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Precise Measurements of transition amplitudes, polarizabilities, and isotope shifts in lead, thallium, and tin using Faraday rotation spectroscopy[1] PROTIK MAJUMDER, DANIEL MASER, GABRIEL PATENOTTE, SAMEER KHANBHAI, Williams College — We have undertaken a series of atomic structure, optical polarimetry measurements in group III and IV elements to test on-going atomic theory and aid in tests of fundamental physics. A high-precision polarimeter consisting of crossed calcite polarizers and a modulation/lock-in detection scheme yields optical rotation resolution at the 1 μRadian/$\sqrt{Hz}$ level. By applying small longitudinal magnetic fields to atomic samples in both heated vapor cells and an atomic beam, we obtain well-resolved Faraday rotation line-shapes even for forbidden transitions and atomic samples with very low population density. Using this technique we have detected for the first time the ground-state $(6s^2 6p^2)^3P_0 -^3 P_2$ 939 nm electric quadrupole (E2) transition in lead, and are completing a precise measurement of its amplitude that can be compared to recent *ab initio* atomic theory in lead. We plan to study E1 transitions originating from thermally-excited atomic samples and measure hyperfine structure and isotope shifts in both the lead and tin atomic systems. Using our atomic beam apparatus and the Faraday polarimetry technique, we will also measure excited-state polarizabilities and transition amplitudes in these atomic systems.

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