News about ghost particles

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(http://physicsforme.files.wordpress.com/2013/07/newsaboutgho.jpg)
This model of the GERDA experiment shows the onion-like structure which suppresses interfering signals from the environment. The germanium diodes in the center of the cryostat filled with liquid argon (–186°C) are to a larger scale. Credit: MPI for Nuclear Physics

(Phys.org) —Neutrinos are the most elusive particles having extremely weak interactions with all other particles. They have rather unusual properties and are even expected to be identical with their own antiparticles. So far this property is, however, not experimentally verified even though many studies of neutrinos over the last 60 years have already boosted our understanding of elementary particle physics.

Now scientists of the GERDA collaboration obtained new strong limits for the so-called neutrino-less double beta decay, which tests if neutrinos are their own antiparticles. The result rules out an earlier claim and has various important implications for cosmology, astrophysics and particle physics and it adds information about neutrino masses.
Besides photons, neutrinos are the most abundant particles in the Universe. They are often called `ghost particles', because they interact extremely weakly with matter. They are therefore an invisible, but very important component of the Universe, which could carry altogether as much mass as all other known forms of matter, albeit traveling almost at the speed of light over fantastic distances. Their tiny masses have also important consequences for the structures in the Universe and they are

the driving element in the explosion of Supernovae. But their most remarkable and important property has been proposed by Ettore Majorana in the 1930ies: Unlike all other particles that form the known matter around us, neutrinos may be their own antiparticles.

The GERDA (GERmanium Detector Array) experiment, which is operated at the Laboratori Nazionali del Gran Sasso underground laboratory of the Istituto Nazionale di Fisica Nucleare in Italy, is aiming to resolve the question whether neutrinos are in fact their own antiparticles, and to determine their mass. GERDA looks for so-called double beta decay processes in the germanium isotope Ge-76 with and without the emission of neutrinos, the latter being a consequence of the Majorana properties. In normal beta decay, a neutron inside a nucleus decays to a proton, an electron and an antineutrino. For nuclei like Ge-76, normal beta decay is energetically forbidden, but the simultaneous conversion of two neutrons with the emission of two antineutrinos is possible and has been measured by GERDA recently with unprecedented precision. This is one of the rarest decays ever observed with a half-life of about 2*1021 years, which is about 100 billion times longer than the age of the Universe. If neutrinos are Majorana particles, neutrino-less double beta decay should also occur at an even lower rate. In this case, the antineutrino from one beta decay is absorbed as neutrino by the second beta-decaying neutron, which becomes possible if neutrinos are their own antiparticle.

Read more at: http://phys.org/news/2013-07-news-ghost-particles.html#jCp (http://phys.org/news/2013-07-news-ghost-particles.html#jCp)

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