Nuclear Theory

Spectral distribution method for neutrinoless double-beta decay nuclear transition matrix elements: Binary correlation results

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Neutrinoless double-beta decay nuclear transition matrix elements are generated by an effective two-body transition operator and it consists of Gamow-Teller like and Fermi like (also tensor) operators. Spectral distribution method for the corresponding transition strengths (squares of the transition matrix elements) involves convolution of the transition strength density generated by the non-interacting particle part of the Hamiltonian with a spreading function generated by the two-body part of the Hamiltonian. Extending the binary correlation theory for spinless embedded k-body ensembles to ensembles with proton-neutron degrees of freedom, we establish that the spreading function is a bivariate Gaussian for transition operators $\co(k_\co)$ that change $k_\co$ number of neutrons to $k_\co$ number of protons. Towards this end, we have derived the formulas for the fourth-order cumulants of the spreading function and calculated their values for some heavy nuclei; they are found to vary from ~ -0.4 to -0.1. Also for nuclei from ^{76}Ge to ^{238}U, the bivariate correlation coefficient is found to vary from $\sim 0.6 - 0.8$ and these values can be used as a starting point for calculating nuclear transition matrix elements using the spectral distribution method.

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