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Precision measurements of excited state atomic lifetimes based on mode-locked femtosecond lasers JERRY SELL, ALINA GEARBA, BRIAN PATTERSON, RANDY KNIZE, United States Air Force Academy, BRETT DEPAOLA, Kansas State University — Measurements of excited state atomic lifetimes provide a valuable test of atomic theory, allowing comparisons between empirical and calculated atomic matrix elements. However, as calculations have progressed the most accurate direct lifetime measurements remain at the 0.1-0.2% precision level, partly due to the nonlinearity and calibration of conventional timing electronics. We will present our progress toward precision excited state lifetime measurements in Rb where the timing is based upon the repetition rate of a mode-locked femtosecond laser. An apparatus consisting of counter-propagating atomic beams is employed, which cross perpendicular to excitation and ionization laser beams. A chopped cw laser provides excitation to the relevant atomic state, while the output of a mode-locked laser is amplified and frequency-doubled to produce ionization pulses. We vary the delay between excitation and ionization by a multiple of the mode-locked laser period, resulting in an extremely accurate time base for future precision measurements.

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