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Nuclear Matrix Elements for Neutrinoless Double-Beta Decay

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Neutrinoless double-beta decay ($0\nu\beta\beta$) is a hypothesized decay mode of certain nuclear isotopes that, if observed, would demonstrate that neutrinos are their own antiparticles. Interpreting experimental measurements of $0\nu\beta\beta$ half-lives in terms of neutrino properties requires knowledge of the nuclear matrix elements encoding the hadronic physics involved in these decays. These matrix elements are currently estimated with nuclear models which produce large systematic uncertainties and are currently a major limiting factor in experimental searches. Nuclear effective field theory (EFT) can be used to express matrix elements of relevance to $0\nu\beta\beta$ in terms of a set of low-energy constants (LECs). Once these LECs are constrained using lattice QCD, they can inform the corresponding nuclear-structure calculations in larger nuclei. This talk will discuss recent developments in lattice QCD calculations of pion and two-nucleon matrix elements of relevance to $0\nu\beta\beta$ decay proceeding by both short- and long-distance mechanisms and the implications of these calculations for matching the relevant LECs of the EFTs.

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