

ASTRONOMY

Neutrino detectors use power of particle to track supernovae

Tuesday, September 19, 2006

KEN HICKS

Professional astronomers use a variety of telescopes in their research. Some measure optical light, such as the typical household telescope; others use shorter wavelengths of light, such as X-rays, and longer wavelengths, such as radio.

Each wavelength has its own advantages and is used to probe different physical processes in stars and galaxies.

However, one type of telescope is different from all others. It is operated by particle physicists, not astronomers, and measures particles called neutrinos, rather than light waves.

Neutrinos are ghostly particles that pass through most matter as if it weren't even there. They are generated by nuclear reactions in stars, including our sun.

Why should we care about neutrinos? In a word: supernovae.

When stars explode, they pour out a huge amount of energy in a very short time. One supernova can outshine an entire galaxy for a few days.

However, most of the energy is released, not as light, but as neutrinos. So many neutrinos are given off that we can detect them if the supernova occurs in our own galaxy.

Supernovae in our galaxy are rare, occurring only a few times per millennium.

One was recorded in 1987 in the Large Magellanic Cloud, which orbits our galaxy.

More than a dozen neutrinos were seen in detectors in Japan and the United States.

Scientists using theoretical models of supernovae need this neutrino data to help understand why stars explode. Perhaps the premier neutrino detector in the world is in Kamioka, Japan. It holds 50,000 tons of water and is located in a mine about a mile underground.

The water is surrounded by sensitive electronics that detect the faint light given off when a neutrino interacts with the water. By sensing the direction of the neutrino, the detector can reconstruct an image of the sun.

Recently, the Japanese detector — called Super-K — was refurbished, making it even more efficient at detecting neutrinos.

Now, we just need to wait for a supernova.

Ken Hicks is a professor of physics and astronomy at Ohio University in Athens.

hicks@ohio.edu

