Neutrinoless double beta decay studied with configuration mixing methods

Tomás R. Rodríguez
GSI Helmholtzzentrum für Schwerionenforschung, D-64259 Darmstadt, Germany
Estructura nuclear

Double beta decay is an extremely rare process where an even-even nucleus decays into the even-even neighbor bypassing the energetically forbidden odd-odd intermediate isobar. Along the nuclear chart, there are only few candidates to be double beta emitters, all found in the valley of stability. The double beta decay where two electrons and two neutrinos are emitted in the final state has been observed experimentally in several isotopes with half-lives ~10^{19-21} years. This process conserves the leptonic number and is compatible with Majorana or Dirac neutrinos. There is also a second mode without neutrino emission that is possible only if the neutrinos are massive Majorana particles and is related to the absolute mass scale of these elementary particles. Except to one controversial claim, neutrinoless double beta decay has not been detected and is currently the main goal of several projects worldwide

In this presentation we will study neutrinoless double beta decay with state-of-the-art beyond self-consistent mean field methods to compute the nuclear matrix elements (NME). Generating coordinate method with particle number and angular momentum projection with the Gogny D1S force is used for the first time for finding mother and granddaughter states and evaluating transition operators between different nuclei. We analyze explicitly the role of the deformation and pairing in the evaluation of the NME.