February 17, 2003

Telescope follows trail of neutrinos into deepest reaches of the universe

By Staff Writer

A unique telescope buried in Antarctic ice promises unparalleled insight into such extraordinary phenomena as colliding black holes, gamma-ray bursts, the violent cores of distant galaxies, and the wreckage of exploded stars.

An international team of physicists and astronomers, which includes University of California, Irvine (UCI), researchers, report that the AMANDA telescope is capable of tracking high-energy neutrinos - elusive subatomic particles - to their sources, which are emitted by these signature events.

Their findings were published in the February 1, 2003, issue of the Astrophysical Journal. "We now have a powerful new tool to scan the heavens," said Steven Barwick, a UCI physicist and corresponding author on the report. "This marks a significant breakthrough in the field of high-energy neutrino astronomy. AMANDA does what it was designed to do. Of all the high-energy particles emitted from the violent, energetic events in the universe, only neutrinos can directly provide information on these activities."

Neutrinos are invisible, uncharged, nearly massless particles that, unlike other kinds of radiation, speed through the universe unhindered by planets, stars, magnetic fields, or entire galaxies. The particles are emitted by phenomena scientists believe can help them understand the origins of the universe.

Using the AMANDA detector - a massive, 400-meter tall structure consisting of 308 optical sensors each the size of a bowling ball - the physicists examined a previously unexplored region of the sky. They calculated that AMANDA could measure the direction of neutrinos within 3.5 degrees, which is accurate enough to reveal sources of high-energy neutrinos. They also determined that an improved version of the detector, AMANDA-II, which has been operational since January 2000, can provide as much as 10 times more information on the emission sources of these neutrinos.

First operational in 1997, the Antarctic Muon and Neutrino Detector Array (AMANDA) facility was established to study the high-energy form of neutrinos, which has 10,000 times more energy than that of low-energy neutrinos emitted by the sun. Buried more than one-and-a-half kilometers beneath the South Pole, the National Science Foundation-funded AMANDA telescope is pointed into the ground instead of up at the sky, so the Earth can act as a filter for other forms of radiation. This means despite its location in the South Pole, the "eye" of the telescope is actually the northern skies.

Along with Barwick, other UCI researchers contributing to the AMANDA project are Lisa Gerhardt, Kyler Kuehn, John Kim, Pat Mock, David Ross, Wenqing Wu, Gaurang Yodh, and Scott Young. Overall, 105 scientists from 20 universities and institutes in the United States, Europe, and South America collaborate on AMANDA research. Their work is supported by a variety of international sources, including the U.S. National Science Foundation, the U.S. Department of Energy, and the UCI AENEAS Supercomputer Facility.