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Two Photon Spectroscopy of Rubidium Using a Grating-Feedback Diode Laser SHANNON MAYER, ABRAHAM OLSON, EVAN CARLSON, University of Portland — We describe an experiment for investigating the 5S 1/2 to 5D 5/2 two-photon transition in rubidium using a grating-feedback diode laser operating at 778.1 nm. Tuning of the laser frequency over 4 GHz allows for the clear resolution of the Doppler-free spectral features and accurate measurement of the hyperfine ground-state splitting. A direct comparison between Doppler-broadened and Doppler-free spectral features is possible because both are distinctly evident in the spectra. By modifying the polarization state of the two laser fields, the impact of electric dipole selection rules on the spectra is investigated. This experiment is a valuable addition to the advanced laboratory; it uses much of the same equipment as the single-photon saturated absorption spectroscopy experiment performed on the 5S 1/2 to 5P 3/2 transition in rubidium at 780.24 nm and provides students with an opportunity to investigate characteristics of atomic spectra not evident in the single-photon experiment. Moreover, rubidium two-photon transitions are of interest as new optical frequency standards due to their transition wavelength and narrow linewidth.

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