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High-precision Phase Shift Spectroscopy of the weak 1283 nm M1 Transition in a Thallium Atomic Beam R. UHL, C.D. BRUZEWICZ, J.A. KERCKHOFF, P.K. MAJUMDER, Phys. Dept., Williams College — Using a thallium atomic beam apparatus, we are undertaking a series of laser spectroscopy measurements with the goal of providing precise, independent cross-checks on the accuracy of new calculations of parity nonconservation in thallium[1]. In our apparatus, a laser beam interacts transversely with a 2-cm-wide thallium beam of density $\sim$4x10^{11} cm^{-3} and reveals roughly tenfold Doppler narrowing of the absorption profile. In the current experiment we study the very weak 1283 nm $6P_{1/2} - 6P_{3/2}$ transition using an interaction region which includes high-voltage field plates and a high-finesse confocal Fabry-Perot cavity to study phase-shifts induced by interaction with the atomic beam. We seek to determine both Stark shift components, as well as the various components of the Stark-induced amplitude within this mixed M1/E2 transition.For these studies a Lasersystem with a frequency stability in the order of $\Delta\nu$=1MHz is essential. This stability is achieved by means of a a new method for laser frequency stabilization using high-resolution detection of thallium Faraday rotation in magnetic fields of a few gauss. This phase-shift detection technique is also being used in a bi-directional ring cavity interaction geometry to search for possible long-range T-violating forces in thallium.

[1]M. Kozlov *et al.*, Phys Rev. A64, 053107 (2001); A. Derevianko, private comm.

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