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Nuclear structure observables as a way to determine ββ decay nuclear matrix elements

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Neutrinoless ββ decay is a special nuclear process where a nucleus decays into its isobar with two more protons by only emitting two electrons. This beyond-standard-model decay can establish the nature of neutrinos and shed light into the matter-antimatter asymmetry of the universe [1]. The process, if exists, is sensitive to the structure of the initial, intermediate and final nuclei of the ββ decay [2].
In this talk I will present different ways in which nuclear structure information can be used to learn about the unknown nuclear matrix elements of the neutrinoless ββ decay. First, recent spectroscopy studies of the relevant nuclei, such as 136Cs, allows one to test different shell-model Hamiltonians which predict different values for the nuclear matrix elements [3]. These measurements complement the nucleon removal and addition experiments carried out at Argonne National Laboratory in the past two decades [4].
Second, I will propose nuclear structure observables which in shell-model and other many-body calculations appear to be correlated with ββ decay nuclear matrix elements, such as double Gamow-Teller [5] and double magnetic-dipole transitions [6, 7]. Measure- ments of these nuclear structure observables, which are being pursued by different groups, would provide very valuable insights on neutrinoless ββ decay nuclear matrix elements in nuclear structure experiments.
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