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Advances in the calculation of double beta decay J. KOTILA, F. IACHELLO, Center for Theoretical Physics, Sloane Physics Laboratory, Yale University, New Haven, CT 06520-8120, USA — The fundamental nature and the absolute mass scale of the neutrino is a subject of great interest at the present. In order to study these issues the nuclear $\beta\beta$-decay is utilized. For an extraction of the neutrino mass and for estimates of the half-life, besides the involved nuclear matrix elements, one also needs the phase-space factors $G_{0\nu}$ and $G_{2\nu}$. A general formulation was given by Doi et al. [1]. However, in previous calculations an approximate expression for the electron wave function at the nucleus is used. We have done an independent calculation with exact Dirac electron wave functions including screening by the electron cloud [2]. The influence to the phase-space factors is seen especially for the heavier $\beta\beta$-decaying nuclei. This is an extremely important observation since, judging by the expected lifetime, ^{150}Nd is one of the most prominent candidates where the $0\nu\beta\beta$-decay could be seen. Furthermore, we have calculated the phase-space factors to the first excited 0^+ state both in 0ν and 2ν mode. All the above mentioned results are combined with recently calculated IBM-2 nuclear matrix elements [3] leading to a more reliable prediction for neutrino mass and estimates of the half-life in both modes. [1] M. Doi et al., Prog. Theor. Phys. 66 (1981) 1739. [2] J. Kotila and F. Iachello, to be published. [3] J. Barea and F. Iachello, Phys. Rev. C79 (2009) 044301 and to be published.

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