Abstract Submitted
for the FWS16 Meeting of
The American Physical Society

Determining the CP odd pion-nucleon coupling with spectroscopic lattice QCD calculations: Part I[1] DAVID BRANTLEY, HENRY MONGE, College of William and Mary and Lawrence Berkeley Laboratory, ANDR WALKER-LOUD, Lawrence Berkeley Laboratory — 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 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 relationship between the CP-odd pion-nucleon couplings and related spectroscopic quantities. These couplings depend upon isospin breaking in the hadron spectrum due to $m_u \neq m_d$. These isovector quantities can only be determined with Lattice QCD. We describe briefly how we include this splitting in our Lattice calculations, and we determine the $2\delta = (m_d - m_u)$ parameter using the Kaon mass splitting.

[1]This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists, Office of Science Graduate Student Research (SCGSR) program.

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Date submitted: 14 Oct 2016 Electronic form version 1.4