UC SANTA BARBARA

THE Current

November 12, 2003
Gail Gallessich

Search for Dark Matter Intensifies

Today scientists announced that the search for dark matter is on -- it has been launched from a laboratory half a mile below ground. Two professors from the University of California, Santa Barbara -- Harry Nelson and David Caldwell -- are playing a major role in the multi-institution experiment.

"This is the best, quietist environment that we have for searching for dark matter," said Harry Nelson, professor of physics at UCSB and one of the leading researchers in the experiment.

Astronomers have known for 70 years that the matter we see cannot constitute all the matter in the universe. If it did, galaxies would fly apart. Recent calculations indicate that ordinary matter containing atoms makes up only four percent of the energy-matter content of the universe. "Dark energy" makes up 73 percent, and an unknown form of dark matter makes up the last 23 percent.

The researchers are using a mine in Soudan, Minn. and have placed sensitive germanium crystals, chilled to nearly absolute zero, in the mine. The location and the temperature shield the crystals from unwanted particles that fall to Earth's surface and "noise" from moving particles that occurs in a warm environment.

"When you hold a sea shell up to your ear, what you hear is the movement of particles," said Nelson. If the shell were frozen, the sound would be gone.

The scientists expect that WIMPS, or weakly interacting massive particles, the leading candidates for dark matter, will reach the crystal and cause small sounds,

which will be recorded by computer. WIMPs are theorized as particles much more massive than protons, but interacting so weakly with other particles that billions pass through a human body each second without leaving a trace. The experiment needs only a few interactions to make a strong claim for detection of WIMPS.

"It is often said that this is the ultimate Copernican Revolution," said David Caldwell, chair of the Cryogenic Dark Matter Search (CDMS II) Executive Committee. "Not only are we not at the center of the universe, but we are not even made of the same stuff as most of the universe. Discovery would be a great breakthrough, one of the most important of the century."

Nelson compared dark matter to a bowling ball surrounding the Milky Way galaxy, with the Milky Way as we see it taking up about the space of a quarter in the center of the bowling ball.

He explained that what is needed now is time. "After 100 days online, we will easily surpass the world's sensitivity for detection of dark matter," said Nelson. An Italian-Chinese team has been working on the problem as well as French and English teams. Nelson said that the CDMS II group is at the forefront.

Funding for the experiment comes from the Office of Science of the U.S. Department of Energy (DOE) and the Astronomy and Physics Division of the National Science Foundation (NSF).

"CDMS II is the kind of innovative and path-breaking research NSF is proud to support," said Michael Turner, Assistant Director for Math and Physical Sciences at the National Science Foundation.

"If it detects a signal it may tell us what the dark matter is and give us an important clue as to how gravity fits together with the other forces.

This type of experiment shows how the universe can be used as a laboratory for getting at some of the most basic questions we can ask as well as how DOE and NSF are working together."

Besides UCSB, CDMS II collaborators include Brown University, Case Western Reserve University, Fermi National Accelerator Laboratory, Lawrence Berkeley National Accelerator Laboratory, National Institute of Standards and Technology, Princeton University, Santa Clara University, Stanford University, University of

California at Berkeley, University of Colorado at Denver, and the University of Minnesota.

Related Links

Photos

Background Information

Cryogenic Dark Matter Search Home Page

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.