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Neutron Spin Rotation: Neutron Optical Polarimetry as a Probe of Fundamental Physics

Friday, 27 September 2019 10:00 (20 minutes)

The Neutron Spin Rotation (NSR) slow neutron polarimeter is an apparatus designed to measure and constrain fundamental interactions to high precision through the use of neutron optical techniques. This apparatus was initially constructed to search for parity-violating spin rotation of neutrons transmitted through liquid ^{4}He. This experiment placed a limit on the rotation angle per unit length of $d\phi/dz = [+2.1 \pm 8.3(stat.)\,^{+2.9}_{-0.2}(sys.)] \times 10^{-7}$ rad/m. This data has been used to constrain light Z' bosons, in-matter gravitational torsion, and nonmetricity. A second target system operated with the same polarimeter was designed to search for an axial coupling of neutrons g_A^2 to light Z' bosons, placing limits on the rotation angle $\phi = [1.4 \pm 2.3(stat.) \pm 2.8(sys.)] \times 10^{-5}$ rad, improving g_A^2 bounds. The polarimeter and targets are being upgraded for future measurements planned for the NG-C beam at NIST Center for Neutron Research. The precision should be sufficient to see the Standard Model contribution to n-^{4}He spin rotation and improve the limits on g_A^2 by about two orders of magnitude. An overview of the apparatus will be presented, along with details of both target systems design and performance. [1]

[1] W. M. Snow, *et al.*, Rev. Sci. Inst. 86, 055101(2015)

Summary

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