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**Determining the cesium $7d\,^2D_j$ hyperfine structure using two-photon resonant spectroscopy of a thermal beam**[1] ANDREW KORTYNA, VICTOR FIORE, Lafayette College — The hyperfine structures of the $7d\,^2D_{3/2}$ and $7d\,^2D_{5/2}$ states of $^{133}$Cs are determined through two-photon, laser-induced-fluorescence spectroscopy of a thermal beam. Two single-mode external-cavity diode lasers provide narrow band radiation for resonant two-step excitation of the $7d\,^2D_j$ states. A servo-feedback circuit locks one laser to the $6s\,^2S_{1/2}(F) \rightarrow 6p\,^2P_{3/2}(F')$ hyperfine transitions. Optical pumping of the ground hyperfine manifold is minimized by phase modulating this laser at 9.193 GHz. The second laser is scanned over the $6p\,^2P_{3/2}(F') \rightarrow 7d\,^2D_j(F'')$ transitions. Using various combinations of the ground and intermediate hyperfine levels (i.e., $F$ and $F'$), all hyperfine intervals of the $7d\,^2D_j$ states are observed. The scanned laser's relative frequency is calibrated through phase modulation; the resulting sidebands cause atomic features to be repeated at precise intervals. High accuracy is achieved by directly referencing the modulation frequency to the $^{87}$Rb $5s\,^2S_{1/2}(F = 1) \leftrightarrow 5s\,^2S_{1/2}(F = 2)$ ground state hyperfine transition using an atomic frequency standard.

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