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The n3He experiment—a new era in Hadronic Parity Violation

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We report the parity violating proton asymmetry A_p in the reaction $\vec{n}$ + ^{3}He $\rightarrow$ p + ^{3}H (the n-^{3}He experiment), the most precise hadronic asymmetry ever measured. Hadronic parity violation offers a unique probe of nucleon structure and the underlying non-perturbative behavior of low-energy QCD. The hadronic weak interaction is characterized by five spin and isospin dependent S-P transition amplitudes. While it was first observed over 50 years ago in compound nuclei, which offer large nuclear enhancements, a systematic characterization of the weak interaction among strongly bound systems is still forthcoming, and requires multiple measurements in few-body systems with exactly calculable nuclear wave functions. New theoretical frameworks, experimental facilities, and advanced technology have rejuvenated efforts to map out this "complexity frontier" of the Standard Model. The n-^{3}He experiment is a critical measurement in this campaign, being sensitive to the $\Delta I = 0, 1$ transition amplitudes. It was performed at the Fundamental Neutron Physics Beamline at Oak Ridge National Laboratory.

Author: CRAWFORD, Christopher (University of Kentucky)

Presenter: CRAWFORD, Christopher (University of Kentucky)

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