

Physics in the FY 2007 Budget

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HIGHLIGHTS

- The National Science Foundation (NSF) requested a 6.6 percent increase in the Physics Division's budget and a 6.0 percent increase in the Materials Research Division's budget (see Table II-7).
- Budgets for most physics research programs in the Department of Energy's (DOE) Office of Science would increase between 8.1 and 25.2 percent (see Table II-11).
- The budget for physics research at the National Institute of Standards and Technology's (NIST) laboratories would increase 50 percent. Materials science and engineering research would increase 18 percent.

The FY 2007 budget request is notable for its recognition of the importance of physical science research. President Bush's American Competitiveness Initiative (ACI) would double total federal spending over ten years for the research programs of three agencies that provide significant support for physics research: DOE's Office of Science, NSF, and NIST.

An FY 2007 document by the Office of Science and Technology Policy states: "Research in the physical sciences and engineering is at the heart of technological innovation for priority areas of nanotechnology, networking and information technologies, energy technologies, defense technologies, and space exploration. Physical science research leads to a better understanding of nature and the universe, and drives innovation in all fields of science, contributing significantly to the Nation's prosperity."

Research in the physical sciences is also supported by the National Aeronautics and Space Administration (NASA), Department of Defense

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(DOD), and the Department of Health and Human Services (HHS). See chapters 10, 6, and 8 for analysis of these budget requests.

DEPARTMENT OF ENERGY (DOE)

The DOE Office of Science provides 42 percent of all federal support for research in the physical sciences. It is the steward for research in high energy physics, nuclear physics, plasma physics and magnetic fusion. In addition to ten world-class national laboratories and scientific facilities, the Office of Science directly supports 21,600 Ph.D.s, postdoctoral associates and graduate students. The Office of Science supports long-term, high-risk, high-payoff multidisciplinary research. (See Table II-11 for DOE details.)

High Energy Physics: Funding for the High Energy Physics program would increase 8.1 percent or \$58 million in FY 2007, from \$717 million to \$775 million. The High Energy Physics program investigates the laws of nature as they relate to the basic constituents of matter and the forces that bind them.

Priority would be given to full experimental operations at Fermilab (IL) and the Stanford Linear Accelerator Collider (CA), with an increase in operating time at Fermilab. Fabrication of U.S. projects for the Large Hadron Collider would be completed, followed by a transition to a partnership in the research program. Project engineering and design would start on the new Electron Neutrino Appearance project, with an increase in funding for the International Linear Collider.

Nuclear Physics: DOE proposes to increase funding for the Nuclear Physics program by 23.7 percent or \$87 million, from \$367 million to \$454 million. FY 2005 funding was \$395 million.

The Nuclear Physics program investigates, as described by DOE, “the structure and interaction of atomic nuclei and the primary forces of particles of nature in nuclear matter.”

The funding request would allow operations at the Thomas Jefferson National Accelerator Facility (VA), the Brookhaven National Laboratory Relativistic Heavy Ion Collider (NY) and two smaller facilities to return to FY 2005 levels. The FY 2006 appropriation seriously underfunded operations at these facilities. The request would increase

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university and national laboratory research and fund upgrades of important facilities.

Fusion Energy Sciences: Funding for the Fusion Energy Sciences program would increase 10.9 percent or \$31 million, from \$288 million to \$319 million. Research would continue in fusion energy, which holds the promise of being both economic and environmentally safe. Fusion is the same force that powers the sun.

Under this request, full U.S. partnership in the International Thermonuclear Experimental Reactor (ITER) would be funded at \$60 million. ITER is a large experimental facility being built by a multinational collaboration in France to demonstrate controlled nuclear fusion. First plasma operations are scheduled for 2016. DOE states that the proposed budget also provides for “funding increases for research and operation of the domestic research facilities,” with a slight reduction and redirection in domestic Science and Enabling R&D programs to support ITER.

Basic Energy Sciences: FY 2007 funding for the Basic Energy Sciences program would increase 25.2 percent from \$1.1 billion to \$1.4 billion. DOE states that the Basic Energy Sciences program “conducts research and builds and operates user facilities to expand scientific foundations for new and improved energy technologies, to advance materials science, and to understand and mitigate the environmental impacts of energy use.” The program supports research in nanoscale science and the Administration’s Hydrogen Fuel Initiative.

With completion of the Spallation Neutron Source (TN) in 2006, DOE would increase funding for facility operations by \$100 million in 2007. The R&D and project engineering and design budget would increase for the National Synchrotron Light Source II project (NY). The budget also contains construction funding for the Linac Coherent Light Source, the world’s first X-Ray Free Electron Laser that will allow researchers to study matter in action. This facility (CA) will be used in a broad range of research areas.

Biological and Environmental Research (BER): The BER budget would decline 12.0 percent or \$70 million from \$580 million to \$510 million. DOE states, “Congressionally-directed projects from FY 2006 (\$128.7 million) are completed, and no additional funding is requested in

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FY 2007.” There are several large activities within BER. Funding would increase substantially for Genomics: GTL which includes work on hydrogen production, and to a lesser extent for Human Genome. DOE proposes to reduce funding for Climate Change Research by 5.0 percent.

NATIONAL SCIENCE FOUNDATION (NSF)

NSF supports physics research through the Physics Division, the Materials Research Division, and the Major Research Equipment and Facilities Construction (MREFC) account. While NSF support is just 4 percent of total federal R&D funding, the foundation provides 22 percent of all funding for academic basic research. In its budget submission to Congress, NSF states that for more than 20 years it has been “a principal source of federal support for basic research at colleges and universities in such areas as . . . the physical sciences.”

NSF highlighted elementary particle physics research early in its budget submission to Congress, stating, “NSF will expand its investment in elementary particle physics by \$15 million to exploit opportunities for discovery that physicists describe as greater than at any point in the last half-century. Recent advances strongly suggest that we are on the verge of a revolution in our understanding of the nature of matter, energy, space, and time. The investment is coordinated with activities in the interagency plans for research on the Physics of the Universe.” (See Table II-7 for details of NSF funding.)

Physics Division: NSF requested a 6.6 percent or \$15 million increase in the FY 2007 Physics Division budget to \$249 million from the current budget of \$233 million. The FY 2005 budget was \$225 million.

The budget submission describes two avenues of support for Physics Division research in diverse physics subfields. The first is for research and education grants, which would increase by \$10 million to \$165 million. The division would provide major funding for new research and education grants, an Elementary Particle Physics Initiative and the Division’s highest priority, the Physics of the Universe, described as a program to address “the compelling questions that have arisen at the interface of physics and astronomy.” This program will also be supported by the Astronomical Sciences Division and will include the grants program, instrumentation development, and new facilities.

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The Physics Division provides ongoing funding for four world-class facilities. Funding for the Large Hadron Collider now under construction near Geneva, Switzerland would increase by 34.7 percent. The Laser Interferometer Gravitational Wave Observatory (WA and LA) budget would see a 4.2 percent increase. Funding for the National Superconducting Cyclotron Laboratory (MI) would increase 1.6 percent, while increasing 1.0 percent for the Cornell Electron Storage Ring (NY). The Rare Symmetry Violating Process project was terminated in August 2005.

The Physics Division had a 37 percent funding rate for competitive actions in FY 2005. Two-hundred and thirty competitive awards were made, with an additional 541 continuing and supplementary award actions.

Materials Research Division: The Materials Research Division budget would increase 6.0 percent or \$15 million to \$257 million from the current budget of \$243 million. The FY 2005 budget was \$240 million.

The Materials Research Division supports research and education awards, centers, and user facilities. The Division provides funding for a broad range of subfields for research in the fundamental behavior of matter and materials.

The Division's research and education grants would increase \$7 million to \$146 million to support individual investigators, small groups, teams, and six International Materials Institutes. Support would increase for nanoscale materials, cyberinfrastructure materials, and biologically-related materials research.

The Division's Materials Research Science and Engineering Centers budget would increase 9.5 percent to \$71 million. Twenty-nine of these centers would be supported in FY 2007, as well as three Nanoscale Science and Engineering Centers (with partial support for an additional seven centers), and a Science and Technology Center on Materials and Devices for Information Technology Research.

Finally, the Division seeks a 2.4 percent increase in its budget for the National High Magnetic Field Laboratory (FL) and the National

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Nanofabrication Infrastructure Network, and an increase of 1.3 percent for other facilities.

The Materials Research Division had a 22 percent funding success rate in FY 2005, making 266 awards.

Major Research Equipment and Facilities Construction (MREFC): NSF supports cutting-edge physics research through the construction of major equipment and facilities. For FY 2007, \$29 million is requested for the IceCube Neutrino Observatory. The schedule calls for this observatory located in Antarctica's icecap to commence full operations in 2011. IceCube's total cost will be \$272 million, of which \$30 million will be from foreign contributions. This will be the world's first high-energy neutrino observatory and will provide researchers with an understanding of the astrophysics of extreme cosmological phenomena.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST's Laboratories support important physics and materials science and engineering research.

The Administration requested a 50.0 percent or \$21 million increase for physics research at all NIST laboratories, from the current budget of \$42 million to \$63 million. Of this requested increase, \$10 million would be allocated to physical measurement standards, fuel cell, and fire hazard and suppression research programs associated with hydrogen economy research. Quantum information science research would receive an additional \$9 million for additional research, new metrology tools and methods, and a Joint Quantum Institute.

Materials science and engineering research at all NIST laboratories would increase 18.0 percent or \$6 million, from the current budget of \$33 million to \$39 million. Scientific instruments would be upgraded or developed at the National Synchrotron Light Source at Brookhaven National Laboratory (NY) to analyze the electronic, chemical, and structural properties of a material at subnanometer resolution.