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Neutrinoless Double-Beta Decay from Lattice QCD

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Neutrinoless double-beta decay ($0\nu\beta\beta$) is a hypothetical nuclear decay that is only possible if the neutrino is a Majorana fermion. This decay can be mediated either by a light Majorana neutrino propagating between two electroweak current insertions or by higher-dimension short-distance operators that appear in some beyond the Standard Model theories. Experimental searches for this process with ever-increasing sensitivity have placed strong constraints on the $0\nu\beta\beta$ half-lives of relevant isotopes. Relating these experimental half-lives to the underlying particle physics – the effective Majorana mass of the neutrino or coefficients of short-distance operators – requires understanding of the nuclear matrix elements for the transition. These matrix elements can be computed within an nuclear effective field theory framework, but input from lattice QCD is necessary to constrain low-energy constants relevant for the decay. This talk will discuss several double-beta decay calculations performed in lattice QCD and their implications for determination of nuclear EFT parameters.

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