Enriched Xenon Observatory Makes Progress

September 7 2006

Jesse Wodin with the EXO cryostat.

A group of physicists will soon be working in the salt mines to learn the mass of neutrinos and determine if neutrinos are their own antiparticle. Only recently shown to have mass, neutrinos stream through the universe but rarely interact with anything.

The physicists plan to lower their prototype observatory 800 meters into a salt mine in New Mexico by the end of the year. SLAC is one of the collaborators on the Enriched Xenon Observatory project, which is led by Stanford University.

To seek the answers, the EXO team is building a detector system. The system includes a special copper vessel containing 200 kilograms of xenon, enriched to contain mostly one form of the element, called xenon

136. Researchers hope to see a rare, and maybe impossible, radioactive decay in which the xenon136 releases two electrons of a particular energy, but no neutrinos. This process is called neutrinoless double beta decay.

"This can only happen if the neutrino is its own antiparticle and it has mass. In addition, if EXO sees a signal, we will be able to measure the neutrino's mass scale," said SLAC Professor Marty Breidenbach.

The experiment is challenging, however, because scientists want to detect only the neutrinos that are created from xenon's decay inside the vessel. The electrons emitted during the decay move through the liquid xenon, ionizing it and creating a signal collected by detectors immersed in the liquid. Cosmic rays or radioactive impurities of even one part per trillion in the liquid, copper and outside shielding can cause electrons unrelated to xenon decay to flow inside the observatory and give false signals.

"Backgrounds are very critical. Things have to be incredibly clean. One of the worst disasters would be someone sneezing on the vessel, because our breath is highly radioactive compared to the scale we care about," said Breidenbach.

That's why the observatory will be ensconced in the salt mine, inside a clean room where researchers will wear bunny suits and face masks. The extra pure copper used to make the vessel comes only from Germany. It was shipped to Stanford’s shielded facility—low in the hold of a fast cargo ship—to avoid as many cosmic rays as possible. An airplane flight would yield radioactive isotopes in the copper that would overwhelm the experiment.

In the coming months, the team will finish designing the vessel and assemble it on campus, before the observatory heads for the salt mines to extract valuable data.

Source: by Heather Rock Woods, SLAC Today, Stanford Linear Accelerator Center

Citation: Enriched Xenon Observatory Makes Progress (2006, September 7) retrieved 25 April 2024 from https://phys.org/news/2006-09-enriched-xenon-observatory.html