

U.S. Should Bid to Host Next Particle Accelerator, Report Says

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To remain globally competitive in particle physics, the United States should seize the opportunity to lead worldwide research efforts that would answer critical questions about the ultimate constituents of matter and the forces that govern them, as well as the composition and evolution of the universe, says a new report from the National Academies' National Research Council.

Specifically, the United States should participate in major international particle physics projects and announce its desire to be the host country for the next state-of-the-art particle accelerator, said the committee that wrote the report. Although America has a distinguished history of leadership in particle physics, other nations have increased their investments, threatening the continued distinction of the U.S. program.

"For more than half a century, the United States has been a leader in particle physics, but its flagship facilities are now being surpassed by new ones in other countries," said committee chair Harold T. Shapiro, president emeritus and professor of economics and public affairs, Princeton University, Princeton, N.J. "Today the U.S. program is at a crossroads. At just the moment when the scientific opportunities are the most exciting, we have no compelling strategic vision for the next stage of our efforts. Our leadership in particle physics either can be sacrificed, or it can be maintained by making a strong commitment to some key new experimental facilities here and thoughtful participation in current and future global efforts."

The nation's contribution to particle physics for the past 50 years has led to very detailed knowledge of the basic constituents of matter and how they interact with each other, as well as to a deeper understanding of the universe and the discovery of new particles. These discoveries also have generated new questions -- about the origin of mass, the relationships between forces observed in nature, and the composition of the universe -- that physicists are now in the position to answer.

While new discoveries will be made using a variety of experimental methods, the committee believes that the key to continued U.S. leadership will be the aggressive pursuit of several key experiments that require accelerators. These huge facilities create very fast and energetic collisions between subatomic particles to either reveal their inner structure or create new particles from the energy released in the collisions. The world's most powerful accelerator, located at the Fermi National Accelerator Laboratory in Batavia, Ill., will be shut down by 2010, and it is not yet clear whether a future facility will be constructed in the United States. An accelerator capable of operating at higher energies, the Large Hadron Collider (LHC), is being assembled in Geneva and will start operating in 2007. Now physicists around the world are planning to build an even more powerful one, the International Linear Collider (ILC). However, a decision on whether to build such a facility will not be reached until 2010 at the earliest, and its location has not yet been chosen.

The U.S. government should support the nation's involvement in both the LHC and the future ILC in conjunction with the newly proposed American Competitiveness Initiative's commitment to strengthen U.S. global leadership through continued technological advances. The government also should announce its strong desire to become the host country for the ILC, the report says. To achieve these two objectives, the particle physics budget needs to be increased by at least 2 percent to 3 percent per year in real terms; doubling the current budget over seven

years would enable even more advances.

"Recently, both the executive and legislative branches of the federal government have expressed a desire to increase funding for basic research in the physical sciences," said Norman R. Augustine, a committee member and retired chairman and CEO of Lockheed Martin Corp., Bethesda, Md. "Particle physics addresses some of the most profound questions of nature, and soon, for the first time, the most compelling machine for exploring these questions will not be in the United States. The ILC gives us an opportunity to reverse our trend of disinvestment in this area and regain a position of strength."

The LHC in Europe will be the center of attention for particle physicists worldwide over the next 15 years because of its unique ability to address questions about the structure of matter and the evolution and composition of the universe. The United States has already made significant intellectual and financial contributions to this overseas project. Continued partnering in the construction and operation of this experiment should be the highest near-term priority for U.S. efforts in particle physics, the committee said. Funding for these efforts should rise at least at the rate of inflation to allow U.S. research groups to contribute significantly to the program.

Next, the most important priority for the United States should be a vigorous program of research and development for the future ILC. Expenditures in this area should be significantly expanded, the committee said. Congress should secure at least \$500 million over the next five years to enable the nation to substantively participate in the global effort to design and engineer the facility. If a U.S. bid to host the facility is successful, additional resources would be required to construct and operate it. However, those decisions should be made when better cost estimates and initial results from the LHC experimental program are available. By committing to actively participate in the LHC and ILC

projects, the United States would ensure that it can reap the benefits of future discoveries and remain a leader in particle physics, the report says.

Leadership in this field does not mean dominance, the committee added. Rather, the United States should partner with other countries in international efforts but play a central role in such partnerships. The United States should be willing to be a significant investor in key components of the LHC and be the lead investor in the remaining research and development necessary for an ILC. The committee believes that the combined capabilities of these two facilities will address the most important scientific questions in particle physics.

The United States should also increase its investment in activities at the interface between particle physics, astrophysics, and cosmology, the report says. Additionally, U.S. involvement in domestic and foreign programs studying particles called neutrinos should be planned in an international forum.

A standing national committee -- either newly formed or already existing, such as the High Energy Physics Advisory Panel -- should establish priorities among current and future U.S. particle physics projects, the report adds. The standing committee could also advise the National Science Foundation and U.S. Department of Energy, the federal agencies that support particle physics.

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