



The Large Hadron Collider

The Large Hadron Collider, located 330 feet below the border of Switzerland and France, is the world's most powerful particle accelerator. Its very-high-energy particle collisions may yield extraordinary discoveries about the nature of the physical universe. Beyond revealing a new world of unknown particles, the LHC experiments could explain why those particles exist and behave as they do. The LHC experiments could uncover the origins of mass, shed light on dark matter, expose hidden symmetries of the universe, and possibly find extra dimensions of space.

The LHC accelerates hair-thin beams of particles to a whisker below the speed of light. Thousands of powerful superconducting magnets steer the beams around the LHC's 16.5-mile-long ring. At four points the particles collide in the hearts of the main experiments, known by their acronyms: ALICE, ATLAS, CMS and LHCb. In the data from these high-energy collisions scientists search for the tracks of particles whose existence could transform our understanding of the universe.

More than 10,000 scientists, engineers and students from almost 60 nations on six continents contribute to the LHC, which is headquartered at the CERN laboratory in Geneva, Switzerland. About 1,700 come from universities and laboratories in the United States. Federal funding for US contributions to the LHC is provided by the US Department of Energy's Office of Science and the National Science Foundation.



Engineers at work on the Large Hadron Collider. Copyright CERN.

The United States and the LHC

US participants: Approximately 1,700 scientists, students, engineers and technicians from US institutions

Institutions: 89 universities, 7 national laboratories and 1 super-computing center

States represented: 32 + Puerto Rico

Cost of US LHC construction projects: \$542 million for construction of the LHC accelerator and the ATLAS, CMS and ALICE detectors

Construction contributions: Superconducting magnets and cable for LHC accelerator; major roles in construction of nearly every aspect of the ATLAS and CMS detectors and computing systems; electromagnetic calorimeter for ALICE detector

Computing contributions: Storage, processing and networking capacity for LHC data provided by 19 U.S. institutions through the Open Science Grid

Operation contributions: US scientists have leading roles in the operation of the LHC experiments, R&D for upgrades to the experiments and accelerator, and analysis of LHC data.

LHC in the US: Scientists monitor the LHC status and help run its experiments from remote operations centers located at several US national laboratories and universities.

LHC Scientific Goals

Scientists from the six LHC experiments use the unprecedented data collected by their detectors in their quest to answer questions such as:

- How did the universe come to be?
- What is the origin of mass?
- What is dark matter?
- What happened to the antimatter?
- Are there undiscovered principles of nature?
- Do extra dimensions exist?
- How can we solve the mystery of dark energy?
- What happens to matter at 100,000 times the temperature at the center of the sun?