Antarctic "Telescopes" Look for Cosmic Rays

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Working in the harsh conditions of Antarctica, Maryland researchers are creating new ways of detecting cosmic rays, high energy particles that bombard the Earth from beyond our solar system.

FIRE AND ICE

Associate professor of physics, Greg Sullivan leads the university's participation in IceCube, a neutrino "telescope" made of a cubic kilometer of clear Antarctic ice embedded with optical sensors that will look up through the Earth to detect cosmic neutrinos coming from beyond our galaxy. Cosmic neutrinos are extremely high energy subatomic particles, like protons and electrons, but neutrinos have no electrical charge. Neutrinos are produced by the decay of radioactive elements and elementary particles The NSF-supported IceCube collaboration will search for neutrinos from the most violent and powerful cosmic sources: exploding stars (hypernova) thought to produce intense bursts of gamma rays and giant black holes (Active Galactic Nuclei) that are found at the center of galaxies.

IceCube will begin providing significant data in 2006 and be completed in 2010. This research project will be a powerful tool in the search for answers to unsolved questions in physics and cosmology, such as the origin of cosmic rays and the nature of dark matter. In addition to Sullivan, the Maryland team includes assistant professor Kara Hoffman and professor and department chair Jordan Goodman.

A BALLOON'S EYE VIEW OF THE COSMOS

Eun-Suk Seo , also an associate professor of physics at University of Maryland, leads the Cosmic Ray Energetics and Mass(CREAM) project designed to determine the energy and composition of a different class of cosmic rays -- charged particles from our galaxy. This NASA-supported project makes use of balloons to fly particle detectors high above the Antarctic ice at the outer reaches of Earth's atmosphere, where such particles can be intercepted before they collide with molecules of air. CREAM promises to provide new insights into the origins of these high speed protons and ions and the cataclysmic process or processes by which these particles are accelerated to energies far higher than is possible in even the most powerful of human-made accelerators.

The project recently completed its first balloon flight, in the process setting a duration and distance record for balloon flights. It soared for nearly 42 days, making three orbits around the South Pole. However, for professor Seo and the many other members of the project team, long flights mean far much more than records; they are vital to the projects ability to image the cosmos. Just as keeping the shutter open longer on a camera allows more photons of light to hit the film, extended balloon flights allow more cosmic ray particles to hit the balloon-born detector. The project is working with NASA to develop ultra long duration balloon flights that eventually will keep the CREAM particle detector in the air for up to 100 days.

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