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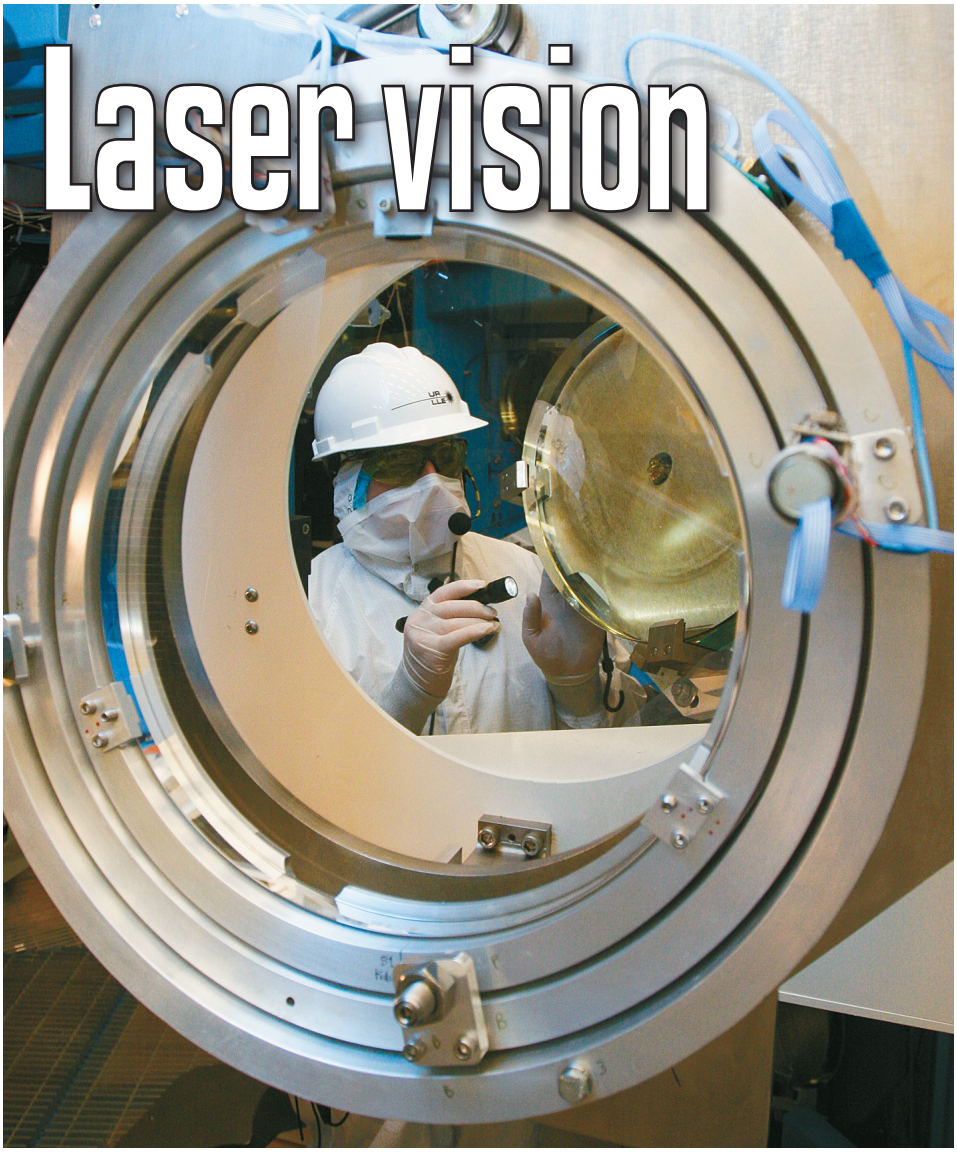
Laser vision



By ANDREA DECKERT

Officials from the University of Rochester's Laboratory for Laser Energetics believe the facility could be an important player in the national effort to develop alternative energy sources through means such as fusion ignition, while also helping Rochester maintain its worldwide leadership in laser science and optical physics.

Last week, scientists and students from around the world met for the first time at the laser lab to talk about how to improve experiments using the laboratory's Omega laser, including attempts to meet increasing energy demands by harnessing the power of the stars.

The 100 scientists represented 26 universities and laboratories from four countries.

The lab houses one of the most powerful lasers in the world and plays a key role in U.S. efforts to achieve fusion and harness its power. Nuclear fusion is defined as the union of atomic nuclei, resulting in the release of large amounts of energy.

Robert McCrory, the lab's vice provost and director, said that unlike nuclear fission—which produces vast amounts of energy but also radioactive waste—fusion has the potential to generate more energy without creating nuclear waste. The fuel for fusion occurs naturally in water, making it an essentially inexhaustible resource.

"Fusion is where one wants to go," McCrory said.

The laser lab is an international center for research, training and education in high-power lasers, fusion, high-energy density physics and electro-optics technology. Scientists there are working to mimic the same thermonuclear fusion reactions occurring in stars, which produce vast amounts of energy.

The university's largest research center is also a major revenue driver for the local economy, McCrory said. In fiscal 2008, the laser lab had a $42.9 million direct economic impact locally. The bulk of that money—nearly $35 million—was payroll, while $8 million was spent on purchases from area businesses, McCrory said.

In fiscal 2007, the lab's local economic impact was $44 million; in fiscal 2006, it was $38.5 million, data from the laser lab shows.

In addition, the lab has helped launch spinoffs and high-tech business startups, including QED Technologies Inc., Sydor Instruments LLC and ASE Optics Inc., he said.

Since its inception in 1970, $1.3 billion has been invested in the lab. The bulk of the funding has come from the federal government, with other investments coming from UR, New York and private industry. This year, the lab is requesting nearly $73 million in federal funds, which would be used to conduct laser-fusion experiments, develop new laser technologies and do research and development.

The lab employs 488 full-time and contract employees, including paid student workers.

Nationally, it is a key partner in the National Ignition Campaign, an experimental effort involving five major U.S. laboratories—including the National Ignition Facility in Livermore, Calif.—aimed at achieving fusion ignition.

The Omega laser produces fusion by striking a small pellet of hydrogen with

laser beams that use 100 times as much power for a billionth of a second as the entire nation's power grid. The laser compresses and heats the pellet.

This year is the first when Omega Extended Power, or EP—an upgrade to the Omega laser completed in April 2008—is accessible to researchers outside of the laboratory for conducting fusion-related experiments. The new capacity allows the facility to continue fusion science work and makes new experiments possible, including the study of relativistic—traveling at nearly the speed of light—laser matter interactions.

The Omega laser is capable of delivering more than a petawatt—a million billion watts —of power onto a millimeter scale target, officials said. Achieving fusion ignition requires such intensities because the fuel must be heated to nearly 100 million degrees—more than six times hotter than the sun's interior—and compressed to extremely high densities. Only by bringing the fuel to these conditions can a self-sustaining reaction occur so as to produce more energy than was supplied, officials said.

The visiting scientists are known as the Omega Laser Facility Users Group.

Richard Petrasso, senior research scientist at Massachusetts Institute of Technology's Plasma Science and Fusion Center, helped organize the users' conference. The capabilities of the lab's laser are numerous, he said.

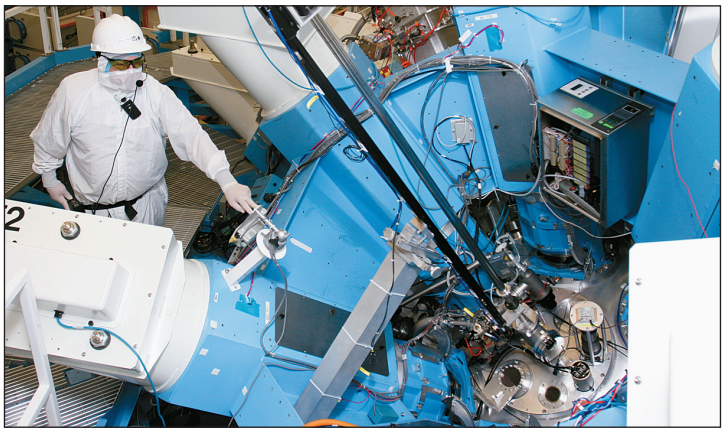


Photo by Kimberly McKinzie

Laser lab scientists are working to mimic the thermonuclear fusion reactions occurring in stars, which produce vast amounts of energy.

"It could lead to a wonderful energy solution that leaves no carbon footprint," Petrasso said. "Anytime you push nature to the extreme, you learn something."

Samuel Morse, Omega facility division director, said the new laser provides an opportunity to the university, as well as those who use it. Since it is new equipment, those gathered last week were able to discuss ways to work together in using it for advances in areas such as alternative energy.

"The ultimate goal is electricity, power," Morse said.

Daniel Casey, a Ph.D. candidate studying nuclear science and engineering at MIT, said the laser lab gives him access to data not available before.

"The scientific benefits are extreme," Casey said.

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