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Determining the CP odd pion-nucleon coupling with spectroscopic lattice QCD calculations: Part II[1] HENRY MONGE CAMACHO, DAVID BRANTLEY, College of William and Mary and LBNL, ANDR WALKER-LOUD, LBNL — The universe is observed to have a slight excess of matter over anti-matter, as measured by the primordial baryon-to-photon ratio, $\eta \simeq 6.2 \times 10^{-10}$, which implies CP violation from beyond the Standard Model (BSM). This has inspired searches for permanent electric dipole moments (EDMs) in nucleons and nuclei, as CP violation gives rise to T violation and permament EDMs. In large nuclei, the EDMs may be dominated by contributions from a resulting CP-odd pion-nucleon couplings, as the pion can propagate over the entire nucleus, enhancing this contribution. Some of the largest uncertainties in constraining sources of BSM CP violation is lack of knowledge of these CP odd pion nucleon couplings. Lattice QCD can be used to compute these couplings with simple spectroscopic techniques by exploiting symmetries. In this talk, I will describe the lattice QCD calculation of the neutron-proton mass splitting arising from $m_d - m_u$. Chiral Pertubation Theory, the low energy effective theory of QCD, predicts the presence of a chiral-logarithm term in this quantity. I will show the evidence of this chiral-logarithm that we have observed in the above calculation. This result improves our knowledge of the CP odd pion-nucleon coupling arising from the QCD θ term.

[1]DOE Office of Science, Nuclear Theory Topical Collaboration for Double-Beta Decay and Fundamental Symmetries

Henry Monge Camacho
College of William and Mary and LBNL

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