

Current Status of Neutrinoless Double-Beta Decay Matrix Elements

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Observing neutrinoless double-beta ($0\nu\beta\beta$) decay is the most promising way to detect lepton number violation in the laboratory, and it would imply that neutrinos are their own antiparticles. The decay half-life naturally depends on a nuclear matrix element that needs to be calculated theoretically. A good knowledge of this matrix element is key for the planning of $0\nu\beta\beta$ decay experiments, and also to extract information on the neutrino mass once $0\nu\beta\beta$ decay is observed.

Currently predicted matrix-element values depend on the many-body method used to calculate them and, in addition, they may need to be “quenched”, as the matrix elements of other beta decays that, however, have a very different momentum-transfer regime. I will discuss recent efforts towards obtaining reliable nuclear matrix elements, ranging from improved calculations with phenomenological many-body approaches, to the first applications of “ab initio” many-body methods to $0\nu\beta\beta$ decay, finalizing with possible measurements that could be very useful to test calculations and to provide information on the value of the $0\nu\beta\beta$ matrix elements.

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