MicroBooNE particle detector makes its move, with Yale's help

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If you want to see neutrinos change flavors, you need a hefty detector. Yale University physicists and others at the Fermilab research facility in Illinois recently helped move a massive, 30-ton particle detector into a new building where it will be used to help scientists better understand the enigmatic particles known as neutrinos.

"We started at seven in the morning," said Bonnie Fleming, a physics professor at Yale and founding scientific spokesperson for the neutrinos experiment. "It was incredibly nerve-wracking. A lot of the postdocs were running behind the truck, each step of the way."

Although the June 23 transport of the 40-foot-long MicroBooNE detector involved only three miles, it represented a huge leap forward in a project that began in 2007. Ultimately, the plan is to collect data with a 170-ton Liquid Argon Time Projection Chamber to spot and measure neutrino interactions.

A $1.1 million National Science Foundation MRI grant to Yale helped pay for various systems within the device and Yale scientists built key elements on campus. Notably, the Yale team in New Haven last year strung 6,000 of the 8,000 wires that make up the active detector element for the experiment.

"We packed them up and put them in a U-Haul," Fleming said.

Along with Fleming, the Yale group includes visiting faculty members

Flavio Cavanna and Ornella Palamara; research scientist Eric Church; postdoctoral research associate Andrzej Szelc; graduate students Corey Adams, Elena Gramellini, Ariana Hackenburg and Brooke Russell; and undergraduate student Elizabeth Himwich.

Some of the crew even sported temporary, MicroBooNE hand tattoos.

Neutrinos, one of the world's basic building blocks, spring from the decay of radioactive elements and hurtle through the cosmos at the speed of light. They carry no electric charge and are unaffected by most forces of the universe. They also come in three "flavors" – electron, muon and tau – relating to a trio of charged particles.

Yet sometimes they change flavors. Such subatomic shenanigans are well documented and understood over long distances, but not in short spaces. "Those don't fit into our picture of a standard neutrino model at all," Fleming said. "If these anomalies are oscillations, that would be a major discovery."

That's where MicroBooNE enters the picture. The experiment will examine how neutrinos interact and change within a distance of 500 meters. It will detect and measure interactions among neutrinos, as well as measure cross-sections of neutrinos.

The particle detector has been under construction for the past two years. Its new home is located on the Booster Neutrino Beamline, a controlled neutrino stream housed in Fermilab's Liquid Argon Test Facility.

"Now we spend a couple of months completing the installation," Fleming said. The device is expected to begin collecting data by the end of the year.

More information: For more information about MicroBooNE, visit:

www-microboone.fnal.gov/

Provided by Yale University