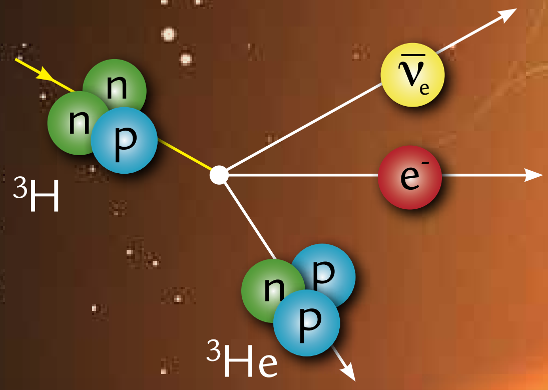
Tiny particle, giant detector

Neutrinos are fundamental particles. They are tiny – a neutrino has a mass about one-millionth of the mass of an electron – and they have no electric charge. So how can we detect these elusive particles?

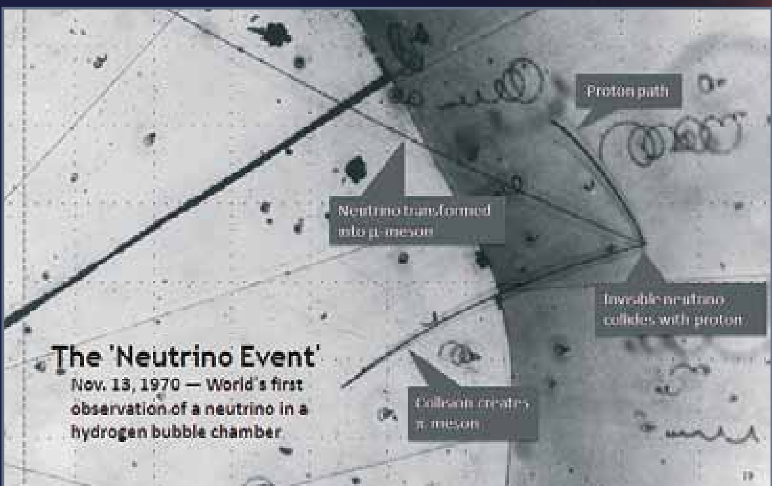
The answer is to use a giant detector. The one shown here is from the Katrin experiment at Karlsruhe in Germany. This is designed to give an accurate measurement of the mass of a neutrino.



Neutrinos are emitted when a radioactive nucleus undergoes beta decay. Here, a tritium (hydrogen) nucleus emits a beta particle (an electron, e$^-$) and an antineutrino ($\bar{\nu}_e$).

The neutrino detector was built in southern Germany but, to reach its final site, it spent two months travelling along rivers and by sea. Here it is seen passing through the town of Eggenstein-Leopoldshafen.

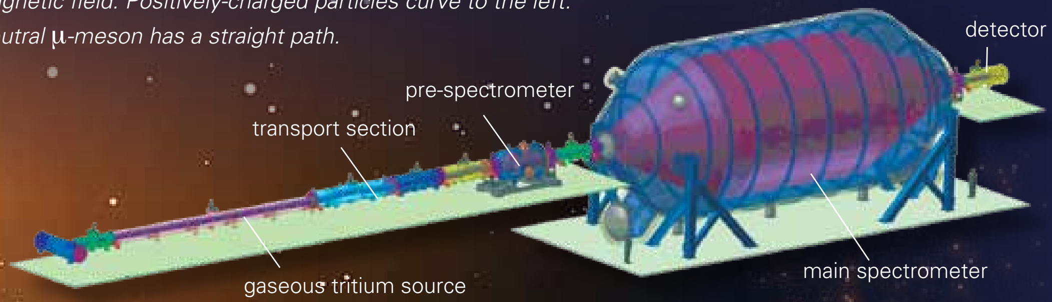
The Katrin detector is lowered into place.



In this photograph, a neutrino entered from lower right and struck a proton. The resulting particles are identified from their paths in the magnetic field. Positively-charged particles curve to the left. The neutral μ-meson has a straight path.

Did you know?

In the time it takes you to read this sentence, millions of billions of neutrinos coming from the Sun will have passed right through you – they interact only very weakly with matter.



The complete Katrin experiment: tritium ^{3}H is a beta emitter; neutrinos travelling along the tube are detected in the giant spectrometer on the right.