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Shell model calculations of double-beta decay lifetimes of ^{48}Ca[1]

SABIN STOICA, ANDREI NEACSU, Horia Hulubei National Institute for Physics and Nuclear Engineering, P.O. Box MG-6, 077125 Magurele-Bucharest, Romania, MIHAI HOROI, Department of Physics, Central Michigan University, Mount Pleasant, Michigan 48859 — Recent results from neutrino oscillation experiments have convincingly demonstrated that neutrinos have mass and they can mix. The neutrinoless double beta ($0\nu\beta\beta$) decay is the most sensitive process to determine the absolute scale of the neutrino masses, and the only one that can distinguish whether neutrino is a Dirac or a Majorana particle. A key ingredient for extracting the absolute neutrino masses from $0\nu\beta\beta$ decay experiments is a precise knowledge of the nuclear matrix elements (NME) for this process. We developed a new strategy for computing the NME for the two-neutrino ($2\nu\beta\beta$) decay mode of Ca48, using GXPF1 and GXPF1A interactions. We reproduce the experimental value of the half-life for the g.s. to g.s. transitions, and we predict the lifetime for the g.s. to the first 2^+ excited state. We also developed a new shell model approach for computing the NME for the $0\nu\beta\beta$ mode and used it in the case of ^{48}Ca. The dependence of the results on short range correlations, the neutrino energy, and on the effective interaction will be discussed.

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