

Physics in the FY 2002 Budget

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HIGHLIGHTS

- R&D funding would remain approximately level for most Department of Energy (DOE) physics programs.
- Construction of DOE's Spallation Neutron Source is within budget and on schedule.
- National Science Foundation (NSF) funding for the Physics Subactivity would decline 2.1 percent in FY 2002.
- The NSF budget for the Materials Research Subactivity would also decline 2.1 percent in the new fiscal year.
- Funding for physics R&D at two laboratories at the National Institute of Standards and Technology (NIST) would increase significantly in FY 2002.
- No facility new starts are proposed in FY 2002.

Millions of Americans are employed by industries that are based on federally-funded physics research. Americans live healthier, more productive lives because of technological developments made possible by physics R&D. For example, medical imaging draws on research that was first supported by the federal government in the 1940s and 1950s. Initial research in the 1930s enabled the Global Positioning System. Technologies used to prevent the proliferation of radioactive materials are based on physics research conducted in the 1960s.

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Physics R&D is supported by many different federal agencies, chief among them DOE, NSF, and the Department of Defense (DOD). These programs play a critical role in sponsoring research that otherwise would not be funded.

DEPARTMENT OF ENERGY (DOE)

DOE's Office of Science provides the greatest amount of federal funding for physics R&D. DOE supports research in 48 states and large user facilities serving more than 16,000 researchers annually.

In FY 2002, DOE will continue cutting-edge investigations into the origin and nature of mass, support nanoscale research that could revolutionize our economy, continue construction of the world-class Spallation Neutron Source, and provide funding for the eventual development of fusion energy. (Please see Table II-11 for R&D in the DOE budget. For more information on DOE, please see Chapter 9.)

High Energy Physics: DOE supports 90 percent of the research in high energy physics in the United States. Major facilities are in California, Illinois, and New York. The Office of Science and NSF also participate in the Large Hadron Collider project, under construction in Switzerland.

The research conducted by DOE's High Energy Physics program centers on the nature of matter and energy. The department's state-of-the-art facilities enable researchers to study atomic particles and the forces between them. DOE intends to increase the operating time of its high energy physics laboratory in Illinois in FY 2002 to provide critical data on one of the central questions involving matter.

Under the Administration's FY 2002 request, the budget for High Energy Physics R&D would increase 0.6 percent, or \$4 million, to \$706 million. Within this budget, funding for the Large Hadron Collider (LHC) would decline by 16.8 percent, or \$10 million, to \$49 million, a level agreed upon with CERN, the European Laboratory for Particle Physics. Additional information regarding the LHC is provided below in the section on NSF.

Nuclear Physics: The Nuclear Physics program investigates atomic nuclei and nuclear matter. Research conducted at universities, the

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national laboratories, various user facilities, and two large accelerators in Virginia and New York explores the structure and the forces found in nuclear matter. DOE supports 85 percent of all research in nuclear physics.

DOE intends for the scope of the Nuclear Physics program to be maintained in FY 2002 pending advisory committee guidance. The FY 2002 Nuclear Physics request would hold R&D funding constant at \$355 million. Utilization of user facilities will be a program priority in the new fiscal year.

Fusion Energy Sciences: Research in this science-based program may lead to the utilization of fusion as a future energy source that would be economically and environmentally attractive. The Secretary of Energy Advisory Board in 1999 concluded that the challenges surrounding fusion will be overcome. In 2000, the National Research Council gave a favorable review to the quality of fusion research. Facilities in California, Massachusetts, and New Jersey are supported by this program. More than \$1 billion in magnetic fusion research is performed by other nations in a highly collaborative effort. The amended FY 2002 budget request from the Bush Administration would increase Fusion Energy Sciences funding by 0.1 percent to \$245 million.

Basic Energy Sciences: This DOE program supports research in innovative energy technologies and environmental mitigation. This program funds facilities in Illinois, California, New York, Tennessee and New Mexico, as well as research at universities, national laboratories, and industrial laboratories.

Basic Energy Sciences is responsible for the construction of the Spallation Neutron Source in Tennessee. As planned, funding would increase for this eagerly-awaited research tool by 4.8 percent, or \$13 million, to \$291 million. DOE officials have testified that the Spallation Neutron Source is on schedule to be completed in 2006 and will be within budget. DOE estimates it will serve up to 2,000 researchers from academia, the national laboratories, and industry every year. This facility will produce 6-10 times more neutrons than its closest rival. Insights made possible by the Spallation Neutron Source will enable researchers to improve medications, fibers, plastics, and catalysts. Better, more powerful

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magnets, for uses ranging from electric motors to computer hard drives, will be made possible with the knowledge gained from this facility.

R&D in the Basic Energy Sciences FY 2002 budget would increase 1.3 percent, or \$13 million, to \$997 million.

NATIONAL SCIENCE FOUNDATION (NSF)

Physics R&D is supported by several NSF programs. Significant funding is provided through the Physics and Materials Research Subactivities, and through the Major Research Equipment account. (See Table II-7 for the NSF budget; see Chapter 7 for more information on NSF.)

Physics Subactivity: A large percentage of the nation's university-based research in physics is supported by NSF. The foundation provides almost 100 percent of the support for research in some sub-disciplines. Research is conducted by single investigators, major user groups, and at centers or institutes. User facilities in New York, Michigan, Indiana, Washington, and Louisiana are supported by the NSF's Physics Subactivity budget.

For FY 2002, the Administration requested \$184 million for Physics, which is a decrease of 2.1 percent, or \$4 million, from the current year. Within this budget, Physics Research would decline 5.3 percent, or \$7 million, to \$125 million. Support would be increased for Physics Frontiers Centers for research in exceptionally promising new areas. The budget for Facilities would increase by 5.3 percent, or \$3 million, to \$59 million. This funding would permit greater operating time at two facilities, maintain operations at a third, and decrease support, as scheduled, for the final year of operations at another facility.

Materials Research Subactivity: Physics R&D is also supported through the Materials Research Subactivity. Research in this area has led to the development of new materials with superior properties. Approximately one-half of all federal support for university-based research in materials is provided by NSF. Research is conducted by individual researchers, small groups, and at various centers and large user facilities.

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In FY 2002, the Subactivity will emphasize nanoscale research, the interface between biological systems and materials, and computational materials science. The Research budget would decline 4.9 percent, or \$9 million, to \$171 million. Up to three centers and one institute will be established through open competition. The budget for Facilities would increase 14.9 percent, or \$5 million, to \$35 million.

The Administration's FY 2002 overall request of \$205 million for the Materials Research Subactivity is a decrease of 2.1 percent, or \$4 million, from the current year.

Major Research Equipment: NSF requested \$17 million in FY 2002 for the construction of two detectors for the Large Hadron Collider (LHC). NSF will provide \$81 million for the LHC for the period FY 1999-2003, with oversight of this project provided through the Physics Subactivity. DOE is providing a total of \$450 million for the project. NSF's funding of the detector construction is scheduled to be complete in FY 2003. The LHC is currently scheduled for completion in FY 2005. NSF states that "U.S. cost performance is satisfactory, with material contracts typically below estimates, and labor costs tracking close to plan." The two detectors are now in production. First data is expected in FY 2006.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

Scientific and Technical Research and Services (STRS) are provided by the Department of Commerce's National Institute of Standards and Technology (NIST). Within STRS are two laboratories with missions centering on physics R&D: the Physics Laboratory and the Materials Science and Engineering Laboratory. The Administration requested significant increases for both laboratories in FY 2002. (See Table II-14 for R&D in the NIST budget; see Chapter 12 for more information on the Department of Commerce and NIST.)

Electronic, optical and radiation technologies are supported by measurement services and research provided by the Physics Laboratory. The research involves immediate need and longer-term projects in four strategic areas: electronic and magnetic devices, optical technology, radiation applications and control, and fundamental physical quantities.

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The Administration requested \$35 million for R&D to be conducted by this laboratory in FY 2002, an increase of 15.2 percent, or \$5 million.

The Materials Science and Engineering Laboratory R&D budget request is \$47 million, an increase of 14.1 percent, or \$6 million, over FY 2001. This laboratory provides measurement and standards services to the microelectronics, automotive, and health care industries, among others. The NIST Center for Neutron Research, the only fully equipped neutron research facility in the United States, is operated by this laboratory. Research areas include ceramics, materials reliability, polymers, metallurgy, the NIST Center for Neutron Research, and the Center for Theoretical and Computational Materials Science.