Abstract Submitted
for the DNP20 Meeting of
The American Physical Society

Neutrinoless Double Beta Decay from Lattice QCD: The Long-Distance $\pi^- \to \pi^+ e^- e^-$ Amplitude[1] WILLIAM DETMOLD, Massachusetts Institute of Technology MIT, DAVID MURPHY, MIT — Observation of neutrinoless double beta decay ($0\nu\beta\beta$) would have important consequences as it would demonstrate that the neutrino is a Majorana particle and that lepton number conservation is violated in nature and provide information on the absolute scale of neutrino masses. Relating experimental constraints on $0\nu\beta\beta$ decay rates to the neutrino masses requires theoretical input in the form of non-perturbative nuclear matrix elements which remain difficult to calculate reliably. In this talk, a first step toward providing a general lattice QCD framework for computing long-distance $0\nu\beta\beta$ matrix elements in the case where the decay is mediated by a light Majorana neutrino will be discussed. The relevant formalism is developed and then tested by computing the simplest such matrix element describing an unphysical $\pi^- \to \pi^+ e^- e^-$ transition. The resulting lattice data is then fit to next-to-leading-order chiral perturbation theory, allowing a fully-controlled extraction of the low energy constant governing the transition rate, and future prospects are discussed

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Date submitted: 26 Jun 2020 Electronic form version 1.4