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Neutrinoless $\beta\beta$ nuclear matrix elements using IVSD $J^\pi = 2^-$ data

Ground-state-to-ground-state neutrinoless double beta ($0\nu\beta\beta$) decays in nuclei of current experimental interest are revisited. In order to improve the reliability of the nuclear matrix elements (NMEs) for the light Majorana-neutrino mode, the NMEs are calculated by exploiting the newly available data on isovector spin-dipole (IVSD) $J^\pi = 2^-$ giant resonances obtained at RCNP, Osaka.

In order to correctly describe the IVSD up to and beyond the giant-resonance region, the present computations are performed in extended no-core single-particle model spaces using the proton-neutron quasiparticle random-phase approximation (pnQRPA) with two-nucleon interactions based on the Bonn one-boson-exchange G matrix. The appropriate short-range correlations, nucleon form factors, higher-order nucleonic weak currents, and partial restoration of the isospin symmetry are included in the calculations. The results are compared with earlier calculations of Hyvärinen and Suhonen [Phys. Rev. C **91**, 024613 (2015)] performed in much smaller single-particle bases without access to the IVSD $J^\pi = 2^-$ giant-resonance data reported here.

The study offers a new way of fitting the g_{ph} parameter of pnQRPA to the measured IVSD giant resonance instead of fitting it to the Gamow-Teller giant resonance in the traditional way. In fact, we study three different combinations to fit this parameter to available data and study the associated errors in the $0\nu\beta\beta$ NMEs.

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