Rochester's Omega Laser Receives 50-Fold Power Increase to Become 'Petawatt' Laser

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The University of Rochester will mark another important step in the effort toward attaining sustainable fusion, the ultimate source of clean energy, Friday, May 16.

University President Joel Seligman, along with special guests, who include U.S. Senator Charles Schumer, U.S. Representative Thomas Reynolds, and Undersecretary and National Nuclear Security Administration Administrator Thomas D'Agostino, will dedicate the new Omega EP (Extended Performance) laser facility at the Robert L. Sproull Center for Ultra High Intensity Laser Research at the Laboratory for Laser Energetics (LLE).

The Omega EP comprises a new set of four ultra-high-intensity laser beams that will unleash more than a petawatt—a million billion watts—of power onto a target just a millimeter across. Working in conjunction with LLE's original 60-beam Omega laser, the Omega EP will open the door to a new concept called "fast ignition," which may be able to dramatically increase the energy derived from fusion experiments and provide a possible new avenue toward clean fusion power. If successful, fast ignition could lead to the highest energy densities ever achieved in a laboratory.

"I look forward to the profound scientific contributions the Omega EP extension will bring to the University and to the world," says Seligman. "It is a vital component of our nation's scientific capital and leadership, a key to strategic work on an independent energy future, and a vital part of the local economy, including $44 million in local expenditures just last year."

"Over the years, the University of Rochester's Laboratory for Laser Energetics has consistently brought Upstate New York's high-tech sector to the forefront of energy innovation," says Schumer. "It is a vital national resource as well as an economic boon to Rochester and to the entire Finger Lakes region. I was proud to secure over $61 million to support their efforts last year and will continue to look for ways in which the federal government can further collaborate with this dynamic laboratory in the future."

"Employing more than 500 Western New Yorkers, the Laboratory for Laser Energetics of the University of Rochester is essential to the growth of our community and ensures Rochester is on the cutting edge of technology," says Reynolds. "The new Omega EP laser is truly remarkable and serves as a clear demonstration of how our region remains a leader in world-class innovation. The Omega EP's success is a testament to the scientists, engineers, technicians, and students who

made the project possible."

The original Omega laser fires multi-trillion watt bursts of energy—more powerful than the entire electrical generating capacity of the United States—making it among the three most powerful lasers in the world. Yet Omega will become approximately 50 times more powerful still with the inclusion of Omega EP. Such incredible intensities are necessary because creating electricity from fusion means heating the target fuel to a high temperature and confining it long enough so that more energy is released than is supplied to sustain the reaction. To release energy at a level required for electricity production, the fusion fuel must be heated to about 100 million degrees, more than six times hotter than the interior of the Sun.

Fusion, nuclear fission and solar energy, which includes biofuels, are widely seen as the only energy sources capable of satisfying the growing need for power for the next century without the harmful environmental impacts of fossil fuels. In a fusion power plant, one gallon of seawater would provide the equivalent energy of 300 gallons of gasoline; fuel from 50 cups of water contains the energy equivalent of two tons of coal. A fusion power plant would produce no climate-changing gases, as well as considerably less environmentally harmful radioactive byproducts than nuclear power plants currently do. And there would be no danger of a runaway reaction or core meltdown in a fusion power plant.

Beyond clean energy production, Omega and Omega EP will facilitate research impossible to attempt almost anywhere else on Earth. The way matter behaves in stars can be replicated on a small scale inside Omega's target chamber. Laser and materials technologies, electro-optics, and plasma physics will also be able to be studied under conditions never before possible.

Source: University of Rochester