Basic Energy Sciences

Research for the Nation's Energy Future

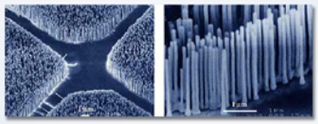
The Basic Energy Sciences (BES) program supports fundamental research in focused areas of the natural sciences in order to expand the scientific foundations for new and improved energy technologies and for understanding and mitigating the environmental impacts of energy use. The BES program is one of the Nation's largest sponsors of the natural sciences by funding fundamental research and is uniquely responsible for supporting fundamental research in materials sciences, chemistry, geosciences, and aspects of biosciences that impact energy security.

Historic Accomplishments

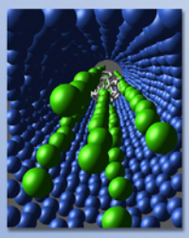
- Advances in catalysis and its industrial impact
- Fullerene research
- Heavy element chemistry
- Ion implantation and its impact on materials properties
- Magnetism and magnetic materials
- Separations and analysis
- Sequencing the first plant genome
- Unraveling the mysteries of photosynthesis
- Neutron scattering facilities
- Synchrotron radiation light sources.

Recent Scientific Achievements

- **World's Smallest Ultraviolet Nanolasers**, based on "nanowires" of zinc oxide, have a broad range of potential applications in fields ranging from photonics—the use of light for superfast data processing and transmission—to the so-called "lab on a chip" technology in which a microchip equipped with nano-sized light sources and sensors performs instant and detailed analyses for chemistry, biology, and medical studies.



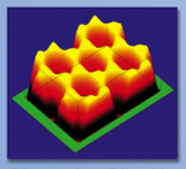
Nanowire Nanolaser: This work was achieved in a university/industry collaboration that also included other government science agencies.
(Photo by Peidong Yang/UC Berkeley, courtesy of Science)



Buckyball Piston

- **Nanohydraulics:** Computational simulation of a nanohydraulic "buckyball piston" in an all-carbon nanotube—a nano-device the size of a dust mote.
- **Nanoscale Electronics:** Atomic force microscope image showing two single-walled nanotubes spanning gold contacts. These structures form the basis of the first nanoscale electronic devices.

Single-walled Nanotubes



Magnesium Diboride

- **Magnesium diboride** is an unusual new superconducting material discovered in 2001. Understanding the origin of superconductivity—the ability of some materials to conduct electricity without losing energy—will help scientists improve magnetic resonance imaging (MRI) and the efficiency of electric power transmission, and build smaller, more powerful electronic devices.

Major User Facilities

Synchrotron Radiation Light Sources

- National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory
- Stanford Synchrotron Radiation Laboratory (SSRL) at Stanford Linear Accelerator Center
- Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory
- Advanced Photon Source (APS) at Argonne National Laboratory

Advanced Light Source

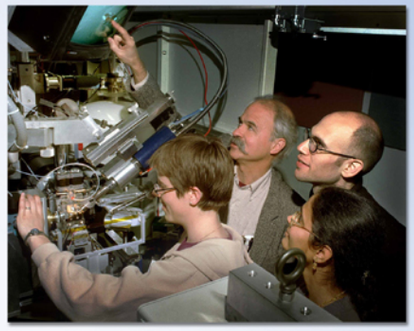
High-Flux Neutron Sources

- High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory
- Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory
- Los Alamos Neutron Science Center (LANSCE) at Los Alamos National Laboratory
- Spallation Neutron Source (SNS), a new facility under construction at Oak Ridge National Laboratory.

Spallation Neutron Source

Science Workforce Development

The BES program supports 3,000 undergraduate researchers, graduate students working toward a doctoral degree, and postdoctoral associates developing their research and management skills. BES scientific user facilities provide outstanding hands-on research experience to 4,000 young scientists annually.



Researchers mentor students at BES user facilities
(Photo at National Synchrotron Light Source, courtesy of Brookhaven National Laboratory)

BES also supports a large extramural research program, with approximately 35% of the program's research activities sited at academic institutions. BES annually funds approximately 1,100 research grants in more than 150 academic institutions located in 48 states.

Office of Science
U.S. DEPARTMENT OF ENERGY

Contact
Dr. Patricia M. Dehmer, Associate Director
Basic Energy Sciences
Office of Science
SC-10, Germantown Building
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585-1290
301-903-3081
patricia.dehmer@science.doe.gov
www.sc.doe.gov/bes/