The NOvA Neutrino Experiment

Fermilab's NOvA experiment is helping scientists determine the role that ghostly particles called neutrinos played in the evolution of the cosmos.

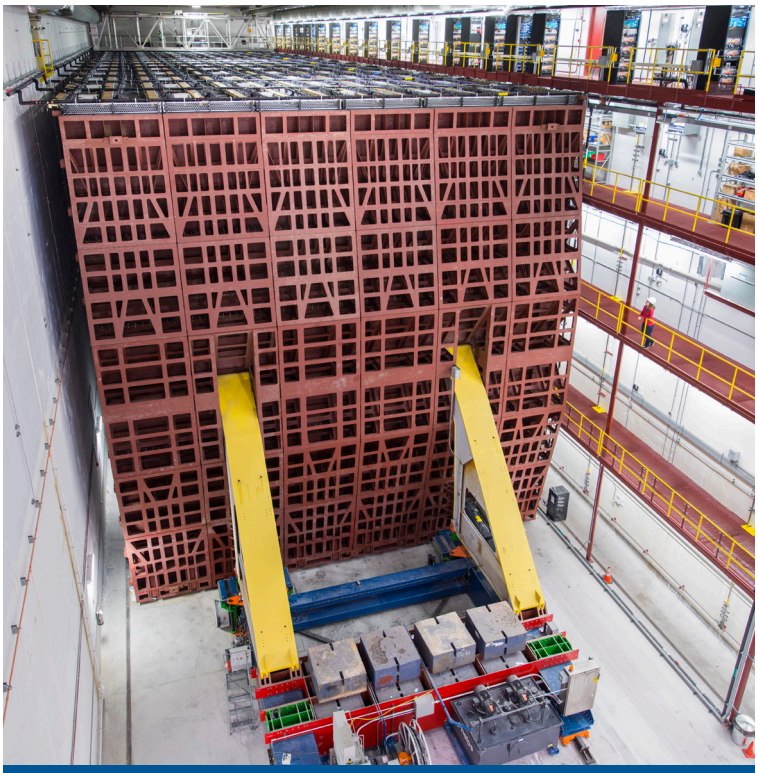
Mysterious neutrinos

Neutrinos are among the most abundant particles in the universe, a billion times more common than the particles that make up stars, planets and people. Every second trillions of neutrinos from the sun and other celestial objects pass through your body.

There are three types of neutrinos. As they travel, neutrinos can transition from one type into another. Researchers are eager to explore these neutrino oscillations because they could reveal why the universe evolved the way it did—into the matter-dominated cosmos where we live.

The NOvA detectors

NOvA scientists use a 300-ton particle detector at Fermilab (the near detector) and a 14,000-ton detector in northern Minnesota (the far detector) to study neutrino oscillations. The near detector sits in a cavern 350 feet underground and measures the composition of the neutrino beam as it leaves the Fermilab site. The neutrinos oscillate as they travel straight through the Earth. The far detector records the types of neutrinos that arrive in Minnesota.



The NOvA detector in Minnesota occupies an area about the size of two basketball courts. It is 200 feet long and made of modules 50 feet high and 50 feet wide. The detector records particle tracks from neutrinos sent by a powerful accelerator at Fermilab. The construction of the NOvA detectors was completed in the fall of 2014, on time and under budget. The experiment is scheduled to collect information for six years.

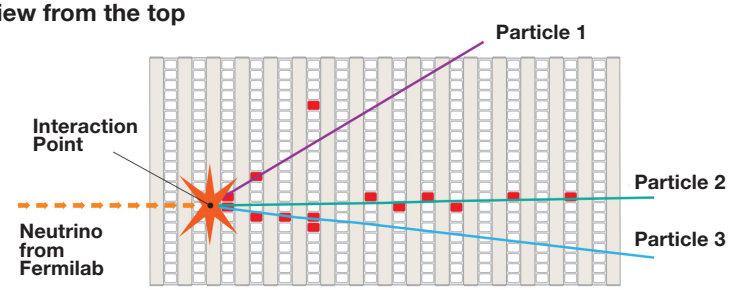
The world's best neutrino beam

Fermilab's accelerator complex produces the most intense neutrino beam in the world and sends it straight through the Earth to northern Minnesota, no tunnel required. Moving at close to the speed of light, the neutrinos make the 500-mile journey in less than three milliseconds.

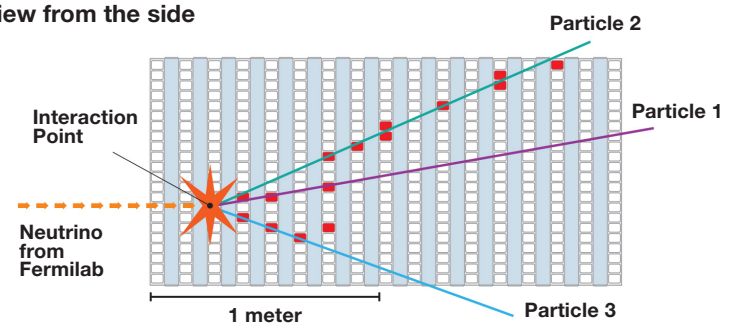
Neutrinos rarely interact with matter. When a neutrino smashes into an atom in the NOvA detector in Minnesota, the resulting particles create distinctive particle tracks. Scientists explore these particle interactions to better understand the transition of muon neutrinos into electron neutrinos. The experiment also helps answer important scientific questions about neutrino masses, neutrino oscillations and the role neutrinos played in the early universe.

Neutrino interaction recorded by NOvA

View from the top



View from the side



For more information and videos

NOvA website:
http://www-nova.fnal.gov

Live feed of particle tracks in the NOvA detector:
http://nusoft.fnal.gov/nova/public/

Check out the Fermilab YouTube channel for NOvA videos, including a timelapse of construction:
http://youtube.com/Fermilab