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International Panel Recommends "Cold" Technology for Future Particle Accelerator

Beijing, China—The International Committee for Future Accelerators (ICFA), meeting during an international physics conference here, today (August 20) endorsed the recommendation of a panel of physicists charged to recommend the technology choice for a proposed future international particle accelerator.

The 12-member International Technology Recommendation Panel, chaired by Barry Barish of the California Institute of Technology, recommended that the world particle physics community adopt superconducting accelerating structures that operate at 2 Kelvin, rather than "X-band" accelerating structures operating at room temperature, as the technology choice for the internationally-federated design of a new electron-positron linear collider to operate at an energy between 0.5 and 1 TeV.

"Both the 'warm' X-band technology and the 'cold' superconducting technology would work for a linear collider," the ITRP's Barish said. "Each offers its own advantages, and each represents many years of R&D by teams of extremely talented and dedicated scientists and engineers. At this stage it would be too costly and time consuming to develop both technologies toward construction. The panel had our first meeting in January 2004 and started our evaluation of the two technologies. The decision was not an easy one, because both technologies were well advanced and we knew the selection would have significant consequences for the participating laboratories. On the basis of our assessment, we recommended that the linear collider design be based on the superconducting technology."

George Kalmus, an ITRP member from the UK's Rutherford Appleton Laboratory, explained the cold technology.

"The superconducting technology uses L-band (1.3 GHz) radio frequency power for accelerating the electron and positron beams in the two opposing linear accelerators that make up the collider," Kalmus said. "The notable feature of this machine is the use of pure niobium cavities for the accelerating structures of the collider. These cavities at their operating temperature have almost no electrical resistance; that is, they become superconducting. When this occurs, the transfer of power from the drive klystrons to the electron and positron beams becomes highly efficient. The proposed collider would occupy a tunnel of up to 40 km long with the experimental areas located at the midpoint, where the electrons and positrons collide."

In accepting the ITRP recommendation today, Cornell University's Maury Tigner, chair of the International Linear Collider Steering Committee, which appointed the panel, thanked them for their work.

"A decade ago such a high-energy linear collider was just a dream—a vision for a revolutionary tool to answer some of the most fascinating and compelling questions about the nature of our universe," Tigner said. "Since then the international science community has developed two different technologies, each capable of accelerating electrons and positrons to record energies: superconducting radiofrequency cavities and room-temperature radiofrequency disks. The ITRP's decision was a difficult but necessary one. It opens the way for the world particle physics community to unite behind one technology and concentrate our combined resources on the design of a superconducting-technology linear collider."

Jonathan Dorfan, chair of the International Committee for Future Accelerators, of which the ILCSC is a subcommittee, expressed appreciation to the panel on behalf of ICFA members.

"The ITRP held meetings in Europe, Asia and the United States," Dorfan said. "They received presentations and input from all of the world's particle physics laboratories, from accelerator experts, and from particle physicists from many nations. Their work represents the recognition of the need to choose a single technology to allow the world particle physics community to proceed cooperatively to a final design. There will be many other issues to resolve before a construction decision can be made, including the choice of a site and the mechanism for international funding, but the ITRP's decision provides a solid basis for moving forward."

Scientists from throughout the worldwide particle physics community have endorsed an electron-positron linear collider as the next high-energy particle accelerator. In 2007, operations will begin at the Large Hadron Collider, now under construction at CERN, the European Organization for Nuclear Research, in Geneva, Switzerland. The LHC, a circular proton-proton synchrotron, will operate at the highest energies any particle accelerator has ever achieved. Together with the LHC, physicists say, the International Linear Collider would be able to address the 21st-century agenda of compelling questions about dark matter, the existence of extra dimensions and the fundamental nature of matter, energy, space and time.

CERN Director General Robert Aymar commented on progress toward an international linear collider design.

"A linear collider is the logical next step to complement the discoveries that will be made at the LHC," Aymar said. "The technology choice is an important step in the path towards an efficient development of the international TeV linear collider design, in which CERN will participate."

Hirotaka Sugawara, former director of Japan’s KEK laboratory, also an ITRP member, described the science opportunities that a linear collider could provide.

“High energy physics has a long history of using proton and electron machines in a complementary way,” Sugarawa said. “With concurrent operation, here is a remarkable opportunity to maximize the science from both a linear collider and the Large Hadron Collider. Exciting physics at the linear collider would start with the detailed study of the Higgs particle. But this would be just the beginning. We anticipate that some of the tantalizing superparticles will be within the range of discovery, opening the door to an understanding of one of the great mysteries of the universe—dark matter. We may also be able to probe extra space-time dimensions, which have so far eluded us.”

Scientists and engineers from universities and particle physics laboratories have worked on the warm and cold technologies in recent years. Much of the work on the superconducting technology has been carried out by the TESLA Collaboration centered at the Deutsches Elektronen-Synchrotron, or DESY laboratory, in Hamburg, Germany. Scientists at Stanford Linear Accelerator Center, in California, and at KEK Laboratory in Tsukuba, Japan, have led the effort to develop the warm technology.

“This decision is a significant step to bring the linear collider project forward,” KEK's Director General Yoji Totsuka said. "The Japanese high-energy community welcomes the decision and looks forward to participating in the truly global project.”

Scientific discovery is the goal, SLAC Director Dorfan emphasized.

“Getting to the physics is the priority,” Dorfan said. “The panel was presented with two viable technologies. We at SLAC embrace the decision and look forward to working with our international partners.”

DESY Director Albrecht Wagner cited the achievement of an important milestone.

"With this decision,” Wagner said, “particle physics has made a major step forward toward the future. The worldwide community of particle physicists can be proud that one of the two viable technologies has now been selected for the design of this global project, independent of its final location. ”

Hesheng Chen, director of the Institute of High Energy Physics, Beijing, welcomed this decision.

“Asian particle physicists believe that the linear collider is the next-generation high-energy accelerator to meet the great challenges in twenty-first century high-energy physics and are willing to make an important contribution to the international project,” Chen said.

Michael Witherell, director of Fermi National Accelerator Laboratory, where scientists have worked on both warm and cold technologies, described the path ahead in the development of the linear collider design.

“With the technology decision behind us,” Witherell said, “the particle physics community can now begin work on a global design for a linear collider. At the same time, science funding agencies from nations in Europe and Asia, along with the U.S. and others, must reach agreement on the mechanisms for funding and operating a truly global accelerator somewhere in the world. There are many steps ahead of us before an international linear collider becomes a reality, but today's announcement of the technology choice provides an important focus."

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http://www.interactions.org/linearcollider/
http://www.fnal.gov/directorate/icfa/International_ILCSC.html)
http://www.ligo.caltech.edu/~donna/ITRP_Home.htm

Images available at http://www.interactions.org/icfa_announcement/images