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Lattice QCD for Hadronic Parity Violation

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The parity violating neutral current is the least well understood of all currents in the Standard Model. At low energies, these weak interactions manifest as short distance, 4-fermion operators. Unlike their flavor-changing charged counterparts, which are easy to detect experimentally, the neutral current interactions exist in the background of the strong interactions with a typical strength of $G_F F_\pi^2 \sim 10^{-7}$, where $F_\pi \sim 92$ MeV is the pion decay constant, a typical hadronic scale. Therefore, despite major efforts, there are very few measurements of the hadronic neutral weak interaction. Lattice QCD is a non-perturbative regulator for QCD, the fundamental theory of strong interactions, and provides a rigorous tool with which to compute the strength of the hadronic neutral current in the simplest hadronic and nuclear systems. I will describe a long-term effort aimed at understanding hadronic parity violation from QCD. One of the simplest systems to use lattice QCD for, the iso-tensor hadronic parity violating NN amplitude, is one of the most promising for shedding light on our current understanding. I will motivate the need and application of lattice QCD for understanding hadronic parity violation from the Standard Model and highlight related lattice QCD results.

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