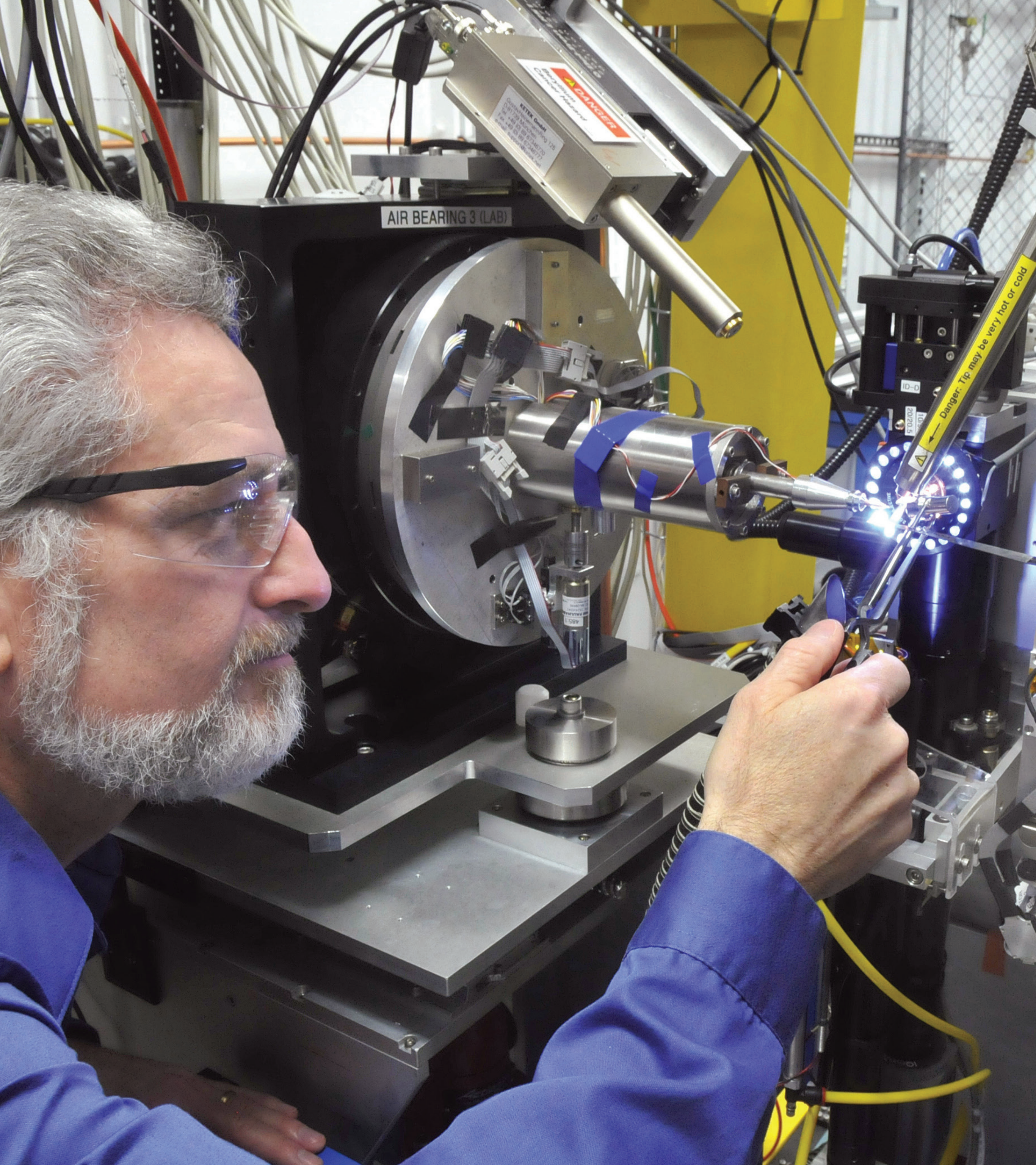
The Advanced Photon Source

at Argonne National Laboratory

Lighting the Way to a Better Tomorrow


AIR BEARING 3 (LAB)
DANGER
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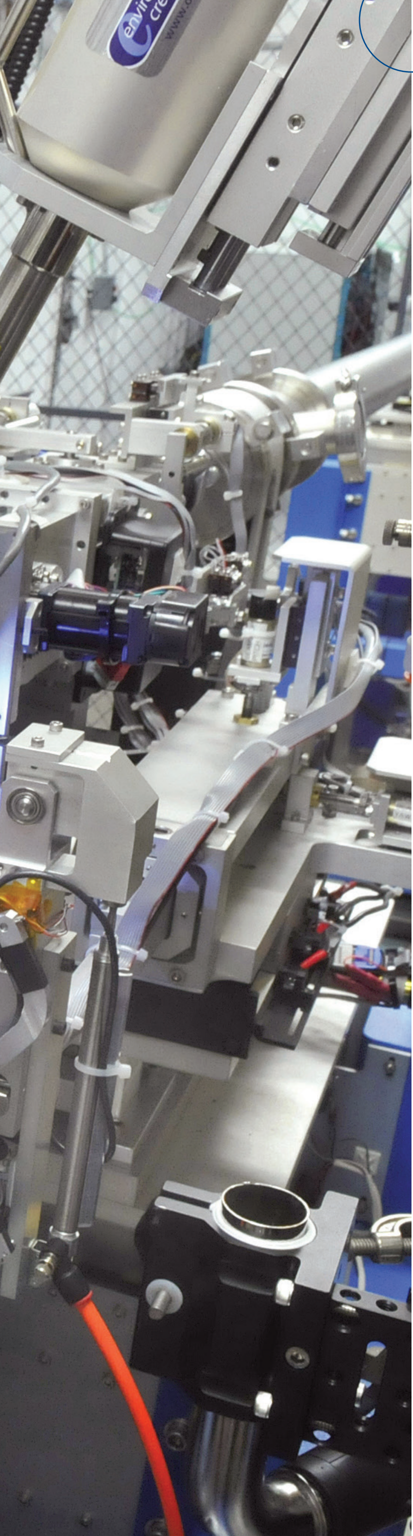


The Advanced Photon Source

Ever since humans first used fire, light has shown us the way. Today, the high-energy, penetrating x-ray beams from the U.S. Department of Energy (DOE) Office of Science's Advanced Photon Source (APS) at Argonne National Laboratory give us access to a powerful, versatile, invisible light that is ideal for:

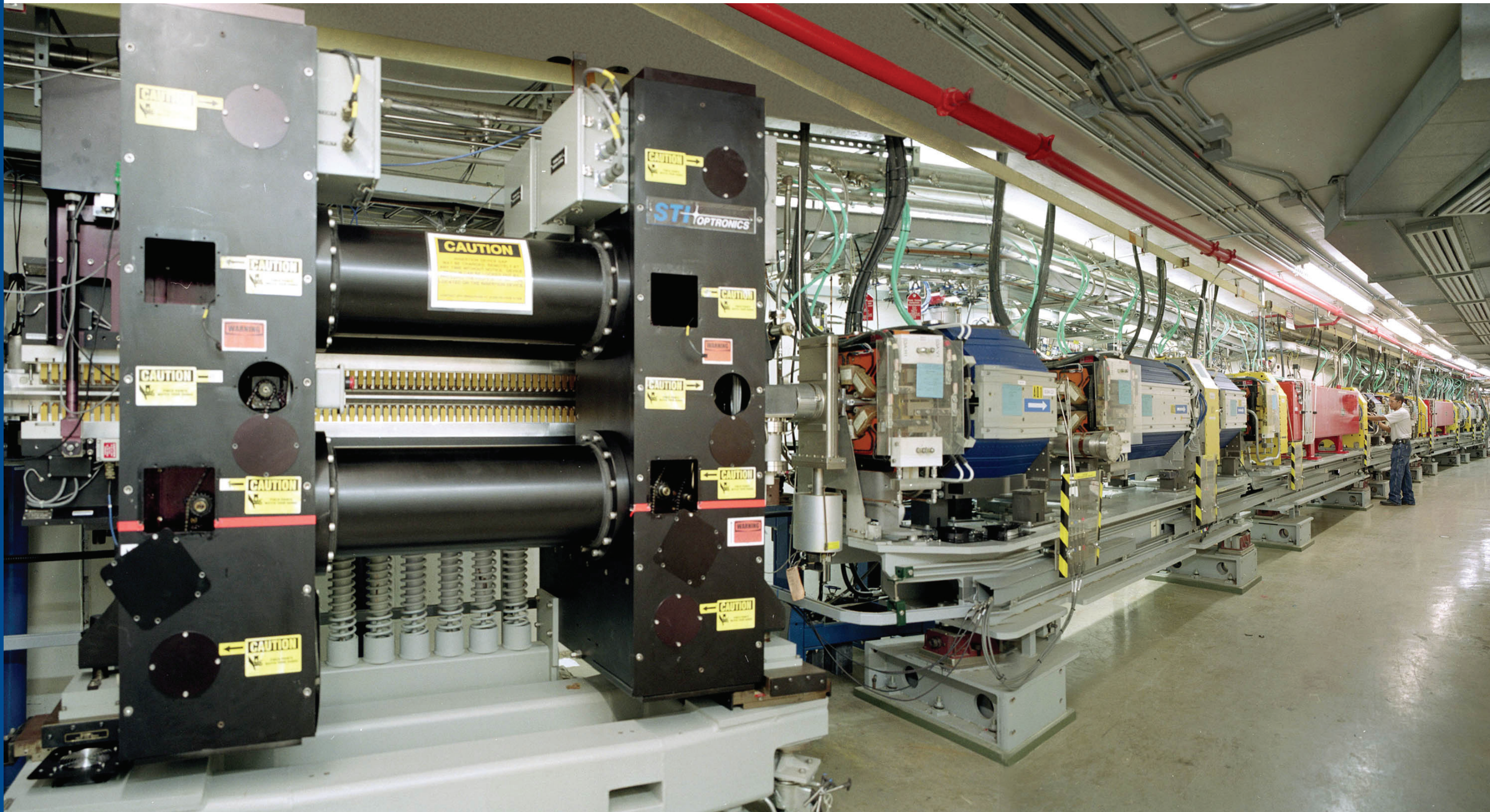
- Studying the arrangements of molecules and atoms,
- Probing the interfaces where materials meet,
- Determining the interdependent form and function of biological proteins, and
- Watching chemical processes that happen on the nanoscale.

This remarkable scientific tool helps researchers illuminate answers to the challenges of our high-tech world, from developing new forms of energy, to sustaining our nation's technological and economic competitiveness, to pushing back against the ravages of disease.

Each year, thousands of researchers representing universities, industries, and research labs from the United States and foreign countries are drawn to the APS. Here, they utilize the brightest high-energy x-ray beams in the Western Hemisphere to carry out experiments in materials science, chemistry, physics, biology and life science, geoscience, environmental science, and agricultural science. The DOE confidently invests in world-leading research centers such as the APS and the other DOE Office of Science User Facilities (see pages 16 and 17) because of the positive impacts of the science carried out on behalf of our nation and the world.

On the cover: Aerial view of the Advanced Photon Source facility

Argonne NATIONAL LABORATORY
Advanced Photon Source



The APS storage ring, where electrons orbit at nearly the speed of light to produce high-energy x-ray beams for research

The APS facility — which is large enough to encircle a major-league baseball stadium — houses a suite of particle accelerators that, along with other equally sophisticated technical components such as x-ray beamlines and detectors, are the result of innovative research and development carried out by Argonne scientists, engineers, and technicians. The accelerators produce, accelerate, and store a beam of high-energy (relativistic) electrons. As the electrons orbit through powerful electromagnets, they are deflected by permanent-magnet devices and emit synchrotron radiation, which covers a broad segment of the electromagnetic spectrum with wavelengths shorter than visible light. These wavelengths are invisible to the human eye and include extreme ultraviolet and x-ray radiation. They match the corresponding features of atoms, molecules, crystals, and cells, just as the longer wavelengths of visible light match the sizes of the smallest things the human eye can see.

These very-high-brightness, high-energy x-ray beams, together with the latest in scientific instruments and techniques allow researchers to carry out the cutting-edge experiments that positively impact nearly every aspect of our lives while training the next generation of scientists for continuing discovery.

The APS is a highly successful partnership between government, academia, and industry. The DOE Office of Science provides the APS operating budget, while UChicago Argonne, LLC operates the APS and Argonne for the DOE.

Researchers representing universities, companies, government agencies, medical schools, and private research labs from all 50 U.S. states, the District of Columbia, Puerto Rico, and foreign countries depend on the APS as a vital resource in their pursuit of knowledge, either by funding research at the APS or sending their own scientists as users. Many of these institutions and companies invest millions of their own dollars to equip APS x-ray beamlines with sophisticated, high-technology instruments to carry out forefront research.

At the Advanced Photon Source, a "sector" comprises the radiation sources (insertion device and bending magnet), x-ray beamlines, research stations, and instrumentation that are associated with a particular section of the electron storage ring and a particular research group. The APS has 40 sectors (see diagram at right), 34 of which are dedicated to user science and experimental apparatus. The 35th has limited space for instrumentation and is used primarily for accelerator-related studies. The remainder are taken up with electron storage ring equipment. All of the user science sectors operate simultaneously and are available to the research community for experiments through an open, peer-reviewed proposal process.

X-ray Science Division (XSD) sectors are operated by the APS, while Collaborative Access Team (CAT) sectors are built and operated by groups comprising scientists from universities, industry, and/or research laboratories. Some current XSD sectors have historic CAT origins.

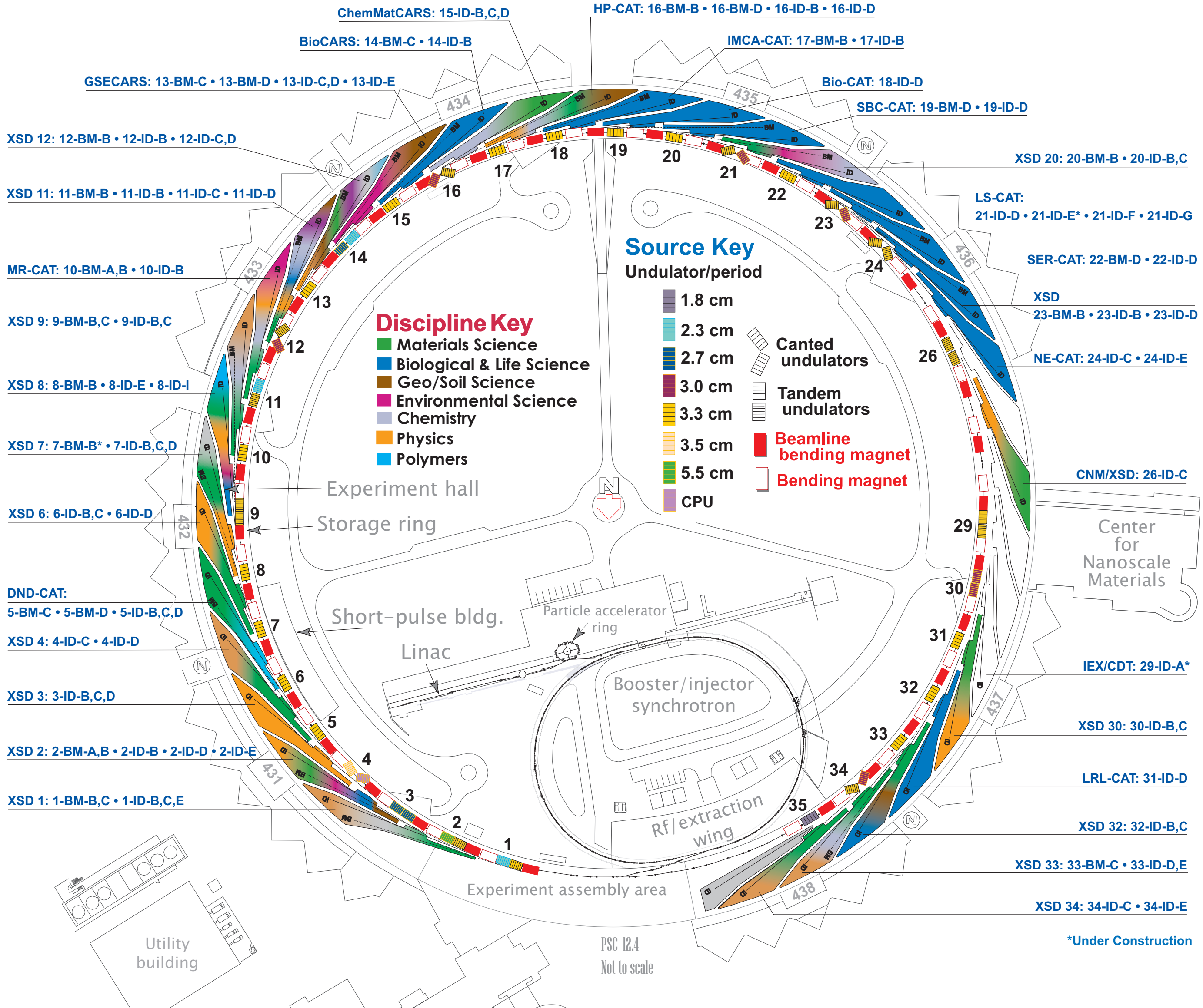
Sectors 1 through 4, 6 through 9, 11, 12, 20, 23, 30, and 32 through 34 are operated by XSD. **Sector 26** is operated jointly between the Argonne Center for Nanoscale Materials and XSD. Researchers using the beamlines in these sectors carry out experiments in materials and chemical science, physics, geological and environmental science, nanoscience, and biological and life sciences utilizing an array of experimental techniques including inelastic x-ray and nuclear resonant scattering, spectroscopy, structural science, surface scattering and nanodiffraction, time-resolved research, x-ray microscopy and imaging, and macromolecular (protein) crystallography. These studies advance our fundamental scientific understanding of the world around us and advance the technologies underpinning a secure energy and economic future.

Sector 5: The DuPont-Northwestern-Dow CAT has as its scientific thrust the study of two-dimensional or quasi-two-dimensional atomic structures (surfaces, interfaces, and thin films), and polymer science and technology. All are of immense technological importance.

Sector 10: The Materials Research CAT enables scientific work that is broadly materials oriented. The main emphasis is on *in situ* studies of materials by x-ray spectroscopy, scattering, and reflectivity. There are strong environmental science and catalysis components to this research in addition to furthering materials-based technologies such as photochemistry and x-ray lithography.

Sectors 13 through 15: Center for Advanced Radiation Sources (CARS):

- GeoSoilEnviroCARS at Sector 13 is dedicated to state-of-the-art research on Earth materials for a better understanding of our environment and planet.
- BioCARS at Sector 14 is dedicated to the development of resources and facilities to foster frontier research in time-resolved macromolecular crystallography. By watching macromolecules in action we further our understanding of how macromolecules function. This ultimately leads to advances in the causes, prevention, and treatment of disease.
- ChemMatCARS at Sector 15 focuses on the study of surface and interfacial properties of liquids and solids as well as their bulk structure at atomic, molecular, and mesoscopic length scales with high spatial and energy resolution to advance materials and chemical science.



A plan view of the APS facility showing (1) locations of x-ray beamlines and beamline operator groups, (2) scientific disciplines investigated at the APS, and (3) locations and arrangements of x-ray producing electromagnets and insertion devices in the electron storage ring.

(continued)

Sector 16: The High-Pressure CAT advances cutting-edge, multidisciplinary, high-pressure science and technology enabling myriad scientific breakthroughs in high-pressure physics, chemistry, materials, and the Earth and planetary sciences.

Sector 17: The Industrial Macromolecular Crystallography Association CAT (a consortium of leading pharmaceutical companies) provides an outstanding support environment for macromolecular crystallography by developing and operating an efficient, reliable, high-throughput facility for the study of pharmaceutically relevant molecular proteins to further research into the causes, prevention, and treatment of disease.

Sector 18: The Biophysics CAT develops and operates state-of-the-art facilities for studies of the structure and dynamics of biological systems under non-crystalline conditions similar to their functional states in living tissues in order to better understand human physiology.

Sector 19: The Structural Biology Center CAT advances and promotes scientific and technological innovation in support of the DOE's mission by providing world-class scientific research and advancing scientific knowledge in biology to further research into the causes, prevention, and treatment of disease.

Sector 21: The Life Sciences CAT provides macromolecular crystallography resources for those with a need to determine the structure of molecular proteins via access to state-of-the-art x-ray diffraction facilities at the APS to further research into the causes, prevention, and treatment of disease.

Sector 22: The Southeast Regional CAT provides third-generation x-ray capabilities to macromolecular crystallographers and structural biologists with an emphasis on new structure determinations, high-resolution structural analyses, drug design, protein engineering, site-directed mutagenesis projects, and support of the genome program to further research into the causes, prevention, and treatment of disease.

Sector 24: The Northeastern CAT operates synchrotron x-ray beamlines to address technically challenging problems in structural biology and to provide an important resource for the national community of researchers to further research into the causes, prevention, and treatment of disease.

Sector 31: The Lilly Research Laboratories CAT is dedicated to the determination of protein structures and the analysis of the interactions between potential pharmaceutical compounds and a protein of interest to further research into the causes, prevention, and treatment of disease.

The Advanced Photon Source Upgrade Project

The brightness and energy of x-ray beams are critical properties for research. Higher brightness means more x-rays can be focused onto a smaller, laser-like spot, allowing researchers to gather more data in greater detail in less time. Higher energies allow x-rays to penetrate deeper inside materials to reveal crucial information about a material's structure and function. The combination of high brightness and high energy allows the observation and imaging — in real time — of fast and ultrafast technologically important processes, including fuel sprays, magnetic switching, and biological processes in living organisms.

The APS Upgrade project will increase the brightness of the APS high-energy (hard) x-ray beams. This will equip researchers for the groundbreaking discoveries and transformational innovations that create new products and industries and generate jobs.

In April 2010, the DOE identified the national need for the APS Upgrade (APS-U) project by approving Critical Decision 0, authorizing development of a conceptual design. In September 2011, the Director of the DOE Office of Science gave his approval for Critical Decision 1, formally approving the alternative selection and cost range for the project, establishing the preliminary technical scope, and authorizing a detailed preliminary design and initial research and development. The completed project will increase the number of users and experiments that can be accommodated by the APS, and the brightness of the x-ray beams at the APS.

One frontier for x-ray science in the 21st century is to combine atomic-level *spatial* and *temporal* information in a quest to understand and control the behavior of complex chemical, materials, and biological systems at a molecular level. Perhaps no research tool is as applicable to this research as tunable, short-pulse x-rays, which provide access to elemental, chemical, orientational, and electronic orbital information for atoms in complex environments on time scales ranging from a few femtoseconds to many seconds. The APS-U will offer experimenters pulses of a few picoseconds duration and tunable x-ray energies.

Materials subjected to extremes of pressure, temperature, and electromagnetic fields often display novel electronic, magnetic, and structural properties. Discovering and understanding these phases of matter can provide key insights for designing new materials and improving their properties. High-energy x-rays are a powerful tool for answering these questions, with capabilities that will be dramatically enhanced through the APS-U.

In addition to many advances in critical fields and technologies, the APS-U will greatly enhance the synergies among Argonne's existing user facilities and research programs, all of which are located within a one-mile radius. These partnering user facilities and research programs include:

The Center for Nanoscale Materials is a regional center for basic and applied research on nanoscale materials. Its portfolio includes energy-related research and development programs.

The Argonne Leadership Computing Facility provides leadershipclass computing resources to the scientific community around the world.

The Structural Biology Center operates a national user facility dedicated to understanding the structure and function of large biological molecules that are important to energy resources, health, a clean environment, and national security.

The Electron Microscopy Center for Materials Research develops and maintains unique capabilities for electron beam characterization and applies those capabilities to solve materials problems.

The Transportation Technology R&D Center brings together scientists and engineers from many disciplines to find cost-effective solutions to the problems of transporting people and goods from one place to another — issues such as vehicle emissions and energy supply.

Energy Research

From better batteries to renewable energy sources, research by APS users is shedding light on energy solutions that will help to reduce our nation's dependence on foreign oil and our carbon footprint.

Research with Impact — Success Stories

Better, cleaner fuel injectors

Fuel injector efficiency and clean combustion are dependent on the best possible mixture of fuel and air in engines. To improve injector design, it is critical to understand how fuel is atomized as it is injected. Argonne researchers are using the APS to look inside liquid sprays from fuel injectors to help optimize combustion for cleaner and more efficient engines.

Improving natural gas turbines

Power plants with turbine engines that burn natural gas can supply clean, increasingly more fuel-efficient, and relatively low-cost energy. The efficiency of these turbine engines can be further increased by reducing the turbine weight, increasing the operating temperature, or increasing the component lifetime. APS researchers are finding new ways to incorporate higher-temperature, higher-performance materials for this promising energy source.

Looking Ahead — Future Innovations

Electric car batteries

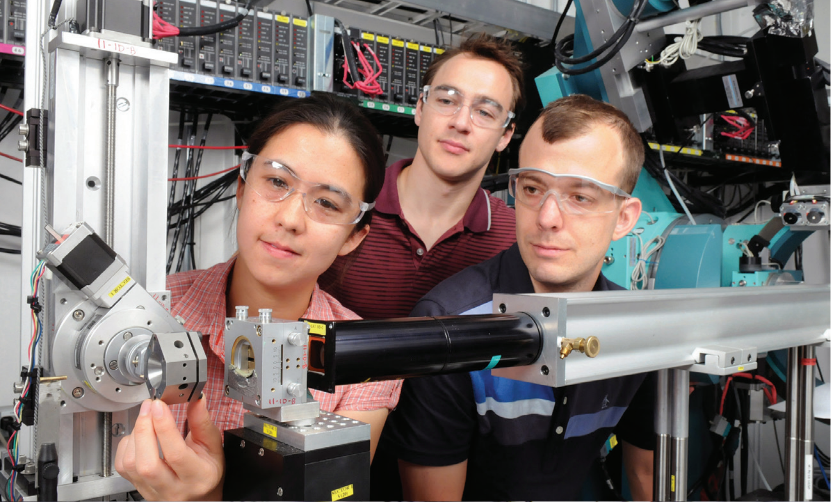
To make all-electric vehicles more commercially viable, we need revolutionary batteries that last longer and store 10 times more energy than today's lithium-ion batteries. Scientists must study the nanoscale chemistry that takes place at electrode interfaces inside realistic, operating lithium-ion batteries—something not possible today.

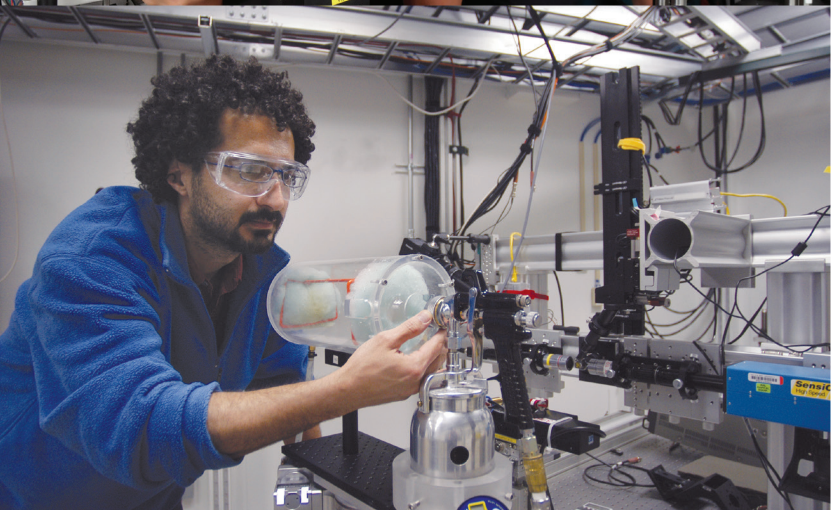
The APS Upgrade project will enable this research with an increase of the inelastic scattering signal for penetrating x-rays.

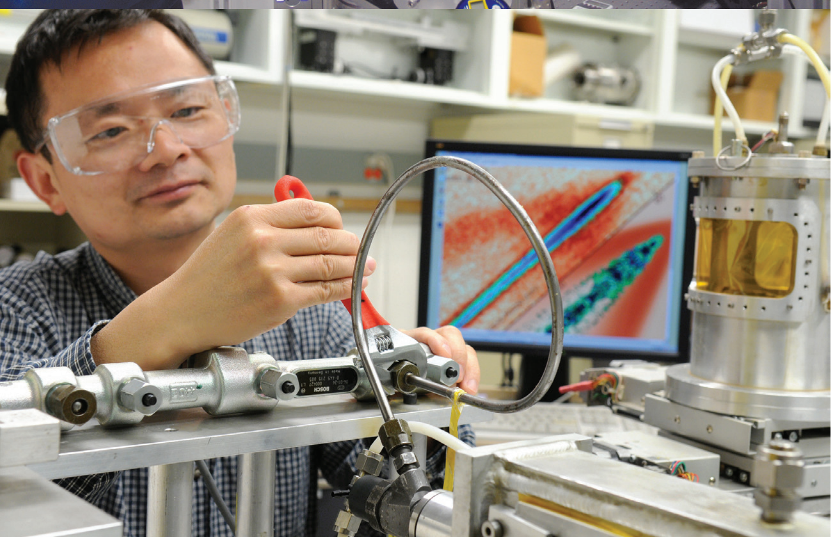
Renewables and electronics

Harnessing the power of sunlight through solar energy conversion could transform the world by making inexpensive energy readily available anywhere the sun shines. Electronics based on photoactive materials could lead to whole new industries and products that create thousands of new jobs. But before these technologies can be created, scientists must understand the intermediate steps within complex reactions, many of which take place in a picosecond (1 trillionth of a second) and involve rapid changes in molecular shape and structure.

The APS Upgrade project will provide x-rays of unprecedented energy that are uniquely suited to real-time studies of reactions that take place in the 1-100 picosecond range.







Catalyst nanoparticles for sustainable energy

Improved catalysts are critical in creating new sustainable energy and environmental technologies, such as solar fuels, fuel cells, and clean-burning engines. They are also used in the manufacture of an estimated 90% of all commercial chemical products and generate nearly $1 trillion in product sales worldwide. But our ability to improve catalytic processes and invent new ones is limited because we cannot study catalysts in fine enough detail in real time and real working environments.

The penetrating hard x-ray beams from the APS Upgrade project will answer critical questions by providing scientists with the tools needed to study catalysts in realistic environments that include the presence of catalyst nanoparticles, substrates, and chemical atmospheres.

Materials Research

Researchers at the APS are exploring novel materials with the goal of understanding their atomic structures and functionalities. This knowledge enables scientists to break through bottlenecks in materials design to develop materials with desirable useful purposes.

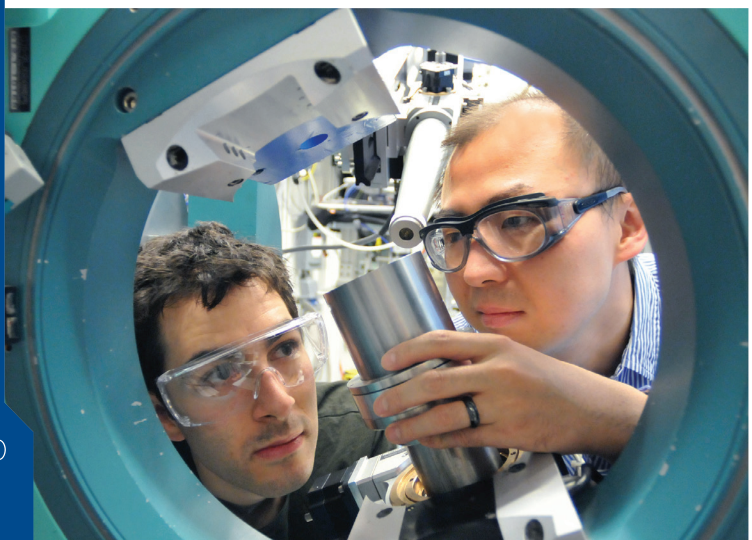
Research with Impact — Success Stories

Next-generation electronic materials

A new class of layered oxide materials discovered at the APS offers unprecedented opportunities for creating the next generation of electronic devices. The materials show intricate physical properties resulting in a rich collection of phenomena including magnetic ordering, metal insulator transitions, superconductivity, magneto-resistivity, and ferroelectricity. By using these properties and the ability to tune them, scientists hope to create a new generation of all-oxide electronics that will enable groundbreaking new device functionalities.

Cementing the structure of calcium silicate hydrates

Surprisingly, the manufacture of cement is responsible for about 5% to 7% of all the carbon dioxide released by humans into the Earth's atmosphere every year. However, research at the APS is providing new insights into the nanostructure of calcium silicate hydrate (CSH), the main ingredient that gives concrete its great strength. With a better understanding of the crystalline structure of CSH, researchers are making it possible to use polymers and other materials to produce hybrid CSHs that are stronger and more environmentally friendly.



Looking Ahead — Future Innovations

Designer nanomaterials and molecules

Every sustainable energy technology, from solar cells to advanced batteries, to catalysts for clean fuel production, requires scientific breakthroughs at the nanoscale. The ultimate goal is to understand the relationships between structure and function so well that we can design entirely new materials to perform specific functions and then build those materials an atom at a time. To achieve this goal, we must study materials in real time as they grow in complex environments.

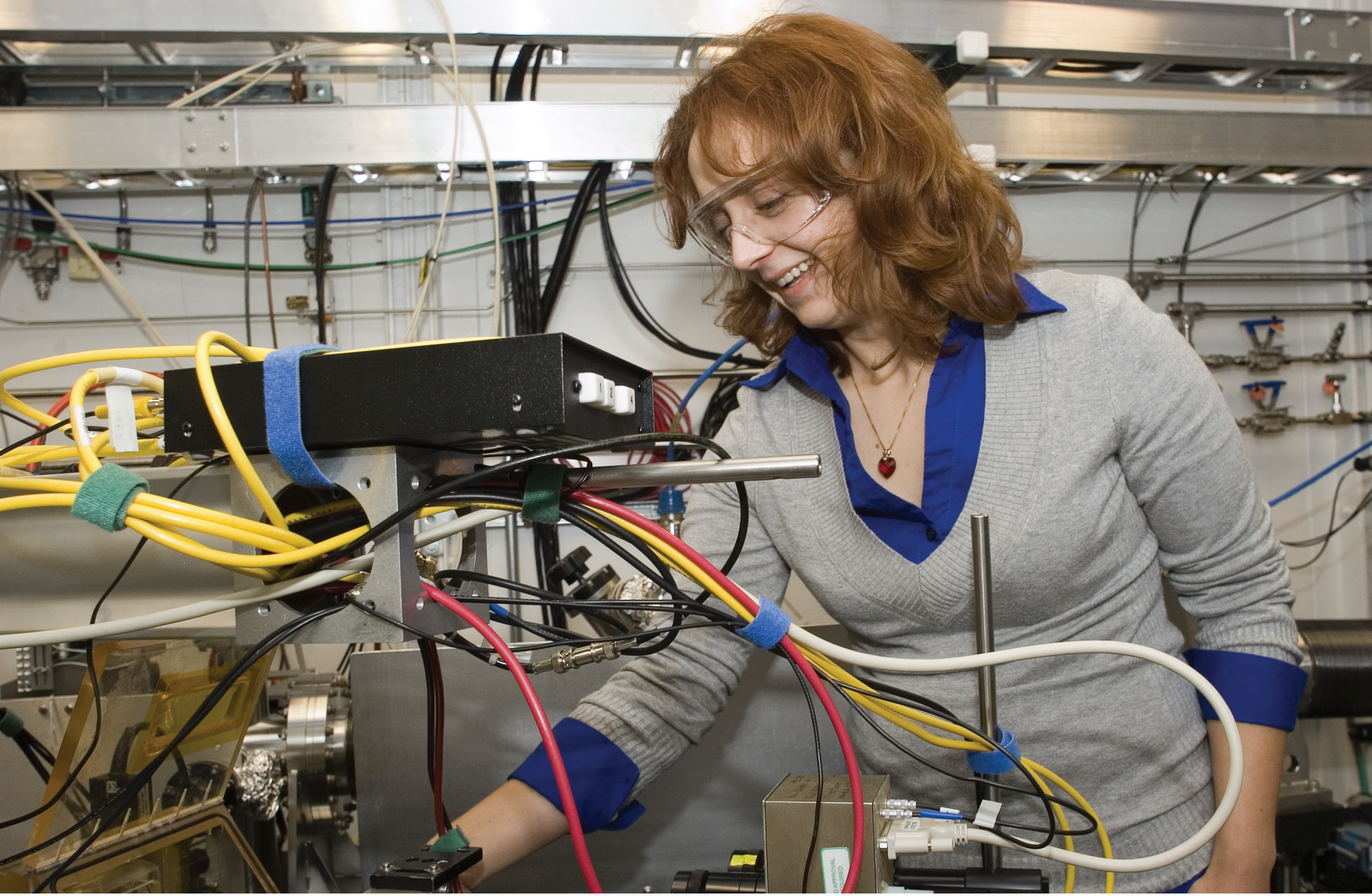
The APS Upgrade project will provide the highly penetrating x-rays that scientists need to image materials as they grow under real conditions.

Alloys and composites

High-performance, high-temperature, lightweight, and durable alloys as well as composites can help reduce fuel consumption and emissions by contributing to efficient turbines, transportation, and other energy technologies. But our ability to use them could be greatly improved with a better understanding of how they respond to the fast deformation of manufacturing techniques such as the rapid stamping of auto bodies, where lack of control prevents their use.

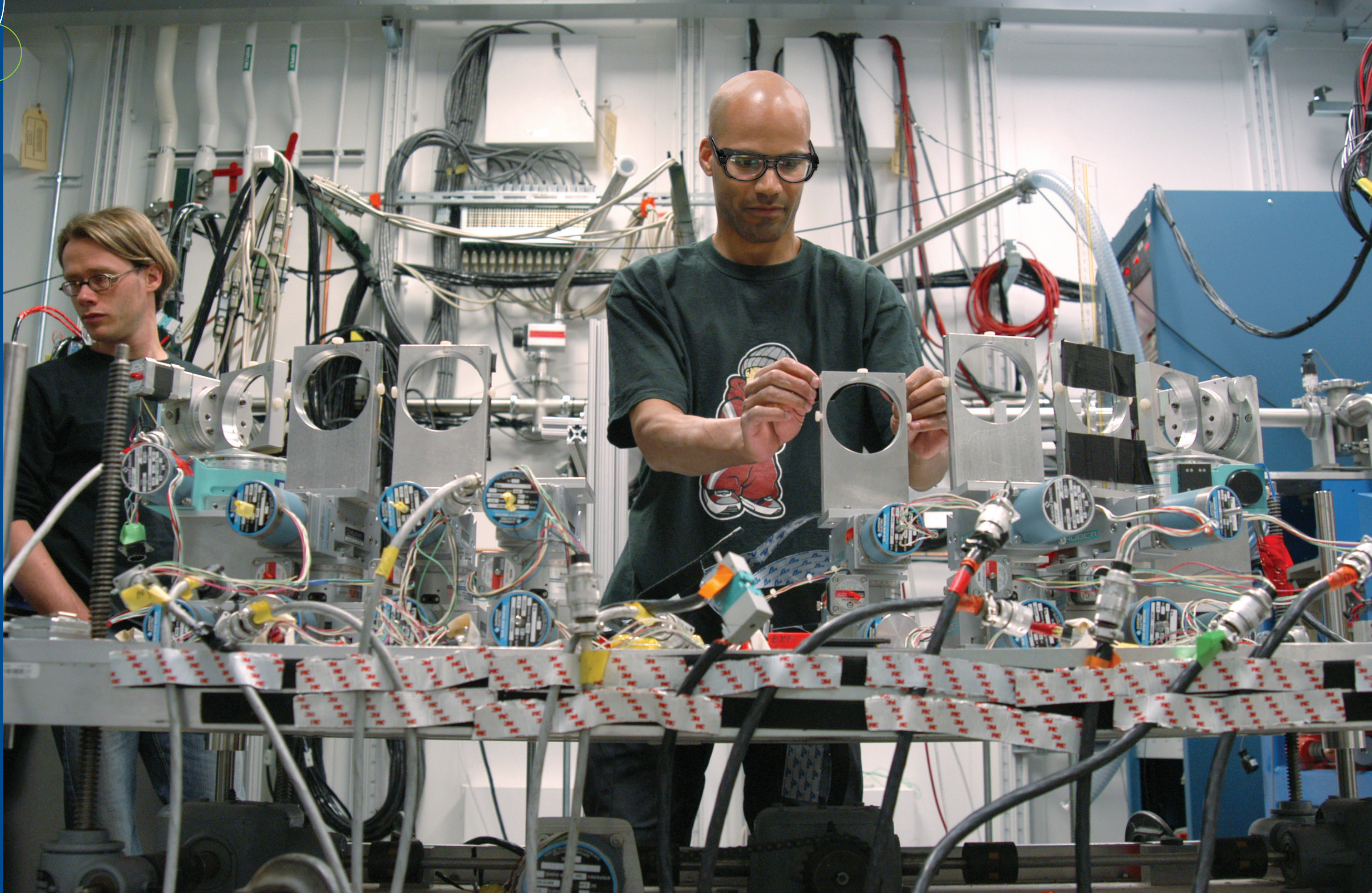
High-pressure and exotic materials

Under high pressure, even simple materials often show unexpected new properties, such as superconductivity, that can lead to innovations for energy and other applications.



By allowing scientists to study microscopic stresses in advanced alloys faster and with greater detail, the APS Upgrade project will enable the design of new metallic alloys for high-performance applications, such as lightweight car bodies, more efficient jet-engine turbines and power plants, and advanced components for nuclear and clean coal energy.

The APS Upgrade project will more than double the pressure and temperature extremes that scientists can study, making it possible to reproduce conditions at the center of the Earth and to test theoretical predictions, such as whether hydrogen exhibits a unique metallic superfluid phase that might be observable with the extended pressures and imaging resolution made possible by an upgraded APS.



The APS Upgrade project will improve the image resolution and “shutter speed” of the APS and expand research to topics such as protein folding, implicated in Alzheimer’s and other neurodegenerative diseases. The APS Upgrade project will also enable high-resolution, jitter-free images of breathing animals for important medical studies such as lung surfactants in post-natal or asthmatic stress conditions.

Health and Life Sciences Research

By studying the compositions and functions of proteins and other molecules, APS scientists are predicting biological behavior at the atomic level, leading to major scientific and medical breakthroughs.

Research with Impact — Success Stories

Answering key questions about the common cold

After more than a decade of research, scientists at the APS pieced together the structure of the cold-causing human adenovirus, the largest complex ever determined at atomic resolution. By determining the structure of the entire virus, the researchers revealed how a major protein, called hexon, was incorporated into the virus and how it interacted with other proteins. The new findings about the human adenovirus, that causes respiratory, eye, and gastrointestinal infections, may lead to more effective gene therapy, in addition to new anti-viral drugs.

Fighting AIDS with x-ray research

Research at the APS helped lead to Abbott Laboratories' development of Kaletra®, one of the world's most prescribed drugs for the treatment of AIDS. X-ray studies of the crystalline structure of the protein called HIV protease revealed the atomic details of how compounds interact with the protein, resulting in the creation of Kaletra, which blocks the ability of the HIV virus to reproduce. Since its approval, Kaletra has made a tremendous impact on helping to prevent progression of the disease in patients infected with the HIV virus.

Looking Ahead — Future Innovations

The machinery of life

The APS community leads the world in solving protein structures. As an example, the 2009 Chemistry Nobel Prize for the ribosome, the cellular machine that manufactures proteins, was based in part on work that was done at the APS. But the future lies in seeing and understanding even larger molecular machineries, such as proteins and assemblies embedded in membranes. These assemblies comprise the targets for 70% of all drugs.

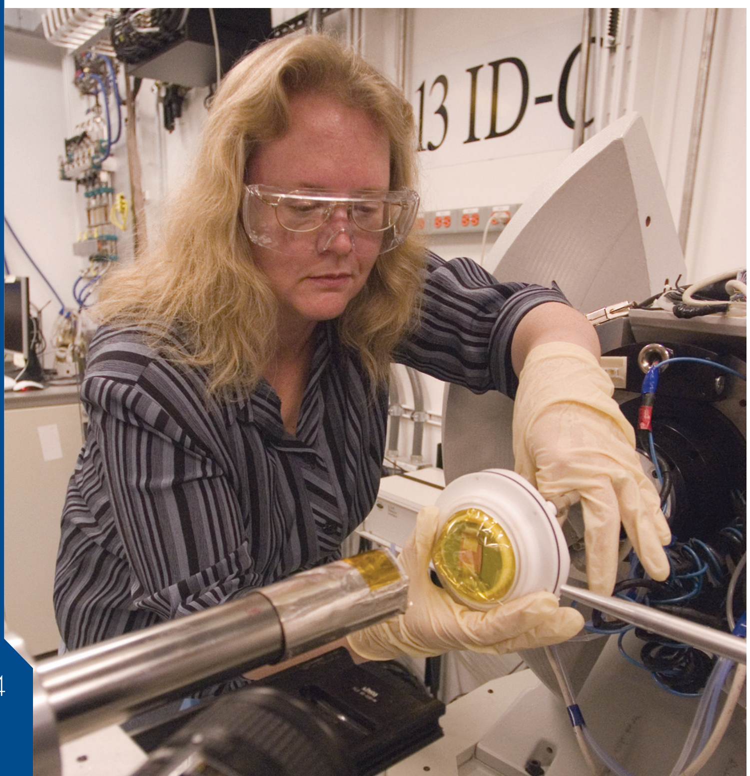
Environmental and Geological Research

Research at the APS is expanding our knowledge about everything from the center of the Earth to materials in outer space. With a better understanding of the world around us, we are better prepared to protect and sustain our planet's precious natural resources.

Research with Impact — Success Stories

A key to drought resistant crops

An international team of researchers at the APS has determined precisely how an important plant hormone works at the molecular level to help plants respond to environmental stresses such as drought and cold. The scientists were able to map the structure of the receptors that plants use to sense abscisic acid, a hormone that keeps seeds dormant and keeps buds from sprouting until the climate is right. Their findings could help engineer crops that thrive in harsh environments around the world and combat global food shortages.



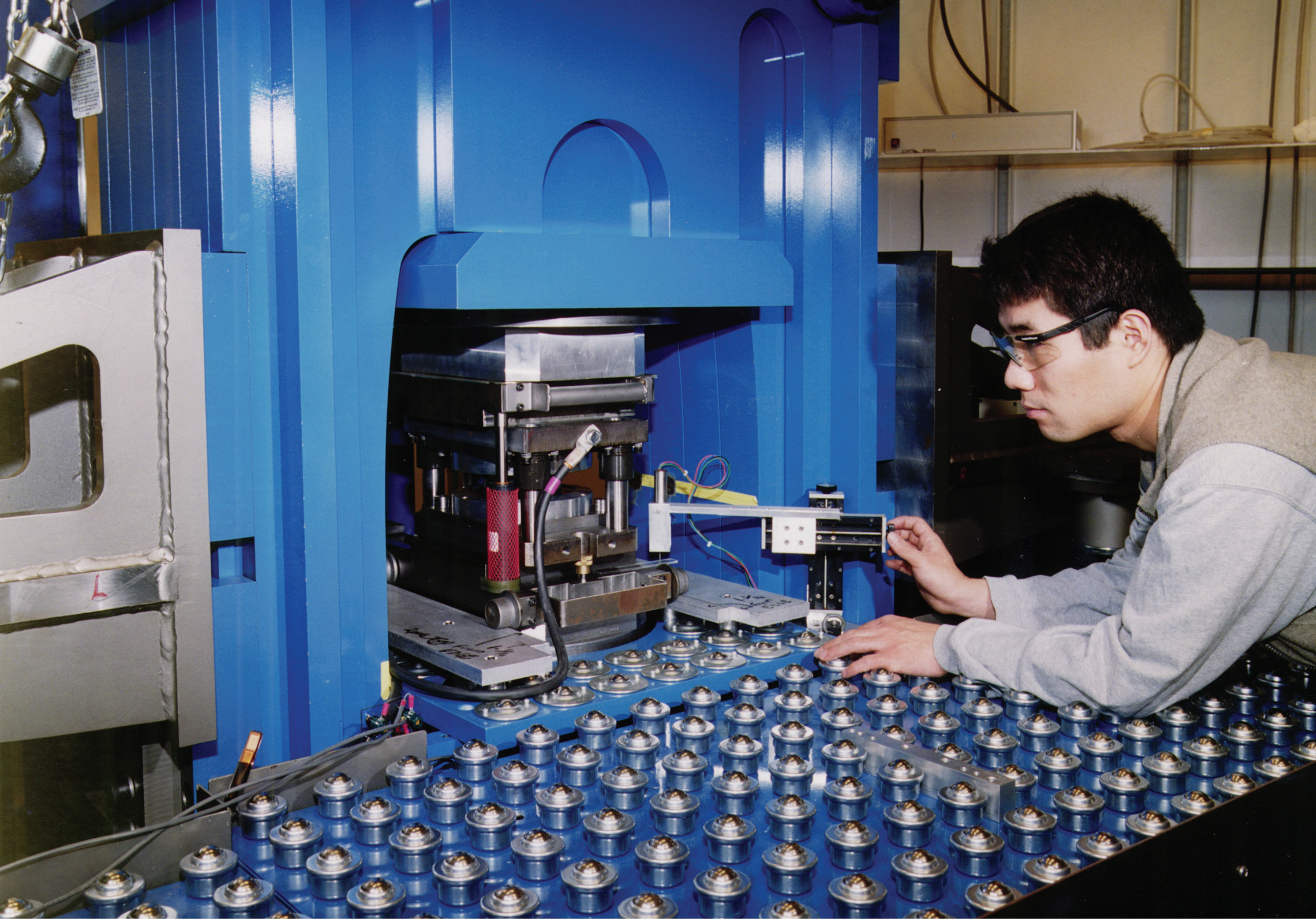
Marine life's impact on CO_2

Carbon dioxide levels are directly related to the growth and productivity of marine life, which is a function of phosphorus availability. A team of scientists at the APS identified a process by which marine organisms influence the amount of atmospheric carbon the sea absorbs. A greater understanding of how phosphorus uptake, metabolism, and sequestration occur within marine organisms could provide clues about how carbon uptake and sequestration take place in the ocean and how they affect global climate change.

Looking Ahead — Future Innovations

Carbon sequestration

One strategy for mitigating global climate change is to capture carbon dioxide emissions and sequester the gas in geological formations. But keeping it there requires the formation of carbonate minerals over thousands of years, a process that involves chemical reactions between carbon dioxide — both as a gas and dissolved in ground water — and the various minerals in the host rock, all under geological temperatures and pressures. We cannot develop reliable carbon-sequestration strategies until we achieve a better understanding of these fundamental geological processes.



New instruments planned for the APS Upgrade project will provide x-ray beams more intense than those available today and will let scientists watch and record key mineral-liquid reactions with molecular-level detail as they occur in real time.

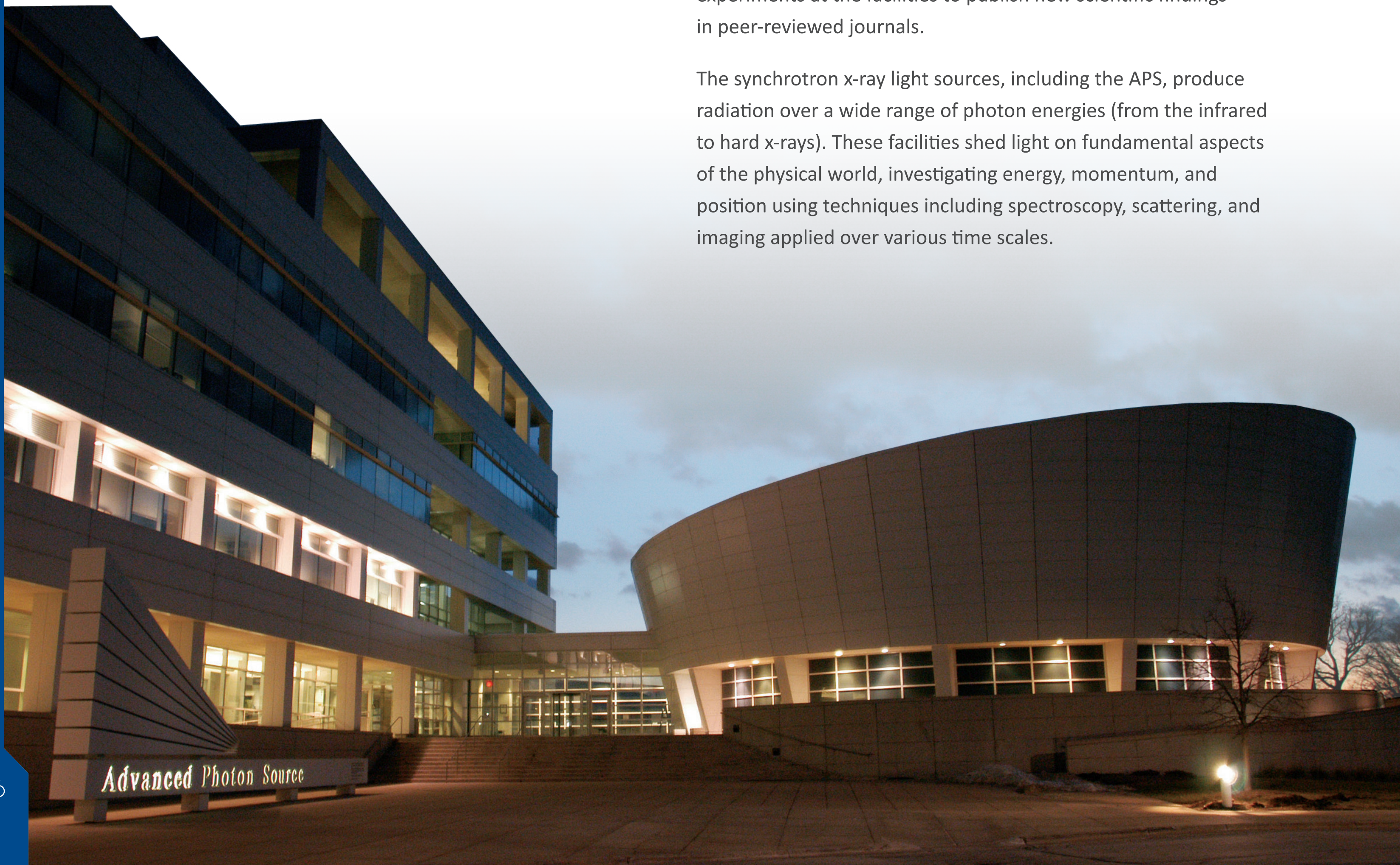
America's Light Sources

The U.S. DOE Office of Science supports the operation of many major research facilities across our nation that provide open, peer-reviewed access to sophisticated research tools for scientists (users) from academia, national laboratories, and industry carrying out research in all major scientific disciplines.

These large-scale user facilities consist of a complementary set of intense x-ray sources, neutron scattering centers, electron beam characterization capabilities, and research centers for nanoscale science. They allow scientists to probe materials in space, time, and energy with the appropriate resolutions that can interrogate the inner workings of matter — transport, reactivity, fields, excitations, and motion — to answer some of the most challenging grand science questions.

More than 10,000 scientists conduct experiments at DOE Office of Science user facilities each year. Thousands of other researchers collaborate with these users and analyze the data from the experiments at the facilities to publish new scientific findings in peer-reviewed journals.

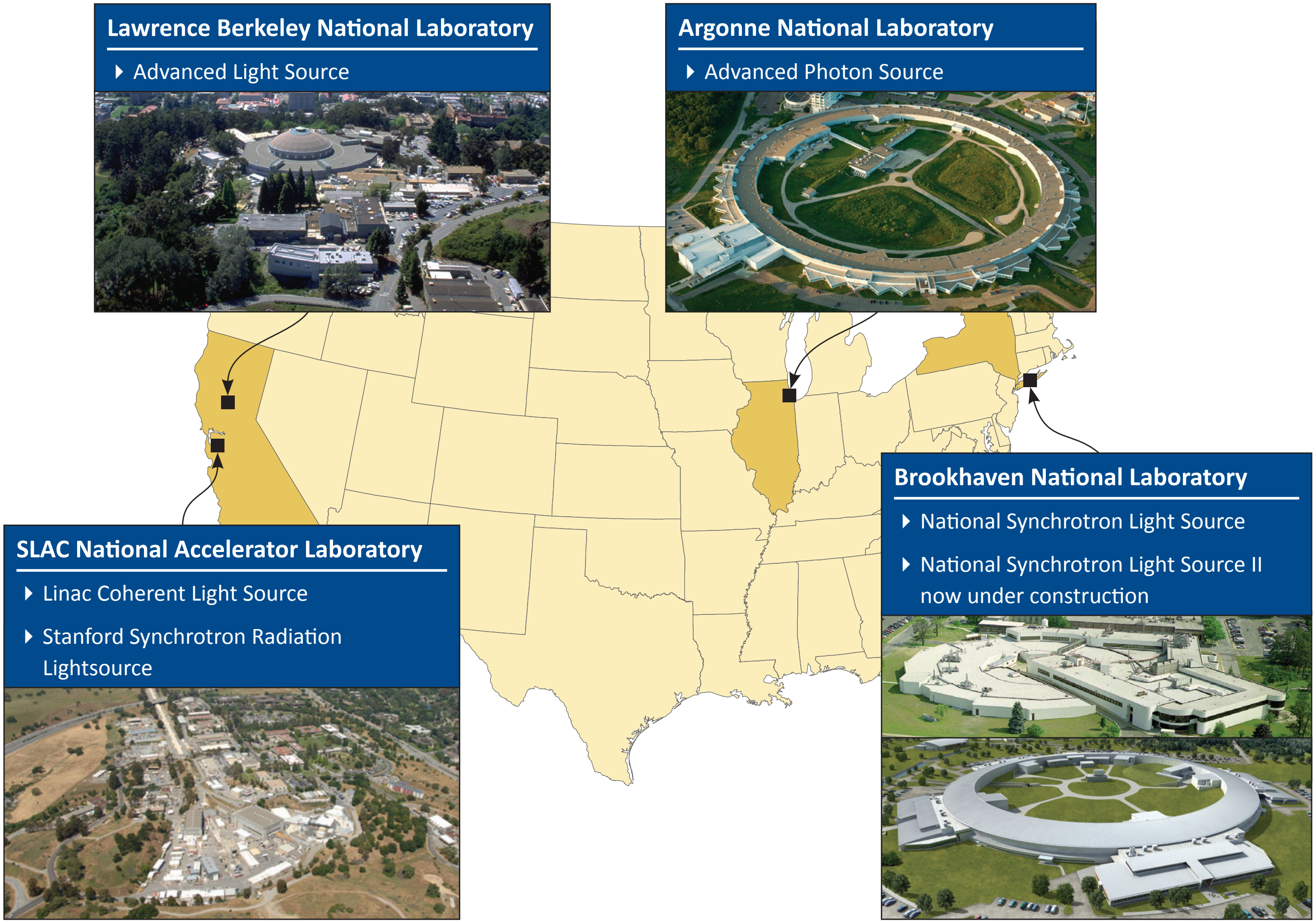
The synchrotron x-ray light sources, including the APS, produce radiation over a wide range of photon energies (from the infrared to hard x-rays). These facilities shed light on fundamental aspects of the physical world, investigating energy, momentum, and position using techniques including spectroscopy, scattering, and imaging applied over various time scales.



In addition to Argonne's APS, the other x-ray light source facilities supported by the DOE Office of Science are:

- Advanced Light Source (ALS) at the Lawrence Berkeley National Laboratory
- Stanford Synchrotron Radiation Lightsource (SSRL) at the SLAC National Accelerator Laboratory
- Linac Coherent Light Source (LCLS) at the SLAC National Accelerator Laboratory
- National Synchrotron Light Source (NSLS) at the Brookhaven National Laboratory

For information about all of the DOE Office of Science user facilities, see http://science.energy.gov/user-facilities/basic-energy-sciences/.



Fast Facts about the APS

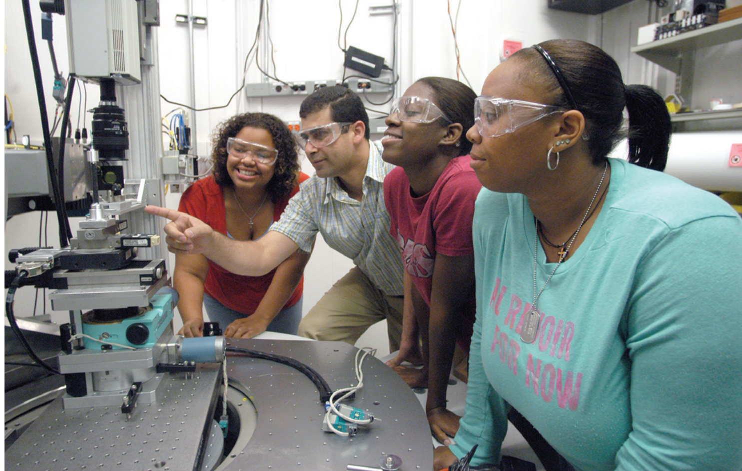
A few of the benefits accruing from research at the APS:

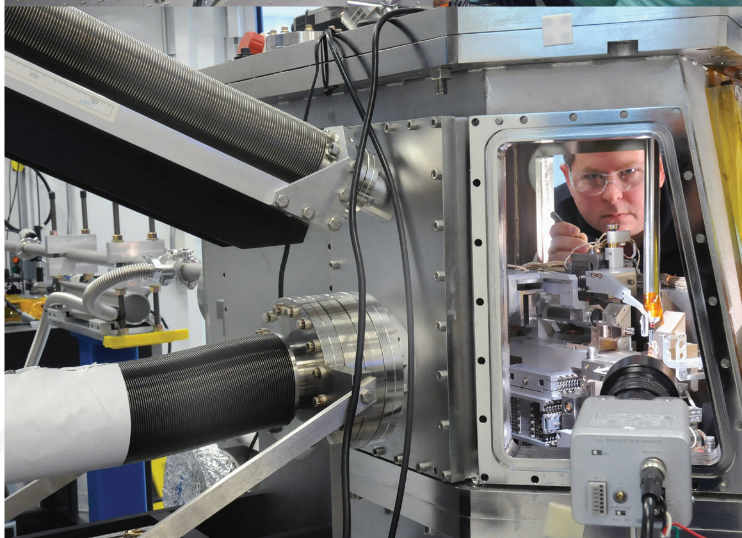
- Better materials for lithium-ion batteries and other energy-related technologies;
- The path to more efficient designs for fuel-injection systems;
- Clues to the causes of and treatments for a multitude of diseases, including AIDS, and toxic threats, such as anthrax;
- Ways of eliminating and remediating environmental depredations;
- Insights about conditions at the center of the Earth (and into the causes of earthquakes and volcanoes) and the composition of cosmic dust;
- A greater understanding of human physiology; and
- A nearly endless array of new information about materials that can lead to the development of such practical applications as advanced digital storage media, more efficient lighting, environmentally friendly refrigerants, methods for protecting the durability of man-made structures, and the characterization of nanostructures whose sizes are measured in atoms, to name but a few.

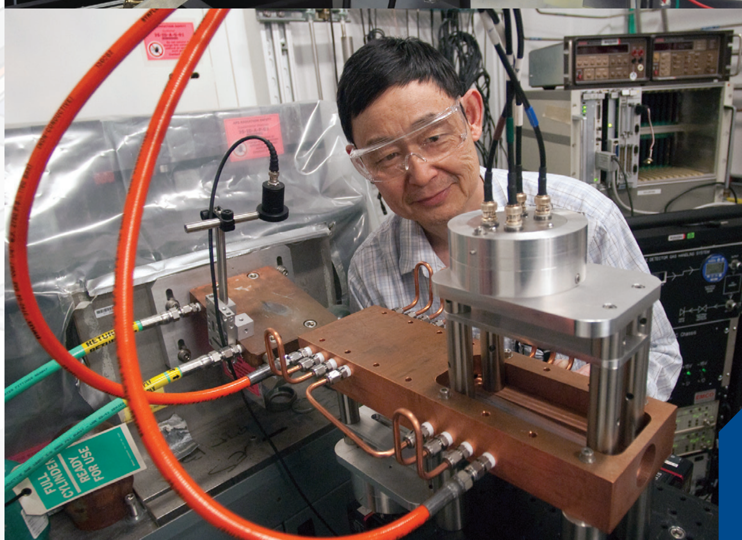
Facts about the APS facility:

- Scientific disciplines investigated by researchers using the APS include materials and polymer science; biological and life science; pharmaceutical research; chemical science; agricultural science; environmental science; planetary science; geoscience; atomic, molecular, and optical physics.
- In fiscal year (FY) 2011, more 350 universities sent researchers to the APS, as did 65 companies, and better than 140 medical schools and research institutions, both government and private.
- In total, more than 5,000 researchers participated in better than 4,000 experiments at the APS in FY2011, resulting in nearly 1,430 peer-reviewed publications.
- There are more than 2,000 conventional electromagnets and 16 pulsed electromagnets in the APS electron accelerators.
- ~1,400 magnet power supplies deliver up to 10 kW of DC power to each magnet for electron-beam focusing and steering.
- Currents reach several thousand amperes and voltages reach 10s of kV.
- Over 700 beam-position monitors, 600 corrector magnets, and 80 computer systems monitor and correct the electron orbit, steering x-ray beams onto experiment samples to micro tolerances.
- More than 120 computers monitoring more than 25,000 signals comprise radiation interlock systems protecting personnel and equipment.
- APS beam diagnostics control multiple x-ray beams simultaneously utilizing >500 ultrahigh-resolution beam-position monitors, each resolving beam motion that is a fraction of the size of the period at the end of a sentence, while nearly 100 remote computers collect data from the 500 monitors and re-steer x-rays 1,500 times per second.

- The APS beam control system comprises 80 workstations, 227 distributed input/output computers (IOCs), more than 7,000 replaceable hardware components, and more than 100,000 IOC points monitoring or controlling more than 450,000 technical parameters.
- The storage ring radio frequency (rf) systems contribute to a combined accelerating voltage equal to a 16-million-V power supply.
- APS rf systems produce more rf power than the combined output of every radio and television station in the city of Chicago.
- The outer diameter of the APS experiment hall is 1,225 ft; slightly less than the height of the Willis (Sears) Tower in Chicago (1,454 ft).
- Experiment hall construction required 56,000 cu yd of concrete (equal to a football-field-sized block 30 ft high); 5,000 tons of structural steel (enough for 3,500 mid-size cars); 2,000,000 linear ft (380 mi) of electrical wire; and 190,000 ft of pipe for water, steam, drainage, and HVAC.
- Total floor space of all APS buildings is 86,310 m^2 (959,000 ft^2).
- The APS is located on an 80-acre site at Argonne National Laboratory near Chicago, Illinois.
- Facility construction started in spring 1990; research started in fall 1996.
- Total APS construction and project cost at completion was $812 million.
- The number of APS employees at any one time is approximately 450.







About Argonne

The nation's first national laboratory, Argonne is the Midwest's largest federally funded R&D center, employing about 3,200 employees. With more than 1,200 scientists and engineers in dozens of fields as well as a unique suite of leading-edge scientific user facilities, Argonne experts conduct basic and applied research focused on solving the nation's challenges in sustainable energy, biological and environmental systems, and national security. Three-quarters of Argonne's scientists and engineers hold doctoral degrees. As well, annually, more than 4,400 researchers from around the world are hosted at Argonne's user facilities.

Location

Argonne is located in DuPage County, Illinois; about 25 miles southwest of Chicago, just south of Interstate 55.

Management

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