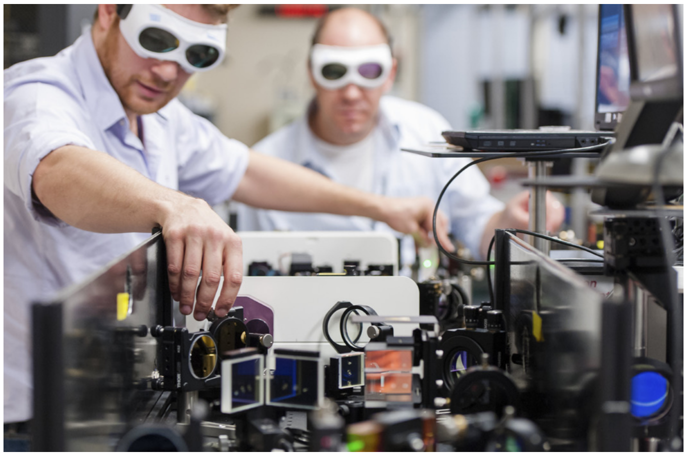
LCLS

Linac Coherent Light Source

The LCLS produces the world's brightest X-ray pulses. Like a high-speed camera with an incredibly bright flash, it takes X-ray snapshots of atoms and molecules at work, revealing fundamental processes in materials, technology and living things. These snapshots can be strung together into movies that show chemical reactions as they happen.

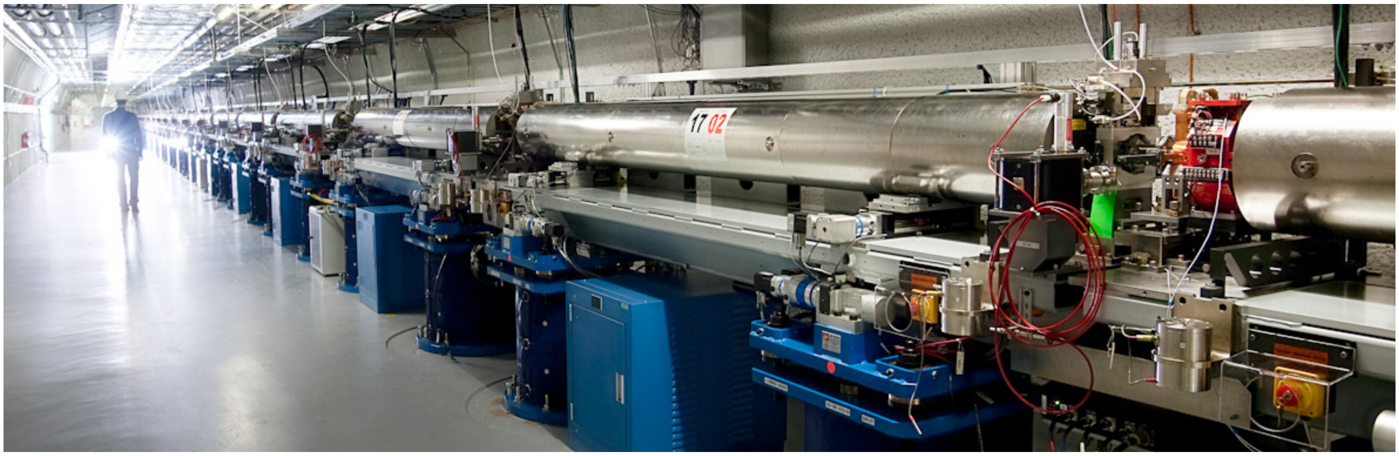


A Unique Tool for Science

LCLS creates X-rays a billion times brighter than those available before. Its laser pulses hit samples more than 100 times per second, with each one lasting just quadrillionths of a second – short enough to study samples in the instant before they are damaged by the intense light.

Catching Photosynthesis in the Act

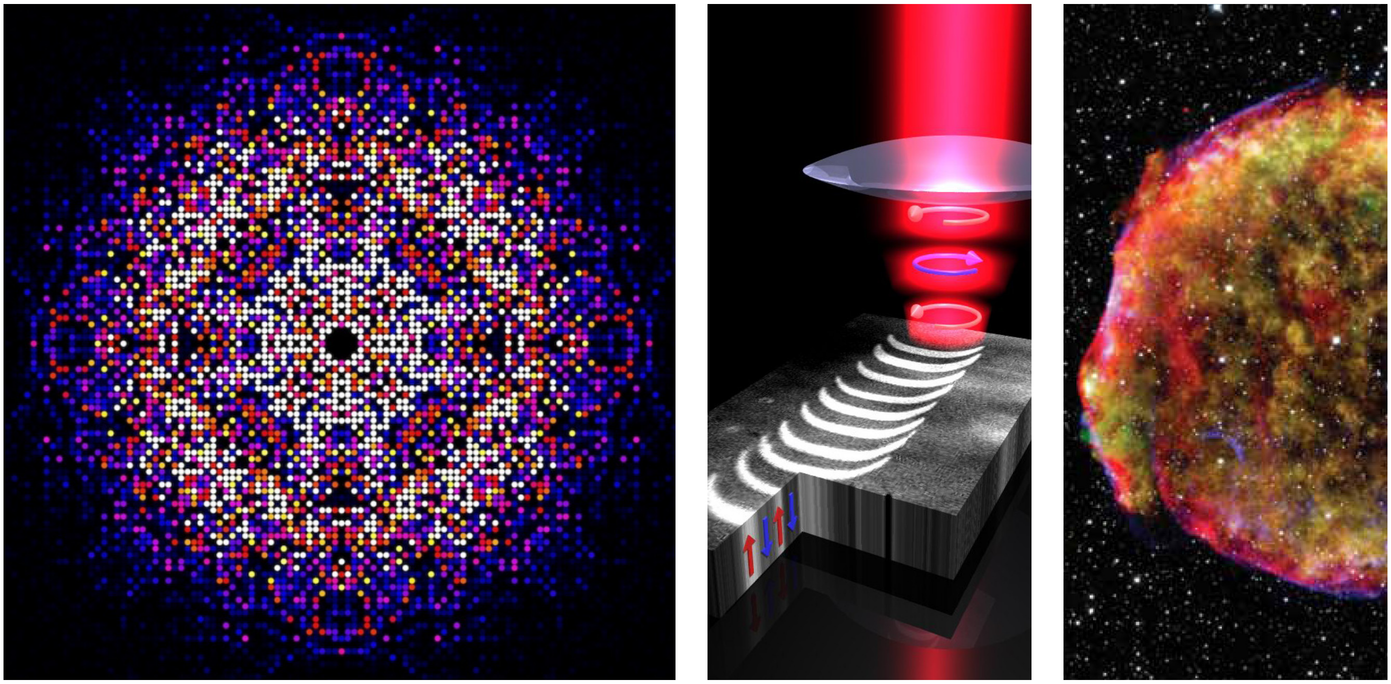
Photosynthesis is one of the most important chemical reactions on Earth, yet most aspects are not fundamentally understood. With the LCLS, researchers can directly observe the natural processes that convert the sun's light into useable energy, with promising implications for America's energy future.



SLAC National Accelerator Laboratory
2575 Sand Hill Road
Menlo Park, CA 94025–7015

slac.stanford.edu
lcls.slac.stanford.edu

U.S. DEPARTMENT OF ENERGY
Office of Science



From left: This pattern, created by merging hundreds of thousands of X-ray images obtained at LCLS, was used to produce the 3-D molecular structure of an enzyme involved in the transmission of African sleeping sickness; 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 LCLS pulses.
(Images by Karol Nass/CFEL; Theo Rasing/Radboud University Nijmegen; NASA.)

Revealing Life's Secrets

Scientists are using the LCLS to determine the structures of proteins from tiny nanocrystals. 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. One LCLS experiment, for instance, has provided important clues on how to combat African sleeping sickness.

Developing Future Electronics

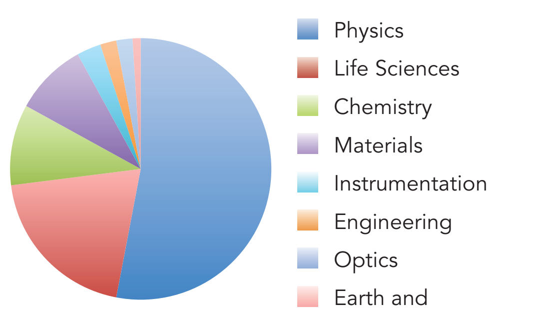
Experiments at LCLS are exploring new ways to design and control the magnetic and electronic properties of an important class of electronic materials with ultrashort pulses of light. This could ultimately lead to extremely fast, low-energy computer memory chips or data-switching devices.

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 help researchers explore how materials respond to stress, design new materials with enhanced properties, and recreate the nuclear fusion process that powers the sun.

LCLS Facts

- 594 scientists conducted experiments in 2013
- 4,580 operating hours in 2013
- 277 publications since LCLS began in 2009
- 15 collaborators, on average, per experiment proposal
- 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.

103165-02-2014