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Double-beta decay processes from lattice quantum chromodynamics ZOHREH DAVOUDI, University of Maryland - College Park, BRIAN TIBURZI, The City College of New York, MICHAEL WAGMAN, MIT, FRANK WINTER, Jefferson Laboratory, EMMANUEL CHANG, None, WILLIAM DETMOLD, MIT, KOSTAS ORGINOS, Jefferson Laboratory, College of William and Mary, MARTIN SAVAGE, University of Washington, INT, PHIALA SHANAHAN, Jefferson Laboratory, College of William and Mary, NPLQCD COLLABORATION
— While an observation of neutrinoless double-beta decay in upcoming experiments will establish that the neutrinos are Majorana particles, the underlying new physics responsible for this decay can only be constrained if the theoretical predictions of the rate are substantially refined. This talk demonstrates the roadmap in connecting the underlying high-scale theory to the corresponding nuclear matrix elements, focusing mainly on the nucleonic matrix elements in the simplest extension of Standard Model in which a light Majorana neutrino is mediating the process. The role of lattice QCD and effective field theory in this program, in particular, the prospect of a direct matching of the nn to pp amplitude to lattice QCD will be discussed. As a first step towards this goal, the results of the first lattice QCD calculation of the relevant matrix element for neutrinofull double-beta decay will be presented, albeit with unphysical quark masses, along with important lessons that could impact the calculations of nuclear matrix elements involved in double-beta decays of realistic nuclei.

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