**BACKGROUND**

General
- Laser spectroscopy to test accuracy, guide refinement of ab initio theory calculations for Group IIIA (\(\text{m}^6\text{S}^1\)) atoms
- "Alkali-like" valence electron, recent theory accurate to 2%
- Essential for tests of fundamental physics and symmetry violations in these systems (PNC, EDM, clocks)

**410 NM LASER LOCKING**

- Complicated three-level system dynamics arise if 410 nm laser is not always on resonance
- Lock to atomic beam transition to ensure laser frequency shifts with electric field
- Use 100 MHz FM spectroscopy to obtain dispersive locking signal
- Locking correction signal follows quadratic Stark shift as expected

**VAPOR CELL SETUP**

- Use heated vapor cell to monitor lasers and IR transition
- Modulated IR laser provides sidebands for calibration and electric field-free reference
- Arrows indicate hyperfine peaks; other peaks are sidebands from EOM

**DATA ANALYSIS AND RESULTS**

- Collect data in voltage off-on-on-off sequence
- ~3000 sets of HV-off and HV-on scans
- Use Fabry-Perot signal for frequency axis linearization and vapor cell spectrum for calibration and referencing

**SYSTEMATIC ERROR TESTS AND RESULTS**

- Comparison of data set split by laser scan direction, field on-off sequence, fit method, and hyperfine transition
- Three-level simulations show failure to stay locked at 410 nm first-step resonance results in systematic dependence of \(k_c\) on laser power and static field
- Data show no resolved correlation (see below)

**ATOMIC BEAM SETUP**

- Overlap blue and IR lasers through ABU, detect IR transmission
- Observe signal using two-tone frequency modulation scheme

**FUTURE WORK**

- Same experimental scheme and (tuned) IR laser allows measurement of indium \(6\text{P}_{1/2}\) state polarizability
- \(J = 1/2\) implies both scalar \((\alpha_0)\) and tensor \((\alpha_2)\) polarizabilities
- \(6\text{P}_{1/2}\) \(\alpha_0, \alpha_2\) already calculated (Safronova 2013)