Industry at the NSLS

An IBM researcher studies computer chips at the NSLS.

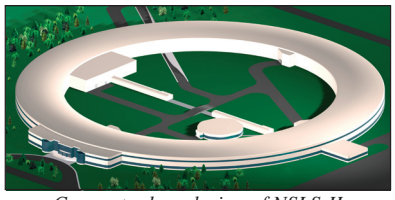
For research that ranges from designing catalysts to developing computer chips, scientists from dozens of industries are drawn to the NSLS because the facility provides advanced analytical capabilities that are not available at their home laboratories.

Pharmaceutical companies conduct experiments to design new drugs. The petroleum industry develops new catalysts for refining crude oil and making useful by-products, like plastics. The microelectronics industry investigates layers of materials and tiny structures used in such products as microprocessors for computers, with the aim of making them more efficient. Research at the NSLS reflects the diverse needs of the U.S. and international marketplace.

Future Technology

The NSLS has continually updated its technology and expanded its scientific capabilities since its first operations in 1982. Recently, Brookhaven commissioned a new cutting-edge research tool at the NSLS called the Deep Ultraviolet Free Electron Laser. This device combines the focus of lasers and intensity of synchrotrons, thus opening up new research opportunities in chemistry, biology, and materials science.

Also, a proposed new electron storage ring, producing x-rays up to 10,000 times brighter than those generated by the current NSLS, would greatly broaden the range of scientific exploration at Brookhaven. If plans for this facility, called NSLS-II, are carried through as proposed, it will be operating by 2012.



Conceptual rendering of NSLS-II

A View of Brookhaven

Brookhaven National Laboratory is a multipurpose research laboratory funded by the U.S. Department of Energy. Located on a 5,300-acre site on Long Island, New York, the Laboratory operates large-scale facilities for studies in physics, chemistry, biology, medicine, applied science, and advanced technology.

Brookhaven's 3,000 scientists, engineers, and support staff are joined each year by more than 4,000 visiting researchers from around the world.

Brookhaven's 5,300-acre site features research facilities for diverse scientific fields.

P.O. Box 5000
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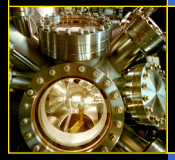
BROOKHAVEN
NATIONAL LABORATORY

managed for the U.S. Department of Energy
by Brookhaven Science Associates, a company
founded by Stony Brook University and Battelle



National Synchrotron Light Source

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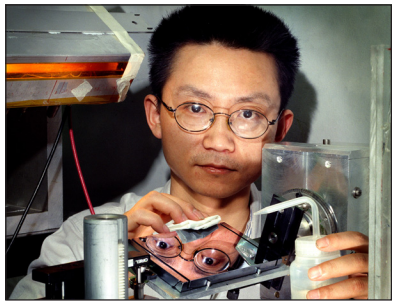
NSLS: A Beacon for Research



A new x-ray technique developed at the NSLS may improve breast cancer detection.

The National Synchrotron Light Source (NSLS) is one of the most prolific scientific facilities in the world. Each year, about 2,400 scientists from more than 400 universities and companies use its bright beams of light for research in such diverse fields as biology and physics, chemistry and geophysics, and medicine and materials science.

For example, researchers have used the NSLS to examine the minute details of computer chips, decipher the structures of viruses, probe the density of bone, determine the chemical composition of moon rocks, and reveal countless other mysteries of science.

Just as a flashlight illuminates small details that may not be seen in dim light, the NSLS provides an entire spectrum of extremely bright light — from very long infrared rays to ultraviolet light and super-short x-rays — to analyze very small or highly dilute samples. Scientists can use these beams to study the electronic and structural properties of materials and surfaces at the atomic level.

Making Synchrotron Light

At the NSLS, an electron gun shoots bunches of electrons into one of two huge, donut-shaped tubes called electron storage rings. Guided by powerful magnets, the electrons are accelerated to nearly the speed of light. As magnets accelerate and bend the beams, the electrons emit energy called synchrotron light, which is piped to over 80 beam lines where scientists perform their experiments.

The smaller of the NSLS rings, the ultraviolet ring, stores electrons at 800 million volts of energy to produce infrared, visible, and ultraviolet light. The x-ray ring stores electrons at 2.8 billion volts, and extends the spectrum of light available for research into the x-ray region. In comparison, a TV picture tube also has an electron gun, but its voltage is only about 30,000 volts.

Powerful Light, Diverse Research

Researchers at the NSLS use sophisticated imaging techniques to get highly detailed images of materials, from biological molecules to semiconductor devices.

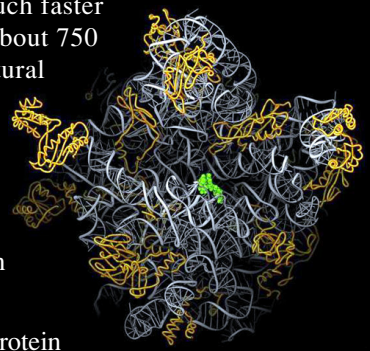
Scientists have used the NSLS to:

- develop a method for breast cancer detection that is more accurate than mammography
- detect drugs in human hair using a technique called infrared microscopy
- analyze the chemical composition of cells flown on the MIR Space Station
- examine material dredged from the Port of New York/New Jersey to determine the nature of pollutants in the sediment
- study the chemical composition of bones, which may aid in understanding arthritis and osteoporosis
- probe electrolytes in lithium-ion batteries with the aim of improving their performance
- investigate magnetic materials to make better recording devices
- study corrosion to develop new methods for its prevention
- explore new techniques for making denser, faster computer chips

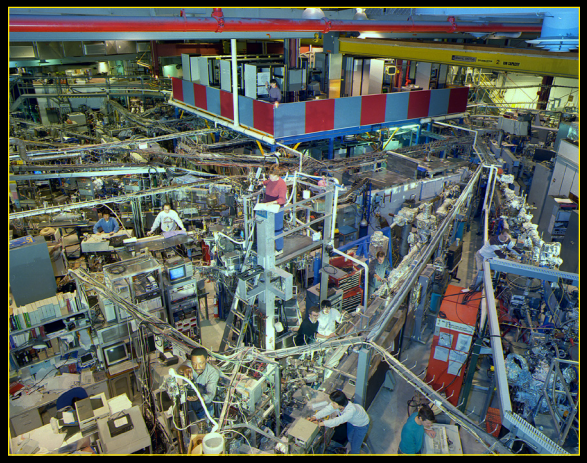
Using beams of infrared light to study bone density, this scientist hopes to unlock the secrets of osteoporosis.

Studying Biological Structures

Within the last decade, synchrotron light sources and powerful computers have made mapping molecular structures much faster and easier. Each year, about 750 biologists use the structural biology beam lines at the NSLS to determine the three-dimensional structures of biological molecules, using a technique called protein crystallography.



The ability to visualize protein structures may help scientists design powerful new drugs that can block the effects of infectious viruses or halt disease processes.



High-tech computers collect and analyze data at the NSLS.

NSLS researchers have already produced images of:

- the AIDS virus as it attacks a human cell
- the structure of the large subunit of the ribosome, which makes proteins that are required for the structure and function of every living cell
- a common cold virus as it binds to and infects human cells
- a key Lyme disease protein structure, which may help in developing a more effective vaccine for the disease