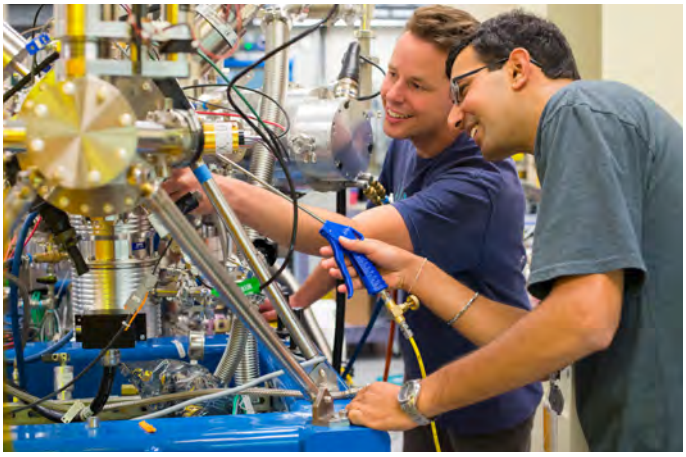
SLAC NATIONAL ACCELERATOR LABORATORY

LCLS
Linac Coherent Light Source

The LCLS is the world's most powerful X-ray laser. Its highly focused beam, which arrives in staccato bursts a few quadrillionths of a second long, allows researchers to probe complex, ultra-small structures and freeze atomic motions, thus shedding light on fundamental processes of chemistry, materials and energy science, technology and life itself.

World's First Hard X-ray Laser

X-rays are scientists' best tool for probing matter on the atomic scale, and the LCLS is an X-ray source unlike any before. Shining a billion times brighter than previous X-ray sources, the LCLS probes matter in new ways—revolutionizing our view of the atomic world one snapshot at a time.



Catching Photosynthesis in the Act

Photosynthesis may be one of the most important chemical reactions on Earth, yet most aspects are not fundamentally understood. With the LCLS, researchers can directly observe the natural processes that convert the sun's light into useable energy, with promising implications for America's energy future.

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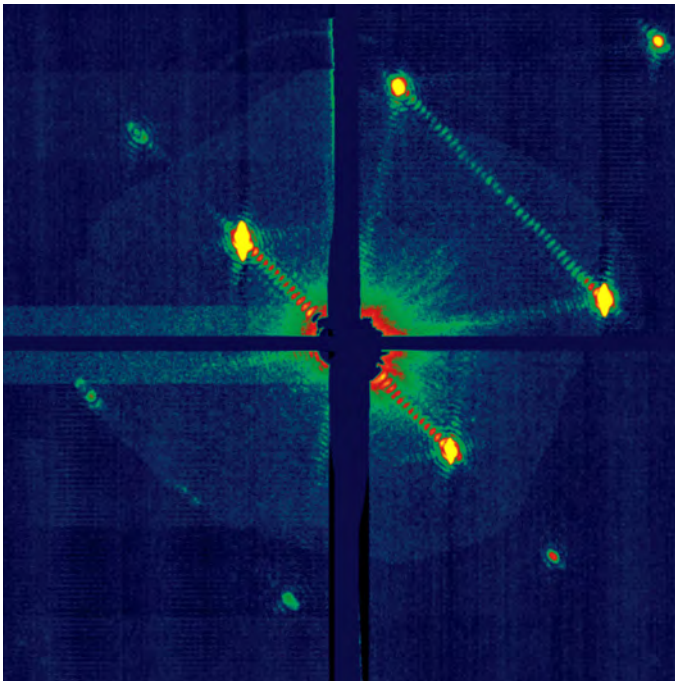
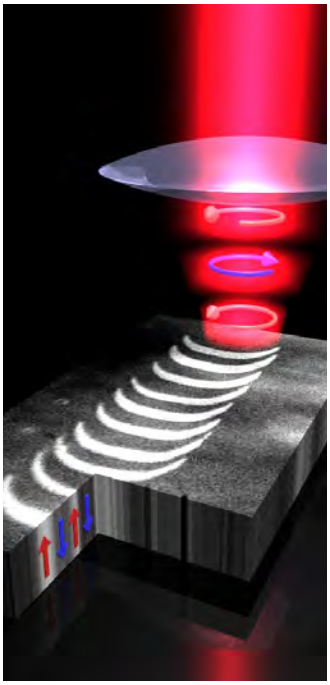
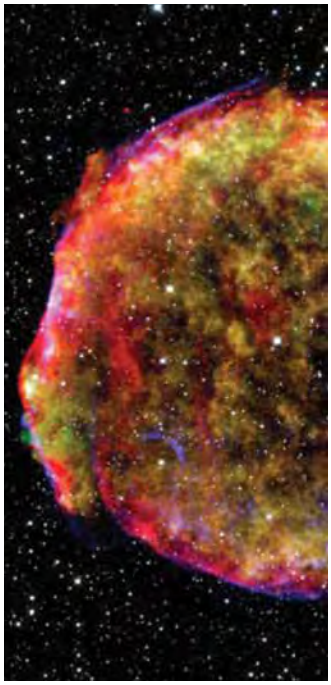
Office of Science







From left: A pattern made by LCLS X-ray pulses hitting a nano-crystal of photosynthetic protein; pulses from an optical laser write information onto magnetic material, a process that's being studied with the LCLS beam; and an image of a supernova, or exploding star, whose hot, dense interior can be recreated and probed with the LCLS.
(Images courtesy of Thomas White, DESY; Theo Rasing, Radboud University Nijmegen; NASA.)

Revealing Life's Secrets

Scientists are using the LCLS to determine the structures of proteins from tiny nanocrystals, some of them grown inside living cells. This unique capability opens the door to studying tens of thousands of biological structures that were out of reach before, including proteins important in disease and its treatment.

Developing Future Electronics

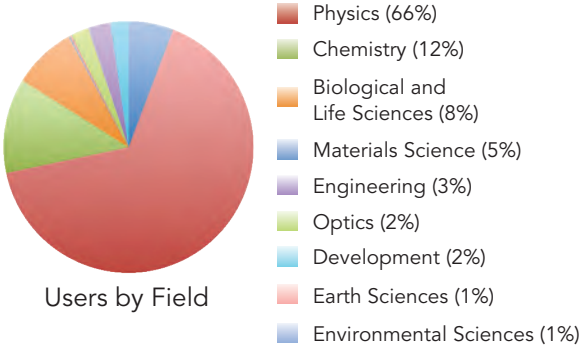
Experiments at LCLS are exploring new ways to change the magnetic and electronic properties of an important class of electronic materials with ultra-short pulses of light. Such control could ultimately lead to extremely fast, low-energy, non-volatile computer memory chips or data-switching devices.

Studying Matter in Extreme Conditions

For the first time, the LCLS gives scientists the right tools to investigate the extremely hot, dense matter at the centers of stars and giant planets. These experiments could help researchers design new materials with enhanced properties and recreate the nuclear fusion process that powers the sun.

LCLS Facts

- 403 total LCLS staff
- 516 scientists conducted experiments in 2011
- 3,925 operating hours in 2011
- 6 experimental stations



Users by Field

The Linac Coherent Light Source at SLAC National Accelerator Laboratory is an Office of Science user facility operated for the Department of Energy by Stanford University.