Mining for dark matter

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While much of the attention in the world of high-energy physics is focused on the Large Hadron Collider nearing completion at the European Center for Nuclear Research (CERN) near Geneva, Switzerland, other physicists, including some from UC Davis, are working on a much lower-budget experiment that will sit in an abandoned South Dakota goldmine.

The National Science Foundation and the U.S. Department of Energy recently approved $1.2 million in funding for the LUX (Large Underground Xenon) detector, about half the cost of the project. LUX will look for evidence of particles of dark matter, thought to make up a quarter of the content of the universe.

"LUX is not so much rocket science as about being very careful," said Robert Svoboda, a physics professor at UC Davis who with Professor Mani Tripathi is a co-investigator on the project. "We're dealing with very low energies where events are very hard to see."

The detector will consist of about 600 pounds of liquid xenon suspended in a 25-foot-high tank of extremely pure water, located 4,800 feet underground in the Homestake mine near Lead, S.D. If dark matter particles called WIMPs (weakly interacting massive particles) exist, then they should occasionally bump into the nucleus of a xenon atom and give off a flash of light.

For physicists, detecting dark matter "would be the biggest deal since finding antimatter in the 1930s," Tripathi said.

The deep-mine location and the water tank are designed to block radiation that would interfere with detecting the rare, low-energy events. The researchers are testing everything down to the epoxy glue to remove the smallest traces of radiation.

"This will be one of the least radioactive places on Earth," Svoboda said.

The mine closed in 2000. In 2004, the state legislature created the South Dakota Science and Technology Authority to develop the mine as an underground laboratory, and in 2007 the National Science Foundation selected the mine as the site for a national Deep Underground Science and Engineering Laboratory (DUSEL). LUX will be the first major experiment installed at the site.

Water is currently being pumped out of the mine, and the researchers hope to begin assembling the experiment in late summer or fall this year.

Source: University of California - Davis