

National Laser Users' Facility and External Users' Programs

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Under the facility governance plan implemented in FY08 to formalize the scheduling of the Omega Laser Facility as a National Nuclear Security Administration (NNSA) User Facility, Omega Facility shots are allocated by programs following NNSA guidance. NNSA funds about 190 shot days each year on the OMEGA and OMEGA EP Laser Systems for experiments. The majority (~68%) of these shot days are committed to the national Inertial Confinement Fusion (ICF) Program and the High-Energy-Density (HED) Program with shots conducted by scientists from Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Sandia National Laboratories (SNL), the Naval Research Laboratory (NRL), and LLE. In FY21, the Omega Laser Facility delivered a total of 2098 shots over 206.5 days, among which 1326 target shots were conducted for the ICF and HED campaigns including calibration shots (112). The successful completion of the large number of experiments at the Omega Laser Facility during the COVID-19 global pandemic is attributed to the “*RemotePI*” operation protocol that has enabled all experimental principal investigators (PI's) and collaborators to safely and effectively conduct experiments via remote access.

The Fundamental Science Program at the Omega Laser Facility, with projects selected through open-call and peer-reviewed processes, is typically allotted between 25% to 29% of the total NNSA-funded Omega Facility shot days. The program has two distinct components: (1) the National Laser Users' Facility (NLUF) experiments (~18% of the NNSA-funded shot time) led by researchers from U.S. academia and business; and (2) the Laboratory Basic Science (LBS) experiments (with ~11% of the NNSA-funded shot time) that are led by the NNSA ICF laboratories including LLNL, LANL, SNL, NRL, and LLE and the Office of Science laboratories such as SLAC National Accelerator Laboratory, Princeton Plasma Physics Laboratory (PPPL), and Lawrence Berkeley National Laboratory (LBNL). In FY21, the NLUF and LBS programs obtained 360 and 231 target shots, respectively, and together accounted for ~28% of the overall facility shots.

Since FY20, LLE has provided a few additional shot days each year on OMEGA EP to the users of the newly established LaserNetUS network funded by the DOE Office of Fusion Sciences (FES) with user experimental proposals annually solicited and selected by a fully independent proposal review panel process. The LaserNetUS program obtained 29 target shots on OMEGA EP in FY21.

Since FY21, a few additional shot days each year at the Omega Laser Facility have also been made available to the University of Rochester (UR)-hosted Center for Matter at Atomic Pressure (CMAP), a new Physics Frontier Center funded by the National Science Foundation (NSF). CMAP is a collaboration among faculty, scientists, researchers, and students at UR, Massachusetts Institute of Technology, Princeton University, the University of California at Berkeley and Davis, the University of Buffalo, and LLNL. CMAP researchers conduct laboratory-based exploration of planets and stars throughout the universe and obtained 43 target shots in FY21.

During FY21, the Omega Laser Facility had also been used to support research grants led by LLE scientists and funded by FES (14 target shots on OMEGA) and Advanced Research Projects Agency–Energy (ARPA-E) (24 target shots on OMEGA) and for other externally funded programs led by teams from the Johns Hopkins University's Applied Physics Laboratory (APL) (24 target shots on OMEGA) and Marvel Fusion, a German fusion start-up company (24 target shots on OMEGA EP). These externally

funded experiments are conducted at the facility on the basis of special agreements put in place by UR/LLE and participating institutions with the endorsement of NNSA.

The facility users who conducted experiments during this year included 17 collaborative teams participating in the NLUF Program including the one-time Academic and Industrial Basic Science Program using the NLUF facility time allocation from the FY20–FY21 awards; 21 teams led by scientists from LLNL, LANL, LLE, and LBNL participating in the LBS Program; three project teams participating in the LaserNetUS Program; six project teams from the CMAP; many collaborative teams from the national laboratories (LLNL, SNL, NRL) and LLE conducting ICF experiments; investigators from LLNL, LANL, SNL, and LLE conducting experiments for HED campaigns; and researchers from APL and Marvel Fusion.

A critical part of the NLUF program and the LaserNetUS program is the education and training of graduate students in high-energy-density (HED) and plasma physics. In addition, graduate students can also access the Omega Laser Facility to conduct their theses research through collaborations with national laboratories and LLE. In total, 66 graduate students (see Table I) from 20 other universities have participated in these external user-led research projects with experiments at the Omega Laser Facility, among which nine students successfully defended their Ph.D. theses in calendar year 2021 (see the highlighted names in Table I). It is worth noting that 18 of these students are new to the Omega Laser Facility.

Table I: Graduate students from 20 universities who have conducted research utilizing the Omega Laser Facility through NLUF, LBS, LaserNetUS, and/or via collaborations with national labs and LLE in FY21. Five students successfully defended their Ph.D. theses during calendar year 2021 (see the shaded cells).

Name	University	Advisor(s)	Notes
A. Aghedo	Florida A&M University	Albert (LLNL)	New–LLNL collaboration
C. Bruulsema	University of Alberta	Rozmus	New–LLE collaboration (PI: D. Froula)
E. Grace	Georgia Tech (GT)	Trebino (GT)/ Ma (LLNL)	LLNL collaboration
J. Gonzalez-Quiles	Johns Hopkins University (JHU)	Wicks	
Y. Li	JHU	Wicks	New
T. Perez	JHU	Wicks	
Z. Ye	JHU	Wicks	
A. Palmer	Michigan Tech.	–	New–LANL collaboration (PI's: Rasmus and Flippo)
P. J. Adrian	Massachusetts Institute of Technology (MIT)	Petrasso/Frenje/Li	
C. Chang	MIT	Petrasso/Frenje/Li	New
S. Dannhoff	MIT	Petrasso/Frenje/Li	New
T. Evans	MIT	Petrasso/Frenje/Li	New
T. M. Johnson	MIT	Petrasso/Frenje/Li	
N. V. Kabadi	MIT	Petrasso/Frenje/Li	Defended Ph.D. thesis in November 2021 (now an Assistant Scientist at CMAP)
J. Kunimune	MIT	Petrasso/Frenje/Li	
B. Lahmann	MIT	Petrasso/Frenje/Li	Defended Ph.D. thesis in February 2021 (now a postdoc at LLNL)
J. Percy	MIT	Petrasso/Frenje/Li	
B. Reichelt	MIT	Petrasso/Frenje/Li	
G. Sutcliffe	MIT	Petrasso/Frenje/Li	

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Name	University	Advisor(s)	Notes
R. Simpson	MIT	Winslow (MIT)/Ma (LLNL)	LLNL Collaboration
A. Chien	Princeton	Ji	Defended Ph.D. thesis in August 2021
D. Kim	Princeton	Duffy	
S. Han	Princeton	Duffy	
I. Ocampo	Princeton	Duffy	
K. Lezhnin	Princeton	–	New–NLUF/AIBS (PI's: D. Schaeffer and W. Fox)
K. Perez	Rice University	Liang	
W. Riedel	Stanford	Cappelli	
M. Harwell	University of California, Davis	Stewart	CMAP
R. Lee	University of California, Los Angeles	Mori	NLUF/AIBS (PI: M. Manuel)
M. Sinclair	University of California, Los Angeles	Joshi	LLNL collaboration including LBS (PI: F. Albert)
K. Bhutwala	University of California, San Diego (UCSD)	Beg	
A. Bogale	UCSD	Beg	New–LaserNetUS (PI: M. Manuel)
T. Cordova	UCSD	Beg	New–LaserNetUS (PI's: K. Matsuo and F. Beg)
J. Vaughan	UCSD	Beg	
J. Strehlow	UCSD	Beg	
J. Saret	UCSD	Beg	New
R. Turner	UCSD	Beg	New–LaserNetUS (PI's K. Matsuo and F. Beg)
D. Zimmer	UCSD	Beg	
G. Righi	UCSD	Meyers	LLNL collaboration (PI's: C. Stan and H.-S. Park) and LaserNetUS (PI: G. Righi)
A. Angulo	University of Michigan	Kuranz	
K. Bryant	University of Michigan	Kuranz	
S. Coffing	University of Michigan	Drake	LANL collaboration (PI's: P. Kozlowski and H. Johns)
C. Fiedler-Kawaguchhi	University of Michigan	Kuranz	New–LANL collaboration (PI's: A. Rasmus and K. Flippo)
K. Kelso	University of Michigan	Kuranz	
H. Lefevre	University of Michigan	Kuranz	Defended Ph.D. thesis in April 2021 (now an NSF Postdoc Fellow at University of Michigan)
K. Ma	University of Michigan	Kuranz	
M. Springstead	University of Michigan	Kuranz	
R. Vandervort	University of Michigan	Drake	

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B. Russell	University of Michigan	Krushelnick/Willingale	
J. Latham	University of Michigan	Willingale	New
H. Tang	University of Michigan	Willingale	
M. Wadas	University of Michigan	Johnsens	LLNL collaboration including LBS (PI: M. Milliot)
E. Gallardo-Diaz	University of Nevada, Reno (UNR)	Mancini	New–NLUF and LLE collaboration
J. Rowland	UNR	Mancini	New
C. Allen	UNR	White	LLNL collaboration including LBS shots and NLUF
J. J. Donaghy	University of New Hampshire	Fox	LaserNetUS
P. King	University of Texas (UT), Austin	Hegelich/Albert	LLNL collaboration including LBS (PI: F. Albert)
I. Pagano	UT, Austin	Downer/Albert	New–LLNL collaboration including LBS (PI: F. Albert)
S. Myren	Virginia Tech	–	New–LANL collaboration (PI's: A. Rasmus and K. Flippo)
C. Samulski	Virginia Tech	Srinivasan	GA collaboration (AIBS, PI: M. Manuel)
V. Bouffetier	University of Bordeaux	Casner	LLE collaboration including LBS (PI: W. Theobald) and LANL LBS (PI: T. E. Weber); Defended Ph.D. thesis in December 2021 (now a postdoc at European X-Ray Free-Electron Laser Facility)
C. Vlachos	University of Bordeaux	Santos	NLUF UCSD collaboration
T. Campbell	Oxford	Gregori	NLUF and LLE collaboration
H. Poole	Oxford	Gregori	NLUF and LLE collaboration
A. Dearing	University of York	Woolsey	LLE collaboration (PI: W. Theobald)
M. Khan	University of York	Woolsey	Rutherford Appleton Laboratory/ University of York (PI: R. Scott) and LLE (PI: W. Theobald) collaboration