Fermi National Accelerator Laboratory

Fermilab seeks to understand how our world evolved and the forces that govern it at the subatomic level. Physicists do this by using powerful accelerator beams and giant detectors and by studying cosmic behavior.

Scientific Accomplishments

Focusing on Dark Energy
The 570-megapixel, four ton Dark Energy Camera was tested and assembled at Fermilab in 2011 in preparation for the largest galaxy survey. The enhanced photo sensitivity of the camera and the fact that it has the largest optical survey power will enable the Dark Energy Survey to trace the history of the expanding universe to find clues to the characteristics of dark energy.

Discovery of a Heavy Relative of the Neutron
Scientists of the CDF collaboration announced the observation of a new particle, the neutral \( \Xi_b^0 \). This particle contains three quarks: a strange quark, an up quark and a bottom quark \( (s-u-b) \). While its existence was predicted by the Standard Model, the observation of the neutral \( \Xi_b^0 \) is significant because it strengthens our understanding of how quarks form matter.

Tevatron Puts Squeeze on Higgs' Hiding Place
Scientists of the CDF and DZero collaborations at Fermilab continue to increase the sensitivity of their Tevatron experiments to the Higgs boson particle and narrow the energy range in which the potential particle may be hiding. Together the collaborations have excluded the existence of a Higgs particle in the 100-108 and the 156-177 GeV/c² mass ranges.

Accelarator Research Powers Innovation
Basic research and the continuous development of powerful investigative tools it requires can lead to discoveries that reshape the way we live and do business. For example, the construction of Fermilab’s Tevatron accelerator enabled the superconducting wire industry and helped launch accelerator-based cancer therapy. Superconducting materials can carry far more electricity with minimal power losses than can be carried by conventional cables. Proton and neutron therapy target difficult to treat cancers.

Societal Impact

Three frontiers of research in particle physics form an interlocking framework that addresses fundamental questions about the laws of nature and the cosmos.

2,311 scientists worldwide work with Fermilab. In the U.S., 1,390 scientists from 117 institutions in 36 states rely on Fermilab for their research.