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Two-photon, sub-Doppler hyperfine measurements of the $6d^2D_j$ states of cesium A. KORTYNA, N. MASLUK, T. BRAGDON, Lafayette College — We measured the hyperfine structures of the $6d^2D_j$ states of cesium using multiphoton, sub-Doppler absorption spectroscopy. In addition to improving upon the precision of previously published hyperfine coupling constants, we demonstrate a simplified approach to frequency calibration. Two narrow-band diode lasers excite cesium within a vapor cell in a two-step resonantly enhanced process. One laser is locked to the $6s^2S_{1/2}(F) \rightarrow 6p^2P_{3/2}(F')$ transition, and the second laser is scanned over the $6p^2P_{3/2}(F') \rightarrow 6d^2D_j(F'')$ hyperfine manifold. The frequency scale is directly referenced to the ^{87}Rb ground state hyperfine transition, $5s^2S_{1/2}(F=1) \leftrightarrow 5s^2S_{1/2}(F=2)$. We modulate the scanned laser frequency using an electro-optic modulator driven by an RF signal generator trained to a rubidium clock, and use the resulting sidebands for frequency calibration. The accuracy of this approach is demonstrated by measuring the hyperfine coupling constants of the $6d^2D_{5/2}$ state, $A = -4.66 \pm 0.04$ MHz and $B = 0.9 \pm 0.6$ MHz, which agree with the literature[1]: $A = -4.69 \pm 0.04$ MHz and $B = 0.2 \pm 0.7$ MHz. We also improve upon the precision of previously reported $6d^2D_{3/2}$ coupling constants[2] ($A = 16.3 \pm 0.15$ MHz and $B < \pm 8$ MHz) by measuring $A = 16.34 \pm 0.05$ MHz and $B = -0.1 \pm 0.3$ MHz.

[1]N. Georgiades, E. Polzik, and H. Kimble, Opt. Lett. **19**, 1474 (1994).
[2]C. Tai, W. Happer, and R. Gupta, Phys. Rev. A **12**, 736 (1975).

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