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The Nucleon Axial-Vector Form Factor for Precision Neutrino Oscillation Studies

Tuesday, 14 June 2016 12:00 (15 minutes)

In this talk, I will discuss recent work fitting the nucleon axial form factor to deuterium bubble chamber data using a model-independent approach known as the z expansion (arXiv 1603.03048[hep-ph]). This talk will briefly introduce the z expansion and talk about the advantages and impacts of such a framework. I will describe the functionality which has been implemented into GENIE to handle a z expansion parameterization for the nucleon axial form factor. I will also discuss an ongoing study of the axial form factor using lattice QCD and show preliminary results.

Summary

Fermilab will host a number of new neutrino experiments over the upcoming years, transitioning to an era of precision neutrino oscillation measurements. The success of these next generation neutrino experiments demands a better understanding of cross section measurement uncertainties, for which the largest contribution comes from the nucleon axial form factor. The standard choice of axial form factor has errors which are which are underestimated due to the model ansatz and which are degenerate with nuclear model errors. We seek to break the degeneracy with nuclear modeling and to obtain a realistic estimate of the uncertainties associated with nuclear form factors. We take a two-prong approach, studying the nucleon axial form factor by fitting deuterium bubble chamber data and performing an ab-initio calculation with lattice QCD. We perform fits using a model-independent formalism, which constrains the form factor shape using analyticity arguments rather than model assumptions. The resulting form factor parameter values and correlations is implemented in the GENIE neutrino event generator and can be directly incorporated into nuclear modeling and neutrino oscillation studies.

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