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High-Precision Measurement of Electric Quadrupole Amplitude in Lead using Faraday Rotation Spectroscopy DANIEL MASER, ELI HOENIG, BINGYI WANG, PROTIK MAJUMDER, Williams College — We have completed a measurement of the $(6s^2 6p^2)^3P_0 - {}^3P_2$ 939 nm electric quadrupole (E2) transition amplitude in atomic lead. Using a Faraday rotation spectroscopy technique and a sensitive polarimeter, we have measured this very weak E2 transition for the first time, and can compare its amplitude to the predictions of recent ab initio atomic theory work in lead,[1] an element in which highly precise atomic parity nonconservation experiments were completed some years ago.[2] We heat a sealed lead quartz vapor cell to between 775 and 950C, apply a $\sim$ 10 G longitudinal magnetic field, and use polarization modulation/lock-in detection to measure optical rotation amplitudes of order 1 milliradian with noise near 1 microradian. We compare the Faraday rotation lineshape of the E2 transition to that from the ${}^3P_0 - {}^3P_1$ 1279 nm magnetic dipole (M1) transition under identical sample conditions. The M1 transition amplitude is precisely calculable without detailed wavefunction knowledge, and thus provides an ideal normalization tool from which to extract the E2 amplitude. Preliminary data analysis indicates precision at the 1% level. Latest results will be presented.

[1]Porsev et al., Phys. Rev. A 93, 012501 (2016)
[2]Meekhof et al., Phys. Rev. Lett. 71, 3442 (1993)

Daniel Maser
Williams College

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