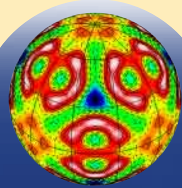
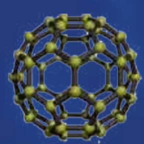
BASIC ENERGY SCIENCES



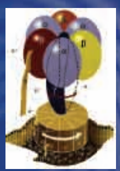
The Basic Energy Sciences (BES) program supports fundamental research in materials sciences, chemistry, geosciences, and aspects of biosciences to expand the scientific foundations for improved and potentially revolutionary advances in energy technologies and for understanding and mitigating the environmental impacts of energy use.

RECENT SCIENTIFIC ACHIEVEMENTS



The 1996 Nobel Prize in Chemistry recognized a new form of carbon, buckminsterfullerene, which initiated worldwide activity devoted to the study of carbon clusters and tubes, all with remarkable new electrical and optical properties.

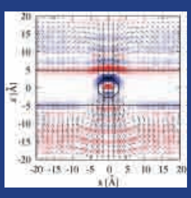
The 2003 Nobel Prize in Physics recognized contributions to the theory of superconductors and superfluids, once both mysterious and perplexing to the scientific community, which led to the development of new superconducting materials and energy transmission technologies.



The 1997 Nobel Prize in Chemistry honored the discovery of the mechanism of adenosine triphosphate (ATP) production in the living cell, a discovery that led to new biological and bioinspired paths to solar energy conversion; fuels and chemical feedstock production; and chemical catalysis.

The 1994 Nobel Prize in Physics recognized the development of neutron scattering as a powerful tool for determining the positions and motions of atoms in materials, with unique applications to magnetic materials and to polymers and biological materials.

The unexpected discovery of parasitic nanoparticles has given insight into the challenges associated with efficient deposition of the layered gallium nitride-based semiconductors critical to Solid-State Lighting – a technology with vast potential for far higher efficiency lighting.



Basic Research in Theory, Modeling, and Simulations Complementing experimental efforts, "computer experiments" have been performed which are difficult or impossible to perform in the laboratory such as investigations into the behavior of electrons flowing in nanowires and nanotubes.

Ultrafast Science
A novel method has been demonstrated for clocking ultrafast x-ray pulses on the femtosecond time scale – a key contribution to the science base for the next-generation light sources anticipated to provide breakthrough discoveries in materials science, chemistry, and biology.

MAJOR USER FACILITIES

Five Synchrotron Radiation Light Sources, sources of intense beams of x-rays, are used to explore the properties of materials, analyze samples for trace elements, probe the structure of atoms and molecules, study biological specimens, investigate chemical reactions, and manufacture microscopic machines.

High-Flux Neutron Sources, sources of intense neutron beams, are used to study the position and motion of atoms in materials. Scientists learn details about materials ranging from liquid crystals to superconducting ceramics, from proteins to plastics, and from metals to micelles to metallic glass magnets.

Three Electron Beam Microcharacterization Centers, sources of intense electron beams, enable the study of high temperature superconducting materials, irradiation effects in metals and semiconductors, phase transformations, and processing related structure and chemistry of interfaces in thin films.

Five Nanoscale Science Research Centers provide the ability to fabricate complex structures using chemical, biological, and other synthesis techniques; characterize them; assemble them; and integrate them into devices – and do it all in one place.

The Combustion Research Facility is an internationally recognized facility for advanced characterization techniques and for the study of combustion science and technology. Research efforts combine theory, modeling, and experiment including diagnostic development, kinetics, and dynamics.