Abstract Submitted
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Systematic Effects in Precision Measurements Performed using a Neutron Interferometer[1] M.G. HUBER, M. ARIF, NIST, T.C. BLACK, UNC-Wilmington, R.W. HAUN, Tulane, B. HEACOCK, NC State, D.A. PUSHIN, U. Waterloo, C.B. SHAHI, U. Maryland, F.E. WIETFELDT, Tulane — Coherent neutron scattering lengths and cross sections for various isotopes have been measured using several different techniques including transmission, gravity refractometry, and perfect crystal neutron interferometry (NI). Neutron interferometry, analogous to an optical Mach-Zehnder interferometer, coherently separates a neutron beam into a reference path and sample path. The relative phase between these two paths is measured by an interference pattern. Neutron interferometry has been the preferred method for precision scattering length measurements due to its notable phase sensitivity and the ability to measure both gaseous and solid isotopes. As greater precision is sought, systematic effects become ever more challenging. Recently, we have found a systematic phase shift that we call the 'shadow' phase. This 'shadow' phase is caused by the 10 mK temperature different between that of the interferometer crystal blades and that of the sample, causing a nonlinear variation in the interferometer's intrinsic phase $\Delta\phi_0$. We have studied this effect and will discuss how to effectively mitigate it. The shadow phase systematic is relevant to precision measurements on weakly interacting isotopes.

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