

Neutrinoless Double-Electron Capture in ^{36}Ar

Samantha Norris
Illinois State University
Normal, IL 61761

Henning O. Back
Princeton University
Princeton, NJ 08543

Yann Guardincerri, Stephen Pordes
Fermi National Accelerator Laboratory
Batavia, IL 60510

Abstract

One controversial topic in particle physics is the mechanism by which neutrinos have their recently discovered mass. One possibility is that they are Majorana neutrinos; this would violate the Standard Model, but if this is the case, then one possible way of detecting them is through neutrinoless double-electron capture, which can only occur with Majorana neutrinos. Although ^{36}Ar has never been observed to decay, it is capable of undergoing double-electron capture with a half-life greater than 1.85×10^{18} years. In this decay, energy is given off in the form of two neutrinos or, in the neutrinoless case, a bremsstrahlung photon. The Darkside-50 detector at Gran Sasso National Laboratory will be used to look for this photon and, if it is not found, a lower limit will be placed on the half-life of the ^{36}Ar nucleus.