Linac Coherent Light Source

The Linac Coherent Light Source at SLAC National Accelerator Laboratory is the world’s first and most powerful x-ray laser. The LCLS’s highly focused beam, which arrives in staccato bursts one-tenth of a trillionth of a second long, gives researchers the unique ability to take crisp pictures of atomic motion and changes in chemical bonds, shedding light on the fundamental processes of chemistry, technology and life itself.

Scientific Accomplishments

Catching Photosynthesis in the Act
Photosynthesis may be one of the most important chemical reactions on Earth, yet most aspects are not fundamentally understood. Using the LCLS, researchers are revealing direct observations of the natural processes that convert the sun’s light into usable energy, with promising implications for America’s energy future.

Viewing Protein Crystals in Vivo
LCLS is the first light source able to image proteins that resist forming large crystals—potentially opening the door to determining the 3D structure of tens of thousands of previously out-of-reach proteins. The LCLS can also view tiny protein crystals grown within a cell, for the first time imaging biological structures as they exist in nature.

Toward Future Electronics
Experiments at LCLS are exploring new ways to change the magnetic and electronic properties of materials with ultra-short pulses of light. Such control could ultimately lead to extremely fast, low-energy, non-volatile computer memory chips or data-switching devices.

Matter in Extreme Conditions
For the first time, experimenters have the right tools to investigate high energy density matter in the laboratory. This work is revealing the true properties of matter present in the centers of stars and giant planets—and could help researchers both design new materials with enhanced properties and recreate the nuclear fusion process that powers the sun.

Breakthrough Innovation
Science magazine selected the LCLS as one of its top-ten breakthrough innovations because “it takes a qualitative stride far beyond its predecessors” by providing exceedingly bright x-ray light, driving applications in energy and environmental sciences, bioscience, and materials engineering.

Societal Impact

LCLS Pushes Frontiers in Many Science Areas

LCLS Trains Future Scientists & Engineers

Significant Demand for LCLS

Oversubscription: Experiments unscheduled due to limited resources & availability

2011 Users by Field of Research

2011 Users by Education Level

2011 Experiments Scheduled