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Precise Measurement of the Isotope Shift of the Lithium D Lines
CLAYTON E. SIMIEN, JOHN D. GILLASPY, CRAIG J. SANSONETTI, National Institute of Standards and Technology — High precision spectroscopic measurements of the isotope shift of low-lying lithium transitions can be combined with precise theoretical calculations to probe the relative nuclear charge radii of various lithium isotopes. The technique is of particular interest for exotic lithium isotopes for which traditional scattering experiments are not feasible. Despite several recent experiments, however, the measured isotope shifts for the D1 and D2 lines of the stable isotopes ^{6}Li and ^{7}Li remain in strong disagreement with each other and with theory. Reported values for the splitting isotope shift (SIS), the difference between the isotope shifts of the D1 and D2 lines, disagree with theory by as much as 16 standard devitions. This is particularly significant, as the SIS is believed to be the most reliable result of theory. In order to resolve these discrepancies we are constructing a new experiment at the National Institute of Standards and Technology. As in other experiments we will observe the D lines by crossing a highly collimated lithium beam with a very stable tunable laser. Unlike previous experiments, however, the relative positions of all lithium resonances will be determined by direct frequency metrology. Our results should provide precise new values for the fine structure, hyperfine structure, and isotope shifts of the lithium D lines and a definitive test of the calculated SIS.

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