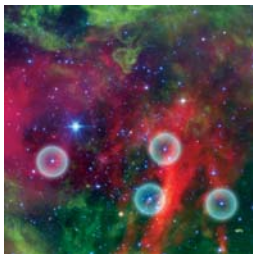
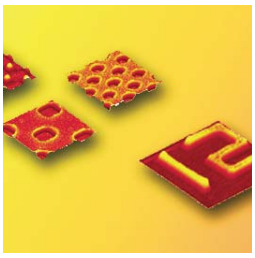
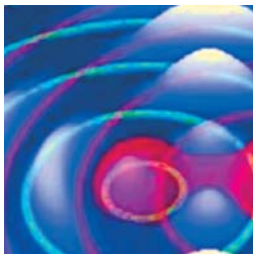
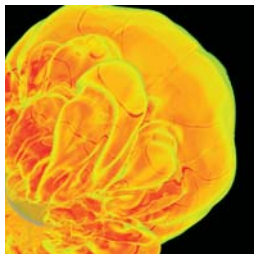
BERKELEY LAB

LAWRENCE BERKELEY NATIONAL LABORATORY

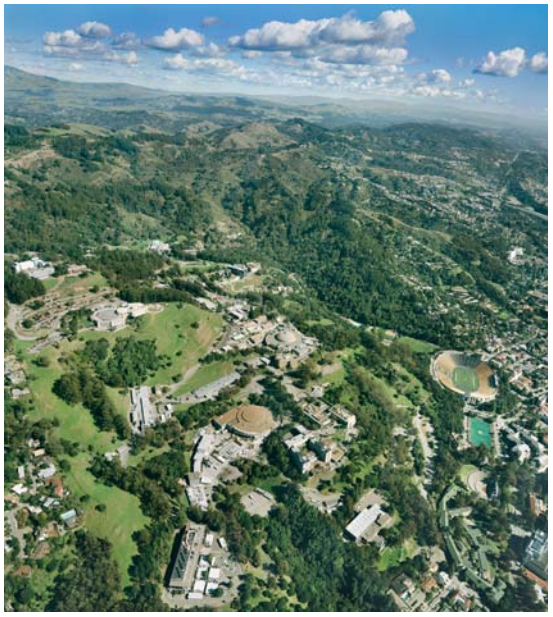



a world of **GREAT SCIENCE**

... and great science solutions

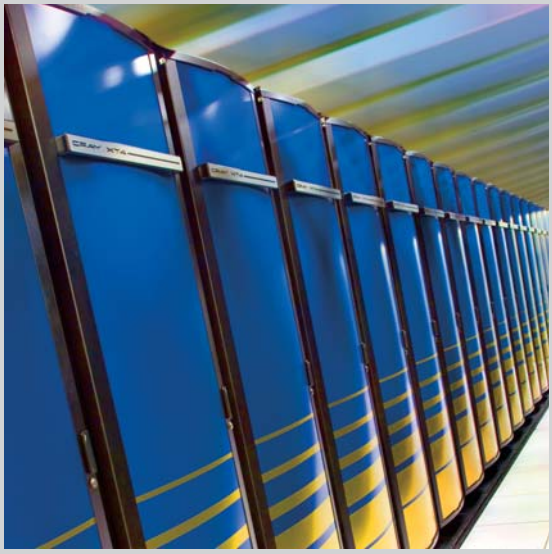
WELCOME TO OUR LABORATORY AND A WORLD OF GREAT SCIENCE



From the infinite scale of the universe to the infinitesimal scale of subatomic particles, researchers at the Lawrence Berkeley National Laboratory — Berkeley Lab — are advancing the scope of human knowledge and seeking technical solutions to some of the greatest problems facing humankind. Scientific excellence and an unparalleled record of achievement have been the hallmarks of this Laboratory since it was founded by Ernest O. Lawrence in 1931. Eleven scientists associated with Berkeley Lab have won the Nobel Prize, and 55 other Nobel Laureates either trained here or had significant collaborations with Laboratory researchers. Thirteen Berkekey Lab scientists have also won the National Medal of Science, the nation's highest award for lifetime achievement in fields of scientific research.

Berkeley Lab is a member of the national laboratory system supported by the U.S. Department of Energy (DOE) through its Office of Science. It is managed by the University of California (UC) and is charged with conducting unclassified research across a broad range of scientific disciplines.

Located on a 200-acre site in the hills above the UC Berkeley campus, Berkeley Lab employs approximately 4,000 scientists, engineers, support staff and students. Its budget for 2008 was approximately $600 million. Technologies developed at Berkeley Lab have generated billions of dollars in revenues and thousands of jobs. Savings as a result of Berkeley Lab developments in energy-efficient technologies have also been in the billions of dollars.



HIGH-PERFORMANCE COMPUTING AND NETWORKING

The expansion of knowledge has raised scientific questions that either cannot be answered via traditional theoretical and experimental methods or would be too impractical or hazardous to study in a laboratory. To tackle such issues, scientists are increasingly looking to computational approaches, including modeling and simulation.

Data sets produced by modern experiments are often so large that discoveries depend upon computational analysis of the results. Consequently, the demand grows for more processing power along with new and improved mathematical models, algorithmic designs, and software and system architectures. Berkeley Lab researchers are working to meet the challenge through applied research and development in computer and computational sciences, mathematics, and new computational tools and techniques.

Berkeley Lab computational researchers are key participants in the Scientific Discovery through Advanced Computing program that is sponsored by the Department of Energy. Berkeley Lab also hosts both the National Energy Research Scientific Computing Center (NERSC) and the Energy Sciences Network (ESnet). NERSC is the flagship supercomputer facility for DOE's Office of Science and a world leader in accelerating scientific discovery through computation. ESNet is a super-high-speed network serving thousands of DOE scientists and collaborators worldwide.

EARTH AND CLIMATE SCIENCES

Studies of earth and atmospheric processes have given us a far better understanding of our planet's history — how plate tectonics have sculpted the earth's surface, how life has been sustained over billions of years, and how our climate is a product of geological, biological, atmospheric and oceanic processes. Yet critical new questions have arisen.

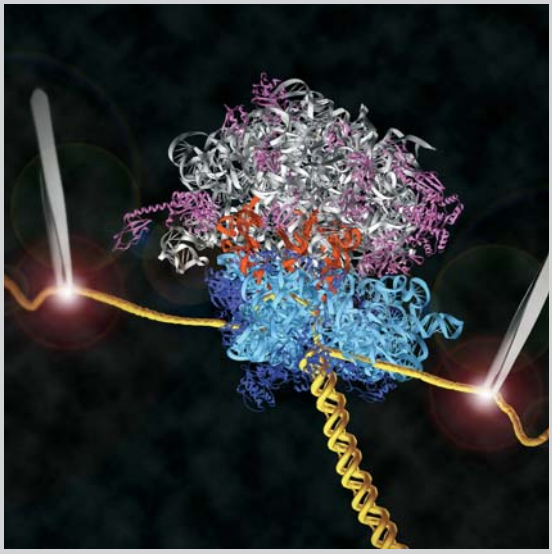
How will human activities change global climate over the next several decades? How will regional ecosystems be affected? What are the environmental costs and benefits of switching to green energy technologies and what will be the effect on climate? What is the best way to remediate contaminated sites? And how can we best manage our fresh water resources?

Berkeley Lab researchers are pursuing answers to these and other questions through programs in hydrogeology and reservoir engineering, geophysics and geomechanics, geochemistry, microbial ecology and environmental engineering. Berkeley Lab has also established a Center for Integrated Earth System Modeling aimed at providing a closer link between climate change models and mitigation efforts. Envisioned are regional models that can deliver detailed predictions about climate, water or energy more than 20 years out and global models that can forecast changes to the end of the century.

Biological systems are nature's version of nanotechnology. They are built from the same fundamental elements of matter and follow the same physical laws as human-engineered systems. When functioning properly, biological systems possess capabilities that exceed those of human technologies by a vast margin.

When functioning poorly, however, biological systems — especially at the molecular and cellular levels — can generate major health threats such as cancer, Alzheimer's disease, and the deficits associated with aging. As a result, Berkeley Lab researchers focus on the molecular and cellular levels where these breakdowns begin.

Berkeley Lab is recognized as a world leader in the development of imaging technologies, such as electron and x-ray crystallography, confocal microscopy, Positron Emission Tomography (PET) and Nuclear/Magnetic Resonance Imaging (NMR/MRI), which have made it possible to zoom in on the internal structures of biological cells and the DNA, RNA and proteins through which they are formatted. Berkeley Lab researchers also pursue advanced genomic and proteomic studies; cancer and neurodegenerative disease research; systems biology, in which biological processes and functions are studied as whole systems; and synthetic biology, in which novel organisms and systems are created to solve problems natural systems cannot. Berkeley Lab is also a contributor to the Joint Genome Institute.



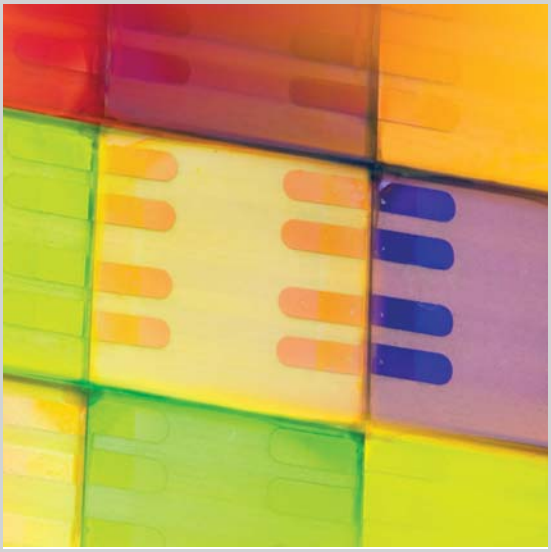
BIOSYSTEMS AND **HEALTH**

Only a tiny fraction of all the materials that are theoretically possible have been made. The potential exists for materials that would yield low-cost photovoltaics, self-repairing and self-regulating devices, integrated photonic (light-based) technologies and nano-sized electronic and mechanical systems that far outstrip our current microtechnology capabilities.

Berkeley Lab researchers are studying the chemical and electronic structures and processes that govern material properties, taking the initial steps towards synthesizing novel materials at the atomic and molecular levels and learning to fashion these materials into valuable nanodevices.

Research into novel materials, ultrafast processes and nanodevices flourishes at the Advanced Light Source, which generates some of science's brightest beams of x-ray and ultraviolet light in pulses as short as a few millionths of a billionth of a second; the National Center for Electron Microscopy, one of the world's foremost centers for electron microscopy and microcharacterization; and the Molecular Foundry, which provides users with instruments, techniques and collaborators for the synthesis, characterization and theoretical studies of nanoscale materials.

NOVEL MATERIALS, ULTRAFAST PROCESSES, **NANODEVICES**



SECURE AND SUSTAINABLE
ENERGY

Humankind needs to develop secure and sustainable energy technologies that will reduce greenhouse gas emissions. At Berkeley Lab researchers are investigating several strategies for harnessing the tremendous potential of solar-based energy sources.

There is enough power in the sunlight that strikes the earth's surface in one hour to meet an entire year's worth of human energy needs. Harnessing this bounty through nonpolluting, efficient, cost-effective and practical technologies is an important step in solving the energy crisis and mitigating global climate change.

In 2005, Berkeley Lab director and Nobel laureate Steve Chu launched an ambitious effort to develop solar-based energy technologies, which he called the "Helios Project," after the sun god of ancient Greek mythology. This effort now encompasses research aimed at the development of a new generation of green biofuels based on agricultural waste products, grasses, algae and other plants not used for food, the direct conversion of water and carbon dioxide into transportation fuels, and the application of artificial nanostructures to solar energy technologies. Berkeley Lab is the lead partner in the Joint BioEnergy Institute, a participant in the Energy Biosciences Institute, and a leader of the effort to develop artificial photosynthesis. Berkeley Lab is also one of the nation's premier institutes for advancing energy conservation and efficiency technologies.

MATTER AND FORCE IN THE
UNIVERSE

Interactions between fundamental particles of matter and force gave rise to our universe and will determine its ultimate fate. Exploring these interactions not only deepens our understanding of the world we live in and the universe around us, but can also lead to new and unexpected technological breakthroughs.

For example, the discoveries of the electron and quantum mechanics made possible the inventions of the transistor, the computer and the World Wide Web. The invention of the cyclotron by Berkeley Lab founder Ernest Lawrence paved the way for modern high energy physics research. In keeping with that trailblazing tradition, Berkeley Lab researchers today are leading investigations into "dark energy," a mysterious force that accelerates the rate at which our universe is expanding. Lab researchers are also at the forefront of neutrino studies. Neutrinos, the phantomlike subatomic particles that fill the cosmos and pass through our planet unnoticed, played a profound role in shaping the universe and are part of the international scientific effort to discover the origins of mass.

Major programs that include Berkeley Lab researchers are the Deep Underground Science and Engineering Lab, IceCube, and the Large Hadron Collider.

National User Facilities

The **Advanced Light Source (ALS)** is one of the research world's premier sources of x-ray and ultraviolet light. ALS light beams make previously impossible studies possible. Visit the Website at www-als.lbl.gov

The **Molecular Foundry** is a DOE Nanoscale Science Research Center. Its mission is to provide the knowledge and tools needed to advance developments in nanoscience. Visit the Website at foundry.lbl.gov

The **Energy Sciences Network (ESnet)** is a high-speed network serving thousands of DOE scientists and collaborators worldwide, and a recognized leader in high-bandwidth connectivity. ESnet4 features 10 gigabit (10 billion bits)-per-second connections. Visit the Website at www.es.net

The **National Center for Electron Microscopy (NCEM)** is an international leader in electron microscopy and microcharacterization, and home to TEAM 0.5, the most powerful transmission electron microscope in the world. Visit the Website at ncem.lbl.gov

The **Joint Genome Institute (JGI)** is dedicated to harnessing the power of information embedded in microbes and plants through DNA sequencing. Research here is applied to clean energy generation and environmental characterization and cleanup. Visit the Website at www.jgi.doe.gov

The **National Energy Research Scientific Computing Center (NERSC)**, is the flagship computer facility for DOE's Office of Science and home to "Franklin," a Cray XT4 TM system that ranks as one of the world's largest supercomputers. Visit the Website at www.nersc.gov

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