INNOVATION at National User Facilities

The advanced and often unique resources at the National User Facilities allow scientists to investigate atom-level and human-scale phenomena.

Argonne Tandem Linear Accelerator System

Applications Outside Nuclear Physics

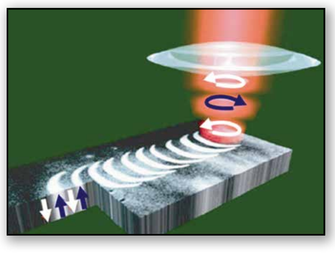
ATLAS can be used as a high-resolution mass spectrometer to detect trace concentrations of specific isotopes down to levels of 10^{-15} to 10^{-17} in various materials. An example is the isotope Argon-39, which has a half-life of 269 years. It is well suited to study the time scale of the 'ocean conveyer belt'. Minute amounts of Argon-39 are imbedded in the ocean water. Detection of the isotope is used to follow the ocean currents across the globe.

The Energy Sciences Network

From Bugs to Drugs and Maybe Jet Fuel

Microbes are microscopic organisms that live in every nook and cranny of our planet. Scientists believe that these tiny organisms could be key to solving a variety of problems, from identifying new sources of clean energy to a cancer cure, yet most of these "bugs" remain largely unstudied. ESnet is helping researchers by providing them with high-bandwidth connections between the Joint Genome Institute (JGI), where experiments like these are performed, and the National Energy Research Scientific Computing Facility. This allows researchers to quickly analyze their experimental data.

Linear Coherent Light Source



Toward 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.

High Flux Isotope Reactor

Advanced Superconducting Materials

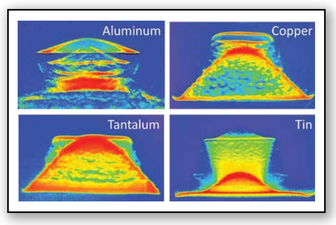
Superconducting materials can lead to improvements in many areas, but their use has been limited by the difficulty and expense of working with materials at cryogenic temperatures. HFIR research on a newly discovered high-temperature superconducting material is helping in the development of these more practical materials, which could provide more-efficient, less expensive products in fields such as energy, transportation, and medicine.

Fermi National Accelerator Laboratory • National Optical Astronomy Observatory

Focusing on Dark Energy

The Dark Energy Camera, a 570-megapixel device for surveying the galaxy, was assembled and tested at Fermilab. The enhanced sensitivity of the camera will enable the Dark Energy Survey to trace the history of the expanding universe and to characterize the dark energy within. The survey begins in 2013, following the installation of the camera at NOAO's Blanco telescope.

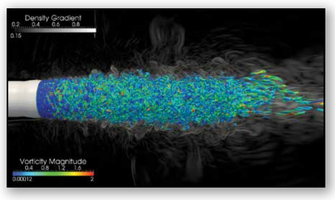
Proton Radiography at LANSCE



Fundamental Materials Research

Proton Radiography, invented at Los Alamos National Laboratory, provides a unique understanding of the fundamental behavior of materials. This set of radiographs, taken after various metals were shocked from below, reveals radically different behaviors- aluminum splits into layers while tin simply melts.

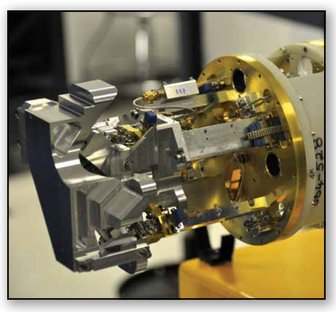
Argonne Leadership Computing Facility



"Greener" Jet Engines

GE Global Research scientists are using Argonne's supercomputing resources to study the complex flow of air and gasses in wind turbine airfoils and jet exhaust nozzles. This information is critical in developing quieter, more fuel-efficient wind turbines and jet engines.

National Radio Astronomy Observatory



Beyond Astronomy

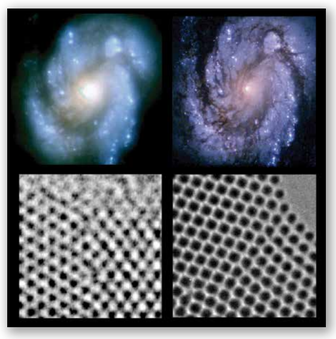
Technology developed or enhanced for radio astronomy is also used in communication antennas, medical and scientific imaging, time and frequency standards, atomic clocks, precision spacecraft navigation, and 911 emergency call centers. NRAO telescopes also track and predict the orbits of potential "killer" asteroids, and monitor minute shifts in the Earth's crust that can help predict seismic activity.

Center for Functional Nanomaterials

A Dream Nanomaterial

CFN researchers have devised a new way of preparing large areas of graphene – a form of carbon that is just one atom thick – in order to uncover the material's unique properties and potential for applications. The scientists have used ordered structures of graphene on metal substrates as a template for producing arrays of uniformly-sized metal nanoparticles, which may serve for discovering size-effects on chemical reactivity and catalysts. They have demonstrated that graphene-terminated metal films are effective reflectors for beams of neutral atoms, opening the door for applications such as focusing mirrors in helium atom microscopy and quantum information processing.

National Center for Electron Microscopy



The TEAM Project

The Transmission Electron Aberration-corrected Microscope (TEAM) project, an NCEM-led collaboration of several national labs (LBNL, ANL, ORNL, BNL) and the University of Illinois, has developed an ultrastable electron microscope with novel electron optics and a high-brightness source. The effect of aberration correction on image quality and contrast is as important for the TEAM microscope as it has been for the Hubble Space Telescope. The improved instrument resolution and contrast are exploited to detect buried defects and the dynamic arrangements of single atoms and atom pairs with sub-angstrom resolution.

NATIONAL USER FACILITY ORGANIZATION