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Precise measurement of the hyperfine splittings within the $6p_{3/2}$ level of atomic indium using two-color diode laser spectroscopy[1]

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The hyperfine splittings of the $6P_{3/2}$ state of indium(I=9/2) have been measured for the first time using a two-color excitation scheme. These results provide a precise experimental test of new *ab initio* wavefunction calculations of three-valence-electron atomic systems such as indium and thallium. We first excite ground-state atoms in a heated quartz indium cell to the intermediate $6S_{1/2}$ state using a blue (GaN) diode laser at 410 nm. By measuring the differential atomic absorption of double-passed, second-order-diffracted beams from an acousto-optic modulator, we are able to stabilize the blue laser frequency to the sub-MHz level. A second laser beam at 1291 nm overlaps the first in the vapor cell, exciting Doppler-narrowed hyperfine transitions to the $6P_{3/2}$ excited state. By modulating the blue laser beam and using lock-in detection, we obtain background-free, low-noise IR spectra. By locking first to one then the other intermediate hyperfine level, we determine all three hyperfine splittings, as well as the 'A' and 'B' hyperfine constants, for the $6P_{3/2}$excited state. While we continue to explore many potential systematic errors, current statistical precision is at the few MHz level, and preliminary results show very good agreement with theory predictions at this level.

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