# Science with a Mission

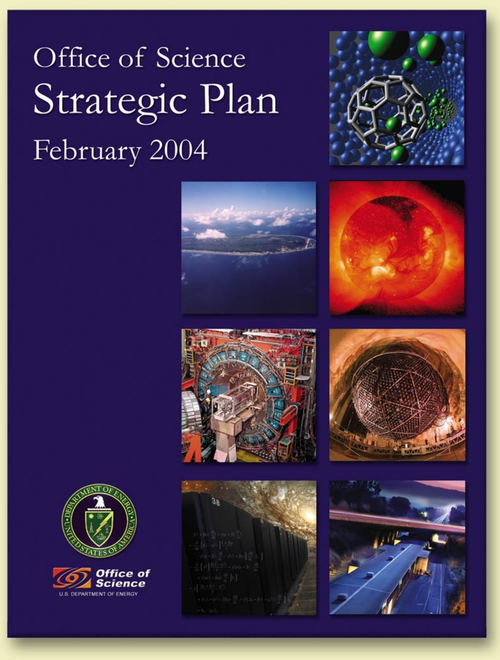
*Advancing the Energy, Economic, and National Security of the United States*

Office of Science
U.S. DEPARTMENT OF ENERGY

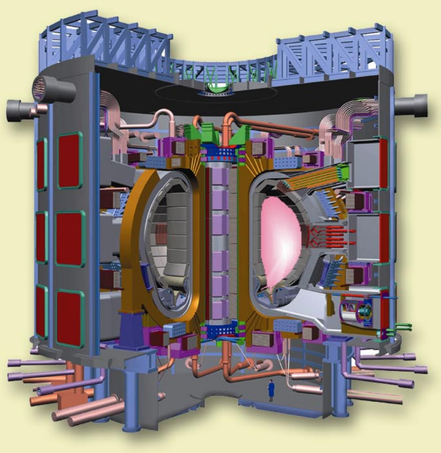
## Our Priorities

The research priorities of the Department of Energy's Office of Science flow from our long-term strategic goals and reflect our Nation's commitment to energy independence, a cleaner environment, improved health care, greater economic prosperity, and intellectual leadership.

Pursuing these research priorities over the next five to 10 years and beyond will be challenging, but they hold enormous promise for the future of our Nation and the overall well-being of our citizens.




## ITER for Fusion Energy

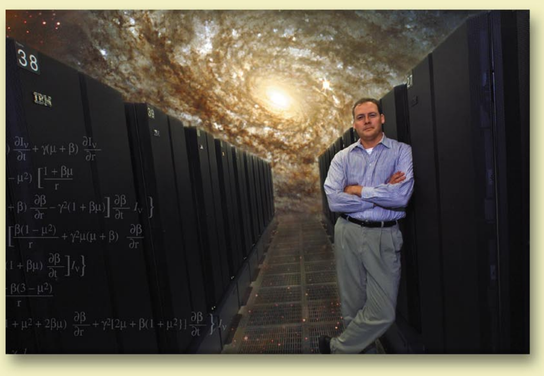


ITER is an international collaboration to build the first fusion science experiment capable of producing a self-sustaining fusion reaction, called a "burning plasma." It is the next essential step on the path toward demonstrating the scientific and technological feasibility of fusion energy.

*The President has made achieving commercial fusion power the highest long-term energy priority for our Nation.*

## Scientific Discovery through Advanced Scientific Computing

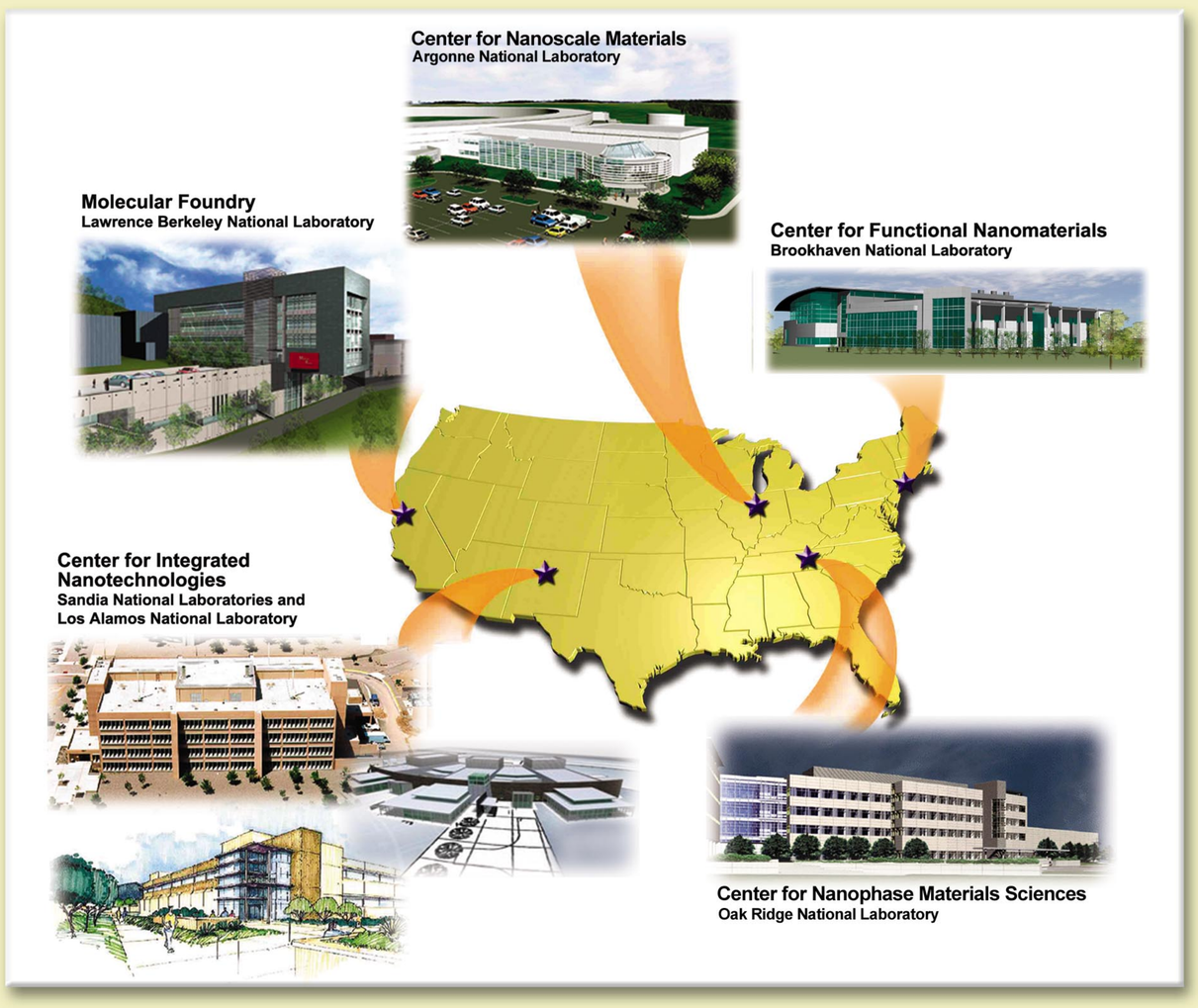
Scientific computing at DOE Office of Science national laboratories and user facilities enables scientists to use quantum calculations to understand the combustion process, model thermal reactions, analyze climate change data, reveal chemical mechanisms of catalysts, and study the collapse of a supernova.



*Extraordinary advances in computer architecture and software design are making scientific computing a true third pillar of discovery, joining theory and experiment as a standard tool that researchers rely upon to make scientific progress.*

## Nanoscale Science for New Materials and Processes

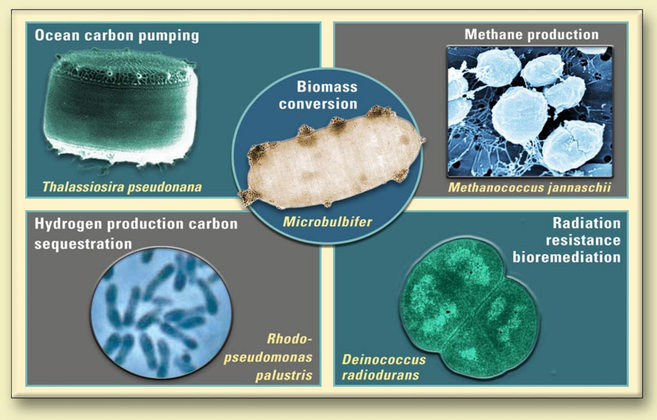
The Office of Science is building five new DOE Nanoscale Science Research Centers to provide the Nation's research community with world-class resources for the synthesis, processing, fabrication, and analysis of materials at the nanoscale.




*Large and complicated structures can be designed, one atom at a time, for desired characteristics such as super-lightweight and ultra-strong materials. The Office of Science will help lead this revolution – with nanoscale research in materials sciences, physics, chemistry, biology, and engineering – and tools that can probe and manipulate matter at the atomic scale.*

## Taming the Microbial World – the Next Revolution in Genomics

The DOE Office of Science will use the tools and knowledge we have developed over the past two decades of research into genomics to understand how microbes may be able to produce abundant and clean energy and clean up chemical and radioactive pollutants.



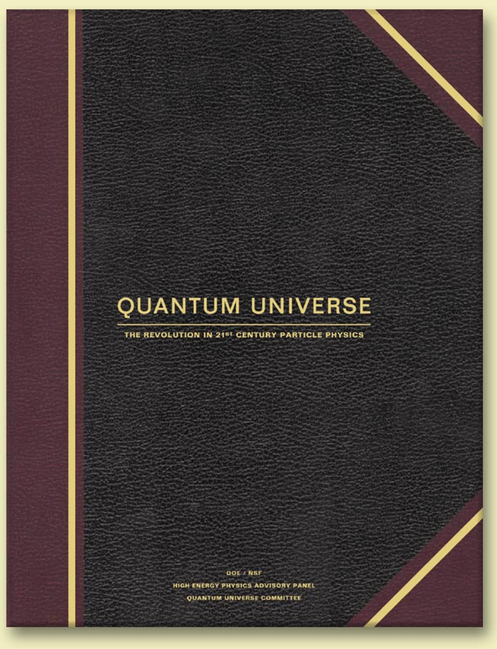

*Microbes are among Nature's most underappreciated resources. Understanding exactly how microbes perform specialized functions is central to applying the spectacular advances in biology and genetics to DOE's missions: for example, to harness microbes to create hydrogen for a new energy source, absorb carbon dioxide, and eat radioactively contaminated waste.*

## Dark Energy and the Search for Genesis

How the universe originated – its genesis – is one of the great mysteries of science. So is "dark energy," which dominates today's universe.

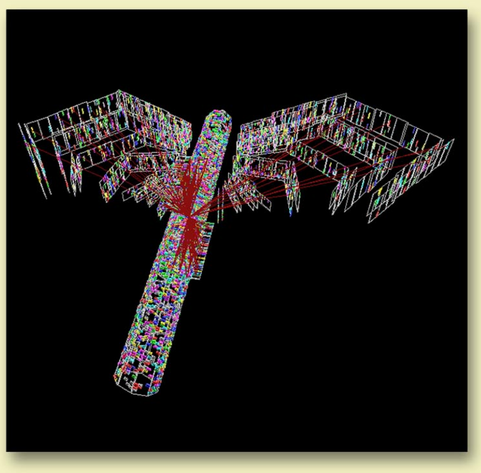
The DOE Office of Science is conducting experiments at its accelerators to determine whether the complex patterns of particles and forces we observe today arose from a much simpler universe at the extremely high energies that prevailed in its first moments.

The Office of Science also is working to solve the mystery of dark energy, which makes up more than 70 percent of the universe and evidently causes its accelerating expansion.




Quantum Universe: The Revolution in 21st Century Particle Physics, *a report jointly commissioned by the Office of Science and the National Science Foundation, has identified the most compelling questions facing contemporary particle physics research and outlined a program to address them.*

## Nuclear Matter at the Extremes



The DOE Office of Science is conducting experiments at Brookhaven National Laboratory's Relativistic Heavy Ion Collider to study brief, submicroscopic samples of hot plasma of free quarks and gluons that filled the universe at the age of one microsecond.

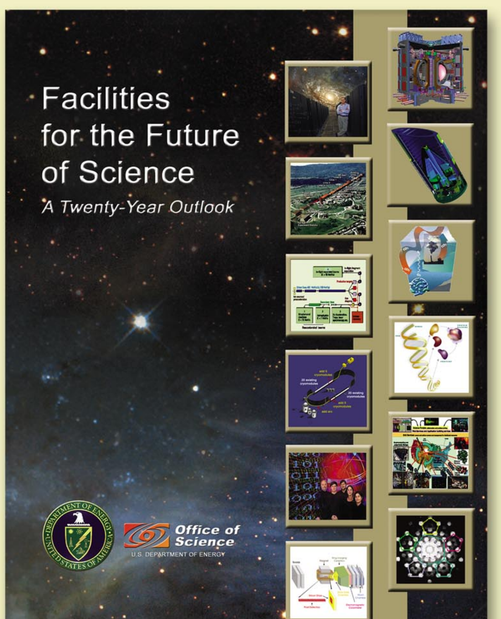
New studies are planned to explore the extremes of nuclear matter and the processes that form nearly all of our chemical elements in stars and supernovae.

*Understanding how nuclear matter is formed is critical to understanding the processes within stars and how elements are created – including possible new elements at high-energy densities and the extreme limits of stability.*

## Research Facilities for the Future of Science

Just as very large and complex machines and instruments have enabled U.S. researchers to make many of the most important scientific discoveries over the past six decades, the discoveries of the future will require powerful next-generation scientific tools.

*In* Facilities for the Future of Science: A Twenty-Year Outlook, *the DOE Office of Science is proposing a portfolio of 28 prioritized new scientific facilities and upgrades of current facilities spanning the scientific disciplines to ensure the U.S. retains its primacy in critical areas of science and technology well into the next century.*

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