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**The Third Omega Laser Facility  
Users' Group Workshop**

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# The Third OMEGA Laser Facility Users Group Workshop (April 27-29, 2011)

## Introduction

A capacity gathering of 115 researchers from 25 universities and laboratories and 9 countries met at the Laboratory for Laser Energetics (LLE) for the third OMEGA Laser Facility Users Group (OLUG) workshop. The purpose of the three-day workshop was to facilitate communications and exchanges among individual Omega users, and between users and the LLE management; to present on-going and proposed research; to encourage research opportunities and collaborations that could be undertaken at the OMEGA Laser Facility and in a complementary fashion at other facilities (such as NIF or LULI); to provide an opportunity for students, post-doctoral fellows and young researchers to present their research in an informal setting; and to provide LLE management feedback from the users about ways to improve the Facility and future experimental campaigns. The interactions were wide-ranging and lively, as illustrated in the accompanying photographs.

The OMEGA Users consist of 266 members from 32 universities and 23 Centers and National Laboratories; their names and affiliations are listed at <http://www.lle.rochester.edu/media/about/documents/OLUGMEMBERS.pdf> OLUG is by far the largest Users group in the world in the field of high-energy density physics, and it is certainly one of the most active.

The first two mornings of the workshop comprised of 13 science and facility presentations (the Workshop agenda is at the end of this document). The facility talks proved especially useful for those not familiar with the art and complexities of performing experiments at OMEGA. But as the facility is constantly changing and improving, even experienced users significantly benefited from these updates. The overview science talks, given by leading world authorities, described the breadth and excitement of high-energy-density science undertaken at the Omega Laser Facility. The next section of this article contains a summary of the range of presentations and activities.

About 50 students and post-doctoral fellows, 44 whom were supported by travel grants from NNSA, attended the workshop and presented 37 of the 57 contributed poster and oral presentations. The content of their presentations encompassed target fabrication to simulating aspects of supernovae; the presentations generated spirited discussions, probing questions, and friendly suggestions. In addition, 20 contributed presentations were made by professional scientists and academics.

An important function of the workshop was to develop a set of **Findings and Recommendations** to help set future priorities for the OMEGA Facility.



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*A capacity gathering of 115 researchers, from 25 universities and laboratories around the world, participated in this year's workshop. The Users group itself has 266 members which come from 32 universities and 23 laboratories, making it by far the largest users group in the world in High-Energy-Density Physics. The OMEGA Facility is now a member of the National Users Facility Organization, which in turn promotes science education and outreach throughout the nation. The next annual OMEGA Users Workshop occurs on 25-27 April 2012.*

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*Fifty students and post-doctoral fellows attended and made 37 presentations. Forty four received travel assistance from an NNSA grant. Travel assistance has already been arranged for the next annual workshop on 25-27 April 2012. The workshop places tremendous emphasis on the participation of young researchers.*

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They were grouped into 4 areas: 60-beam OMEGA, OMEGA EP, General Facility-improvements, and Accessibility of OMEGA operational information. These categories comprise a report given to Omega Facility management, highlights to follow. LLE management is currently using these recommendations as a guide for making decisions about Omega Laser Facility operations, priorities, and future changes. In addition, the status of these OLUG **Findings and Recommendations** were updated and reviewed at a satellite meeting during the fall APS-DPP conference (in Utah, 15 November 2011). They will also form the grist for the forthcoming workshop.

One highlight of the workshop was the panel of students and post-docs that discussed their experiences at the Omega Laser Facility and their thoughts and recommendations on facility improvements. Engaging discussions were sparked by this forum, which resulted in the student/postdoctoral report.

Another important event was a “job fair” designed to bring students together with potential future employers, and to discuss career opportunities that exist at National Laboratories, in private industry, and at universities.

Finally one of the important decisions made at the workshop was the selection of 25-27 April 2012 as the date of the next Users workshop. Plans are already well underway for this event.

### **The Presentations**

A diverse and extensive set of 70 talks and posters was presented over a 3-day period. In morning sessions, invited talks on the facility and science were given. The invited science talks focused on several important topics, including high-energy-density plasmas in general, laboratory astrophysics, ignition in ICF, the physics of shock and fast ignition, and future experiments on OMEGA and the NIF.

The Facility talks presented important details and developments on the status and performance of OMEGA/OMEGA-EP from pulse shaping and duration to beam smoothing; the qualification process for interfacing new experiments; the present, and soon-to-be operating, set of diagnostics; and the critical role of targets, from design, to procurement, to full characterization, to fielding and finally shooting.

In addition to the 13 invited presentations, 57 contributed posters and talks were given, and they covered a wide spectrum of work on OMEGA from target fabrication to fast-ignition experiments to basic and novel nuclear physics experiments. Work was also presented on opportunities for taking physics platforms developed at OMEGA to other facilities that are both larger (the NIF) and smaller (Jupiter, Trident, Comet and LULI, as examples). The invited and contributed presentations formed much of the basis for the ensuing discussions and materials in the **Findings and Recommendations**. The topics and chairpersons for each are presented herein.

The photographs on the following pages provide a representative sampling of the workshop’s talks, interactions, and ambience.



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*In the plenary sessions, thirteen authorities spoke about the science and opportunities of high-energy-density physics, and described the evolving capabilities of the OMEGA Facility needed to reach new science frontiers. Here LLE Director Dr. Robert McCrory, a strong supporter of OLUG since its inception, welcomes the Users and discusses the evolving capabilities of the facility that keep it at the cutting edge of research.*

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*Univ. of Rochester astrophysicist Adam Frank gave a stellar talk on instabilities and clumping processes in jets in both astrophysical and laboratory settings.*

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*Theorist Will Fox, from the University of New Hampshire (UNH), talked about theoretical aspects of 3-D reconnection in laboratory and astrophysical settings. UNH is one of 32 Universities who are members of the OMEGA Users group. University researchers, 107 in number, comprise the largest component of OLUG's 266 members.*

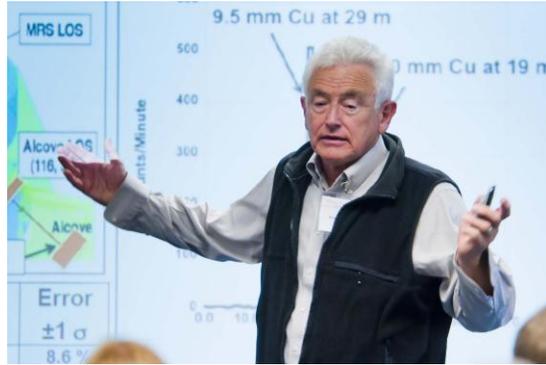
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*Nuclear physicist Dennis McNabb of LLNL described new and exciting opportunities in Plasma Nuclear Science that are emerging at OMEGA and the NIF. Several contributed workshop talks, as well as Facility Recommendations, focused on this nascent frontier field, whose origins directly derive from recent OMEGA Users experiments. Subsequent to the workshop, a joint MIT, LLNL and LLE press conference (<http://web.mit.edu/press/2011/omega-laser.html>) announced the results of the first basic nuclear physics experiments obtained in ICF. Many more such experiments are either already underway or are being actively planned at OMEGA by Users.*

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*The peripatetic physicist Joe Kilkenny of General Atomics talked about the importance and pervasiveness of moving diagnostic and experimental platforms from OMEGA to the NIF. Many critical diagnostics at the NIF, such as the magnetic recoil (neutron) spectrometer, were first developed and utilized at OMEGA before being duplicated and deployed at the NIF.*

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*LLE's ubiquitous Sam Morse, the OMEGA Facility Director, talked about changes in the Facility and LLE's implementation of OLUG's Findings & Recommendations. Sam is one of several of the facility's cognizant engineers and managers who are constantly working to facilitate and improve Users experiments. A very strong working relationship exists between the Users and the LLE management team, and extensive discussions occur throughout the year between OLUG and the management regarding OLUG's Findings and Recommendations.*

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*NNSA's Deputy Administrator for Defense Programs, Dr. Don Cook, talked to the OMEGA Users about their perspective on HED science at OMEGA, and on the value NNSA places on the Users work and research.*

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*Two poster sessions presented an opportunity for informal discussion about OMEGA experiments and their connections to important work at other HED facilities, especially the NIF.*

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*The workshop provided many opportunities for informal interactions and discussions, and for sowing the seeds of new experimental and theoretical efforts.*

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*Thirty seven Posters and contributed talks were given by students and postdocs.*

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*The student-postdoc panel, chaired by LLNL's Tammy Ma, led an engaging discussion about issues that young researchers face in performing experiments at OMEGA. This panel formulated their own Findings and Recommendations that became part of the workshop Proceedings.*

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*13 different Findings and Recommendations for the Facility were extensively discussed by User Leads and Chairs. (Shown here from left to right are Maria Gatu Johnson from MIT; Hye-Sook Park from LLNL; and Carolyn Kuranz from Univ. of Michigan) Women physicists have an extremely strong presence at every level of OLUG, from the Executive Committee to the chairs of the major OLUG committees on Findings and Recommendations.*

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*Tours of OMEGA and OMEGA-EP are a critical component of the workshop, and greatly appreciated by Users new and old. Here LLE engineer Steve Stagnitto is shown in the OMEGA viewing gallery talking with workshop attendees about the intricacies and challenges of organizing a successful experimental program.*

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*Physicist Ray Leeper discussed career opportunities in research at Sandia National Laboratory. Lawrence Livermore National Laboratory and Los Alamos National Laboratory also presented overviews of laboratory research opportunities. These talks presented a unique opportunity for young researchers to learn about research not only at OMEGA, but at the other major facilities, and at Universities and in the private sector.*

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*The workshop banquet was enjoyed by all and offered a wonderful opportunity for good cheer and good food. The making of lifelong colleagues and friends is one of the lasting results of the Users workshop. Good friends make for good science!*

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**The 13 Findings and Recommendations of the OMEGA 2011 Users Workshop (Reports and presentations can be found on-line at [http://www.lle.rochester.edu/about/omega\\_laser\\_users\\_group.php](http://www.lle.rochester.edu/about/omega_laser_users_group.php)).**

1. Tammy Ma, Chair, LLNL, *Findings and Recommendations of the Student/Postdoc Panel.*
2. Louise Willingale, Chair, Univ of Michigan, *Bringing EP performance up to full specification, and 4-  $\omega$  probe utilization.*
3. Mingsheng Wei, Chair, GA, *Long-pulse operations of OMEGA-EP*
4. Carolyn Kuranz, Chair, Univ. of Michigan, *Independent operations of the 3 legs of OMEGA 60*
5. Dustin Froula, Chair, LLE, *Work to develop a simulation capability for the OMEGA external Users*
6. Peter Norreys, Chair, Rutherford Appleton Laboratory, *Dual Foci for the OMEGA 60 Facility.*
7. Dennis McNabb ( LLNL) and Johan Frenje (MIT), Chairs, *Developing implosion capabilities at OMEGA with arbitrary fuel mixtures of tritium for advancing Plasma Nuclear Science*
8. Alex Zylstra, Chair, MIT, *An Ultra-low charged particle spectrometer for studying nucleo-synthesis reactions in OMEGA implosions*
9. Nareg Sinenian (MIT) and Jim Cobble (LANL), Chairs, *Utilization of Thomson Parabola on OMEGA for characterizing implosion ion-loss channels and for studying nucleo-synthesis reactions in OMEGA implosions*
10. Hans Herrmann, Chair, LANL, *Gamma-ray spectrometry for Plasma Nuclear Science and implosion physics*
11. Maria Gatu-Johnson, Chair, MIT, *A Low-Energy Neutron Spectrometer for Plasma nuclear science and implosion physics*
12. Gennady Fiskel, Chair, LLE, *Developing magnetic inertial fusion platforms for basic science and implosion physics*
13. Hye-sook Park, Chair, LLNL, *Cu-K(alpha) crystal imaging on OMEGA-EP for HED physics*



12:00-1:00 Lunch (box lunches);  
 12:00-1:00 OMEGA and OMEGA-EP tours  
**JOB FAIR:**  
 1:00-2:15 Panel discussion on opportunities in High-Energy-Density-Laboratory Physics  
 Universities: Paul Drake  
 LLE: Craig Sangster  
 LLNL: Hye-Sook Park  
 GA: Richard Stephens  
 LANL: Jonathan Workman  
 SNL: Ray Leeper

2:15-3:00 Open discussion with panelists  
 3:00-4:30 Individual discussions with panelists

### **Questions addressed in the General Workshop Sessions:**

*What new avenues of research should we be pursuing on the OMEGA / OMEGA-EP facilities?*

*What facility improvements, large or small, can improve current research and help us pursue science at the cutting edge?*

*How can the administrative organization and the infrastructure at LLE better support ongoing and groundbreaking research?*

*What additional platforms/experiments/diagnostics might advantageously be built and coordinated, e.g., between OMEGA and NIF, and/or between OMEGA and Trident or Jupiter?*

### **NEXT OMEGA USER MEETINGS and WORKSHOP:**

2011 November 15 meeting, Tue., 5:30- 7:00 PM, APS/DDP Utah, Update  
 2012 April 25-27, Next OMEGA Users Workshop, LLE

### **ACKNOWLEDGMENTS:**

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