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 \(\approx 100\) 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.

\(^1\)Research supported by Colby College and NSF.