Report of the Fusion Energy Sciences Advisory Committee



"Access to Premier U.S. Facilities in High Energy Density Science Is Essential for the Workforce ..." LaserNetUS "continued growth benefits HED science and the workforce"

National Academies - Fundamental Research in High Energy Density Science



"Leverage existing facilities (including LaserNetUS), ... , to advance IFE S&T. Explore ways to expand shot time on existing U.S. Facilities and develop upgrades to meet IFE-specific needs"

Fusion Energy Sciences Basic Research Needs Workshop on Inertial Fusion Energy

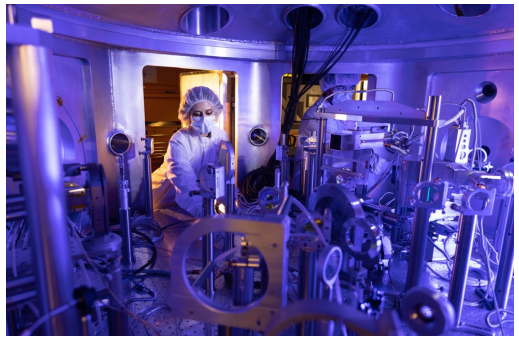
U.S. DEPARTMENT OF ENERGY | Office of Science

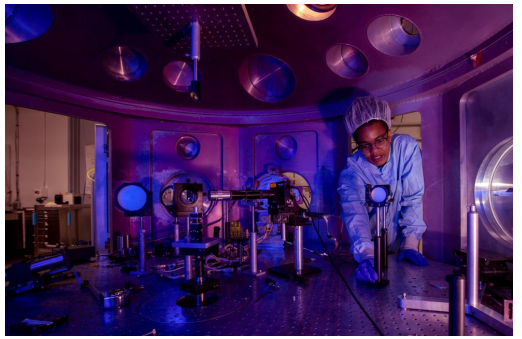
OUTLINE

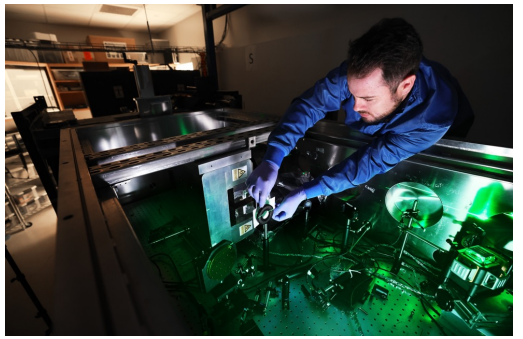
1. LaserNetUS Overview
2. Update on Summer Undergraduate Program
3. Highlights from CY 2023

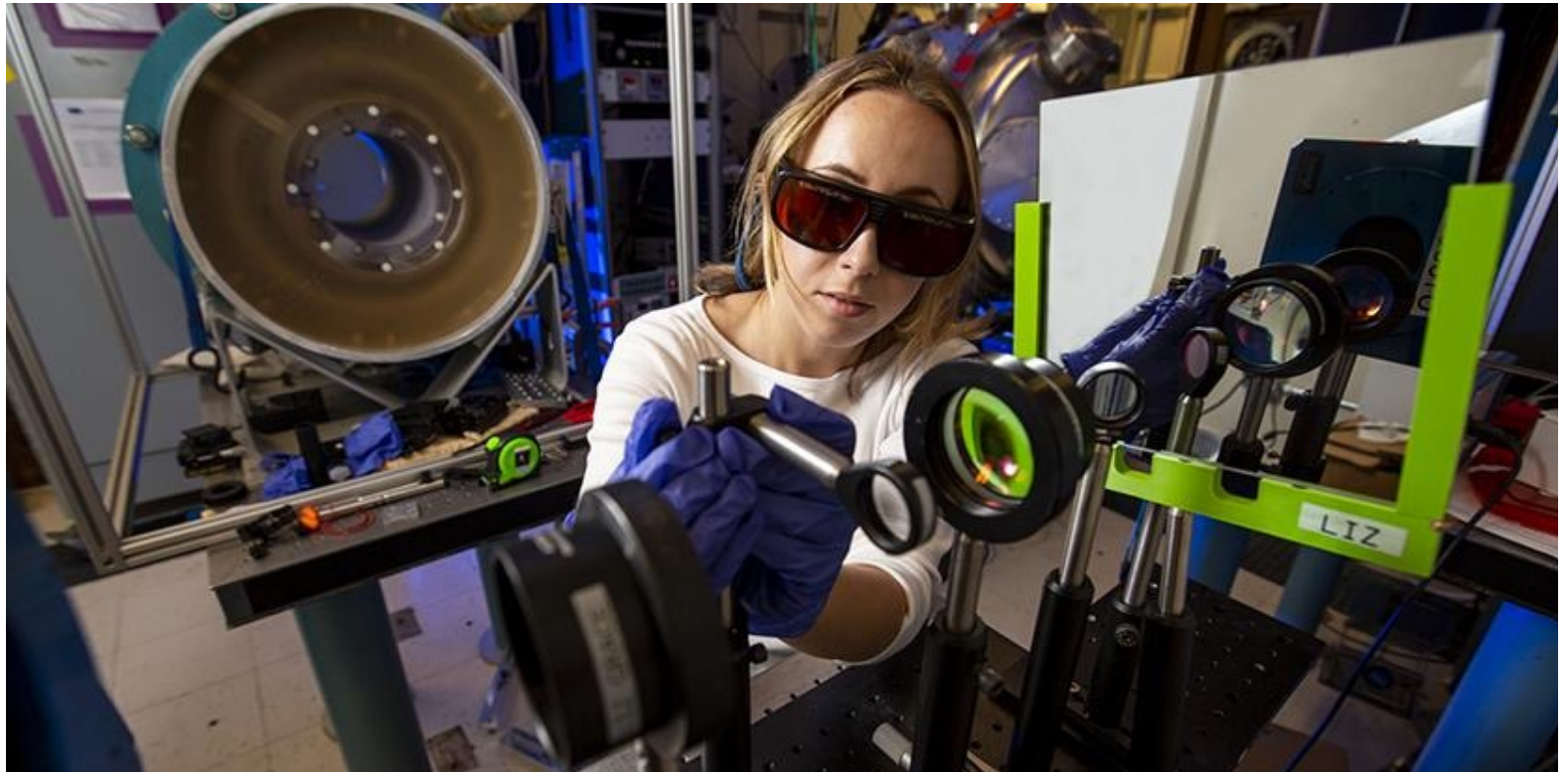
BUILDING THE NEXT ENERGY SCIENCES WORKFORCE

- Encourage students and postdocs to lead experiments as PIs to cultivate new leaders
- Train students and faculty at LaserNetUS facilities
- Develop capabilities and expertise at universities to create new programs
- LaserNetUS was awarded a DOE RENEW grant:
  Reaching A New Energy Sciences Workforce









U.S. DEPARTMENT OF ENERGY | Office of Science

REACHING A NEW ENERGY SCIENCES WORKFORCE (RENEW)

LaserNetUS launched its summer undergraduate research program in 2023

Cohorts from 3 MSI institutions spent 6-8 weeks at a LaserNetUS node

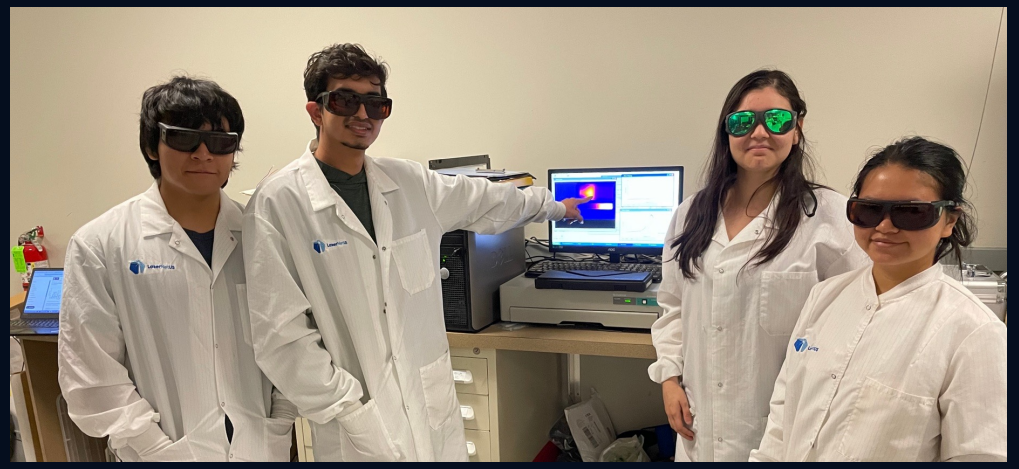
Weekly lectures on lasers, plasma physics, and high energy density science

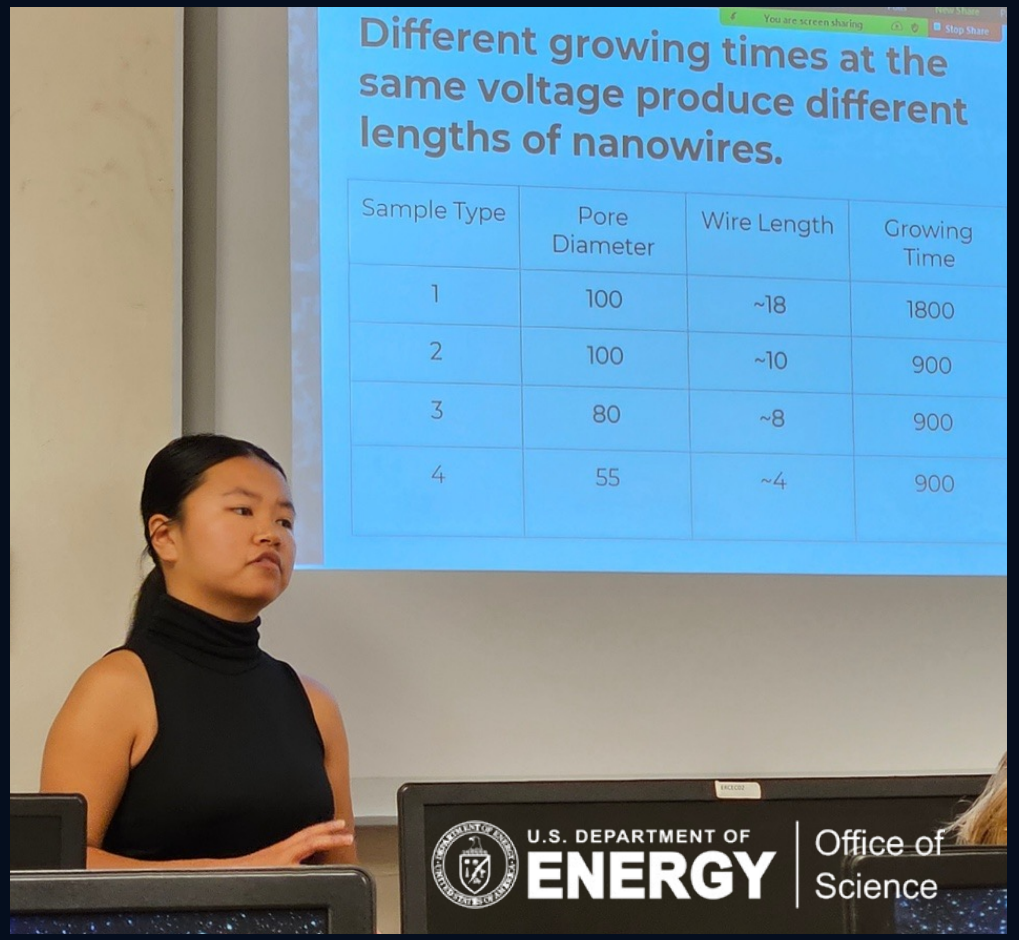
Students completed summer research projects at the LaserNetUS nodes

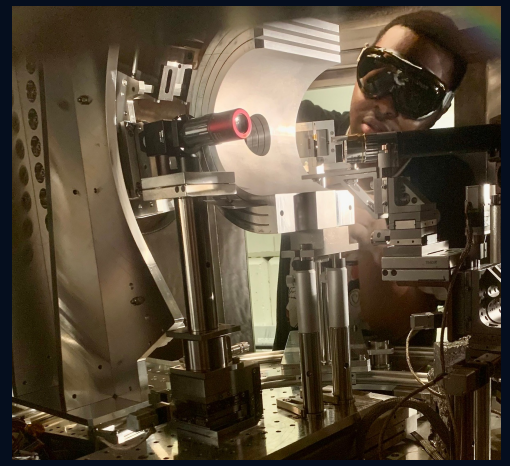
Emphasis on mentorship and advising on future opportunities such as pursuing graduate studies

U.S. DEPARTMENT OF ENERGY | Office of Science


Lasers: An introduction




Different growing times at the same voltage produce different lengths of nanowires.
Sample Type | Pore Diameter | Wire Length | Growing Time
1 | 100 | ~18 | 1800
2 | 100 | ~10 | 900
3 | 80 | ~8 | 900
4 | 55 | ~4 | 900
U.S. DEPARTMENT OF ENERGY
Office of Science

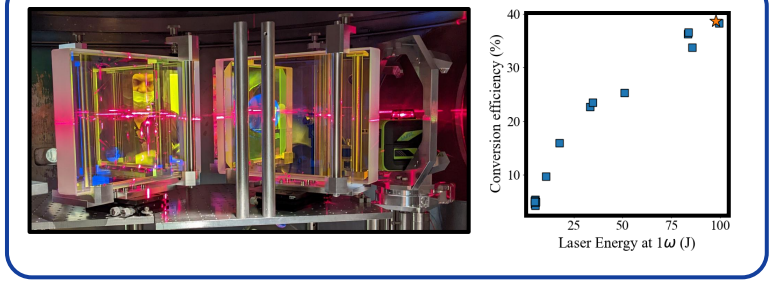


OUTLINE

1. LaserNetUS Overview
2. Update on Summer Undergraduate Program
3. Highlights from CY 2023

PRIVATE FUSION INDUSTRY HIGHLIGHTS FROM

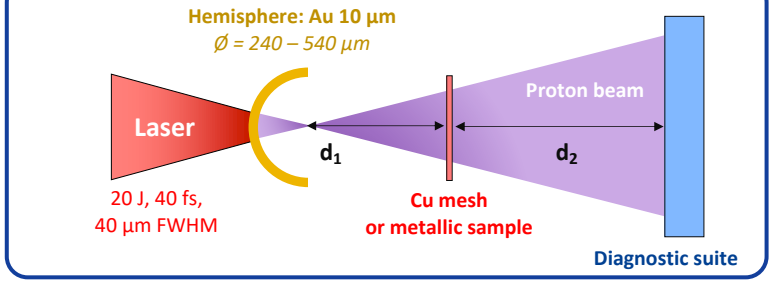
AWARDED LASERNETUS EXPERIMENTS



Second harmonic generation of the 130 fs Texas Petawatt Laser System at UT Austin

Researchers aimed to improve the laser temporal intensity contrast for high-intensity laser experiments. They used a second harmonic generation setup to boost the temporal contrast of the Texas Petawatt Laser (130 J, 130 fs).

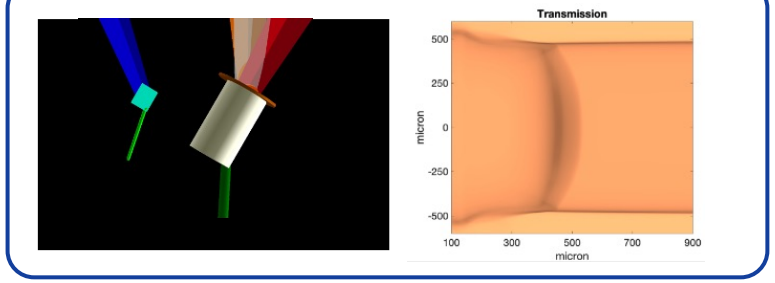
TEXAS The University of Texas at Austin MarvelFusion



Proton beam focusing and isochoric heating of warm dense matter using hemisphere targets at CSU

The experiment aims to systematically characterize the efficiency and focusability of hemispherical proton drive at moderate repetition rate operation. The results will be used to benchmark scaled-down numerical simulations of proton fast ignition for IFE.

PPPL PRINCETON PLASMA PHYSICS LABORATORY FOCUSED ENERGY



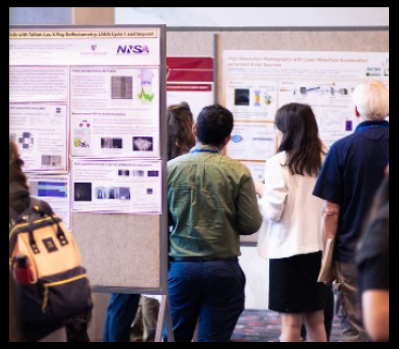
Shock compression of foam for inertial fusion energy with OMEGA-EP at LLE

The team will develop liquid filled foam targets and deploy them on OMEGA-EP. The project aims to inform the Focused Energy IFE design. The work will also be of interest to the broader community since many HED and ICF experiments use non-wetted foams.

UNIVERSITY OF MICHIGAN FOCUSED ENERGY

C. B. Curry | ccurry@slac.stanford.edu | 15

U.S. DEPARTMENT OF ENERGY | Office of Science



2023 LASERNETUS USERS' MEETING

- The 3 day meeting was hosted by the University of Maryland in College Park, MD.
- 200+ attendees with over 50% students and postdocs
- 9 exhibitors from national labs or private industry
- ***LaserNetUS provided support for over 60 students to attend the meeting and present their research***

AN INAUGRAL MEETING

2023 LASERNETUS DATA & DIAGNOSTICS WORKSHOP

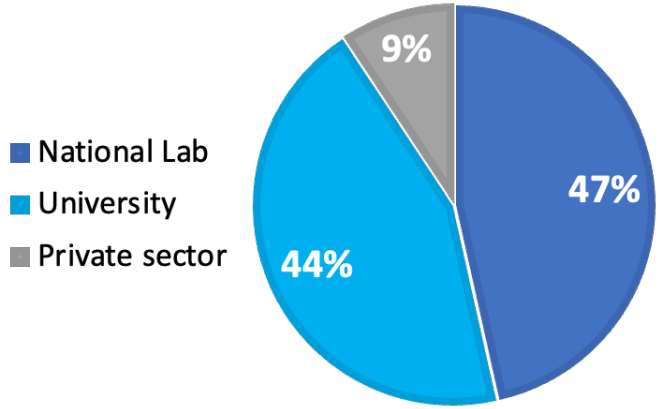
Workshop Format

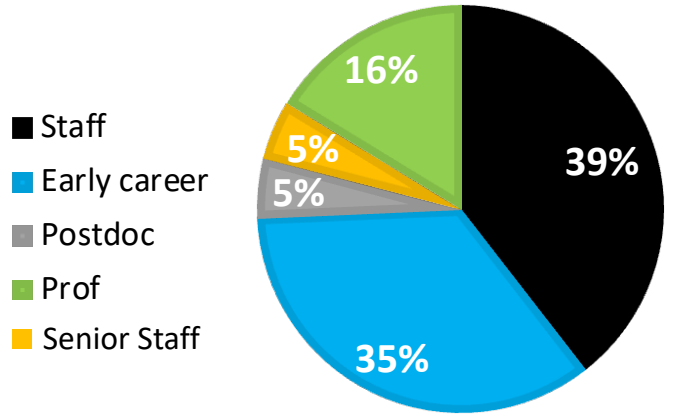
44 invited attendees participated in four moderated breakout sessions:

- Common Diagnostics Program (CDP)
- High Repetition Rate Diagnostics
- Diagnostics for new generation of facilities
- Data collection and processing tools

Main Objectives

- Identify scientific challenges requiring novel diagnostics
- Identify technical gaps between present capabilities
- Identify diagnostic-related areas of mutual interest across LaserNetUS nodes





C. B. Curry | ccurry@slac.stanford.edu | 17

U.S. DEPARTMENT OF ENERGY | Office of Science

THANKS FOR YOUR ATTENTION

Any questions?