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The Nucleon Axial Form Factor for Neutrino Oscillation from First Principles

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Next generation neutrino oscillation experiments are poised to provide answers to key questions about the nature of the neutrino. The axial form factor is a vital ingredient in the nucleon amplitudes used to predict quasielastic scattering, a primary signal measurement process for flagship neutrino oscillation experiments, yet the uncertainty on this form factor is vastly underestimated by the dipole parameterization and a model independent determination is not well constrained by elementary target data. To fulfill this experimental need, Lattice QCD can be used to compute, from first principles, the interaction of a nucleon with a weak current in the absence of a nuclear medium. Results from LQCD calculations will significantly improve constraints on the uncertainty of nucleon amplitudes and allow for a theoretically robust, systematically improvable error budget. Recent calculations of the nucleon axial vector coupling have demonstrated that sub-percent precision is within reach of current generation calculations. In this talk, I will discuss preliminary results for LQCD calculations of the axial form factor of the nucleon and outline the path toward achieving a result with a complete error budget. Results from LQCD will permit factorization of uncertainties originating from nucleon and nuclear sources in order to better isolate the source of discrepancies with experimental data.

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