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Constraining nuclear matrix elements from lattice QCD for beyond the Standard-Model explorations

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Understanding the structure and interactions of nuclei is of special interest to the HEP community given the role of nuclei in experimental searches for violation of fundamental symmetries and searches for new physics. From neutrino physics to dark matter searches, nuclei are used as targets to probe new particles and new interactions. Interpreting the results of these experiments with fully controlled uncertainties requires a better theoretical understanding of nuclear medium. The goal of the NPLQCD collaboration is to compute the required nuclear matrix elements for light nuclei using lattice QCD calculations, and then constrain phenomenological models or effective field theories that are used in nuclear many-body calculations, expanding the validity of QCD-based results to larger nuclei. Particular examples of such calculations are the extraction of the axial charge and momentum fraction of light nuclei, needed to study neutrino-nucleus cross sections, identifying the short- and long-distance contributions to neutrinofull and neutrinoless double beta decays, and computing scalar and tensor matrix elements for dark matter and CP violation searches.

In-person or Virtual?

In-person

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