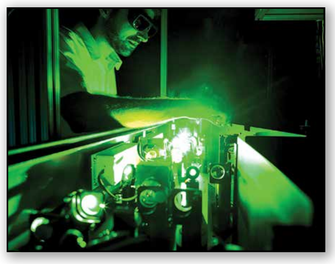
INNOVATION at National User Facilities

National User Facilities enable novel, large-scale collaborative research in materials science, nuclear physics, astronomy, and computing.

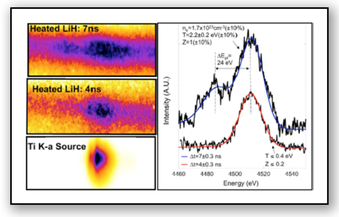
Linac Coherent Light Source



Breakthrough Innovation

In 2009, *Science* magazine selected the LCLS as one of its top-ten breakthrough innovations of the year because "it takes a qualitative stride far beyond its predecessors". Protein structure research at LCLS received the same honor from the magazine in 2012. LCLS provides exceedingly bright x-ray light, driving applications in energy and environmental sciences, bioscience, and materials engineering.

Jupiter Laser Facility



Looking Inside Dense Matter

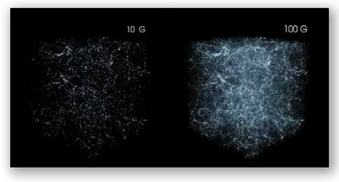
Using a technique known as Thomson scattering, X-rays produced by a laser beam from Jupiter facility scatter through a plasma. Analysis of the scattered X-rays measures the temperature and density of the plasma.

Fermi National Accelerator Laboratory

Accelerator Research Powers Innovation

Basic research and the continuous development of powerful investigative tools it requires can lead to discoveries that reshape the way we live. The construction of Fermilab's Tevatron accelerator enabled the superconducting wire industry and helped launch accelerator-based cancer therapy. Superconducting materials can carry far more electricity with minimal power losses than can be carried by conventional cables. Proton and neutron therapy target difficult to treat cancers.

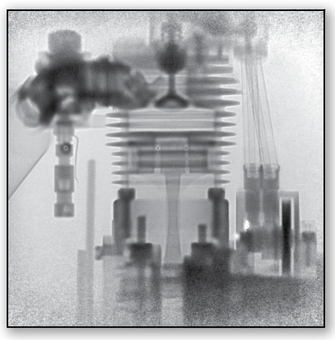
The Energy Sciences Network



World's Fastest Science Network

ESnet launched the world's fastest science network in 2011, with an initial speed of 100 gigabits per second and the ability to be extended to 44 times the initial capacity. The network, which initially connected the National Energy Research Scientific Computing Facility in California, the Oak Ridge Leadership Computing Facility in Tennessee, and the Argonne Leadership Computing Facility in Illinois, was extended nationwide in 2012.

Proton Radiography at LANSCE



Myriad Opportunities

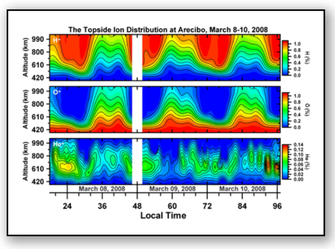
Research at pRad examines questions crucial to stewardship of the nation's nuclear stockpile. pRad experiments also investigate critical questions in fundamental and applied science. The penetrating power of protons makes it possible to see internal details in materials, even dense metals.

Advanced Photon Source

Living in the Material World

The extreme brightness of APS x-ray beams helps scientists analyze the properties of materials at the molecular level, where changes occur that can affect the way a material performs. This unique insight can lead to new materials: potentially metals that do not fail when deformed, new semiconductors and electronic devices for information technology and catalysts for the efficient production of environmentally-friendly refrigerants.

National Astronomy and Ionosphere Center



Space Weather and the Atmosphere

The Arecibo radar telescope in Puerto Rico monitors the ionosphere, the highest level of the Earth's atmosphere, and its reaction to the solar wind. These particle winds can disrupt communications and cause power outages and other electromagnetic disturbances. Arecibo's lidar capabilities probe the atmosphere between 30 and 110 km, profiling the temperature and chemistry by measuring the by-products of meteor burn-up.

Environmental Molecular Sciences Laboratory

A Twisting Turn for Energy Materials

To explore why batteries succeed or fail in operating conditions, scientists at EMSL built a working lithium-ion battery using a single nanowire as an electrode, and developed a custom probe to observe the nanowire's structural evolution during battery use. EMSL scientists are now working with GM and Applied Sciences Inc. to study silicon and carbon fiber nanocomposites to improve batteries for electric vehicles.

Molecular Foundry

Smart Window Coatings

Berkeley Lab researchers have discovered a semiconductor nanocrystal coating material capable of controlling heat from the sun while remaining transparent. Based on electrochromic materials, which use a jolt of electric charge to tint a clear window, this breakthrough technology is the first to selectively control the amount of near infrared radiation from the sun. Such a scheme could add a critical energy-saving dimension to "smart window" coatings.

U.S. Large Hadron Collider Program

Computing Grids and Global Networks

The LHC program produced more than 100 Petabytes of processed data in 2011. The data was distributed over long-range networks among 300 computing and data storage facilities, where thousands of scientists analyze the data. CERN, Fermilab, and Brookhaven National Laboratory work together to develop this massive scale distributed computing, storage and network environment necessary for prosecution of the experiments.

NATIONAL USER FACILITY ORGANIZATION