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Precise measurements of hyperfine structure and atomic polarizability in indium and thallium using two-color diode laser spectroscopy. P.K. MAJUMDER, MEVAN GUNAWARDENA, HUAJIE CAO, SCOTT SMEDINGHOFF, Williams College Physics Dept. — We are pursuing a series of precise atomic structure measurements in Group III elements – currently thallium and indium – designed to test recent *ab initio* theory calculations in these three-valence-electron systems [Phys. Rev. A 74, 022504 (2006); Phys. Rev. A 76, 022501 (2007)]. For thallium, independent atomic theory calculations are essential for atomic tests of discrete symmetry violation. In an experiment just completed, we used two-step, two-color laser excitation to measure the hyperfine constants of the $6P_{3/2}$excited state of indium(I=9/2) for the first time. Currently we are pursuing a similar two-step excitation experiment in thallium to measure the isotope shift and hyperfine splitting in the $7P_{1/2}$ excited state using a heated quartz vapor cell. In both experiments, the blue laser for the first excitation step is locked to its transition using a new scheme which makes use of an acousto-optic modulator. The thallium optical system will next be used with our thallium atomic beam apparatus to measure the Stark shift of the thallium 1301 nm $7S_{1/2}$- 7 $P_{1/2}$ transition. Future experiments may include using a laser near 400 nm to study the light shift in the ground state hyperfine splitting of another Group III element (gallium) which has been proposed as a possible neutral atom frequency standard.

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