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Radiative lifetime measurements of high-n Rb Rydberg states[1] DUNCAN TATE, DREW BRANDEN, TAMAS JUHASZ, TATENDA MAHLOKOZERA, CRISTIAN VESA, ROY WILSON, MAO ZHENG, Colby College, ANDREW KORTYNA, Lafayette College — We present results of radiative lifetime measurements of the $n\ell$ Rydberg states of rubidium in the range $30 \leq n \leq 50$ and $0 \leq \ell \leq 2$ (s, p and d states) using cold atoms in a MOT. Two experimental techniques have been adopted to reduce random and systematic errors. First, a frequency doubled, pulse amplified diode laser is used to excite the target $n\ell$ Rydberg state. The output from this laser has a Fourier-transform linewidth of ≈ 100 MHz at 480 nm, and results in minimal shot-to-shot variation in the Rydberg state population when it is used to drive the $5p_{3/2} \rightarrow n\ell$ transition. Second, we monitor the target state population as a function of time delay from the 480 nm laser pulse using a short mm-wave pulse that is resonant with a one- or two-photon transition $n\ell \rightarrow n'\ell'$. We then selectively field ionize the $n'\ell'$ state, and detect the resulting electrons with a microchannel plate (MCP). We step the time delay between the laser pulse and the mm-wave pulse and acquire the MCP signal as a function of the delay. This signal is an accurate mirror of the $n\ell$ population, which we fit to an exponential decay to recover the $n\ell$ state lifetime.

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