Measurement of Excited State Lifetime Using Two-Pulse Photon Echoes in Rubidium Vapor\textsuperscript{1} ERIC ROTBERG, SCOTT BEATTIE, IAIN CHAN, BRYNLE BARRETT, ERIC PARADIS, A. KUMARAKRISHNAN, Department of Physics and Astronomy, York University — We have observed two-pulse photon echoes in a Doppler broadened rubidium vapor. The system interacts with traveling wave optical pulses that are \( \sim 20 \text{ ns} \) in duration. The pulses are on resonance with the \( F=3 - F'=4 \) transition in \(^{85}\text{Rb}\) and \( F=2 - F'=3 \) transition in \(^{87}\text{Rb}\). They are generated from a CW laser using acousto-optic modulators. The first pulse, occurring at \( t=0 \), induces a macroscopic dipole moment that dephases due to atomic motion. The second pulse, occurring at \( t=T \), reverses the direction of the dephasing process so that the echo is formed at \( t=2T \). The echo is detected using a heterodyne technique and its intensity decays exponentially as a function of \( 2T \). We report a measurement of the excited state lifetime precise to \( \sim 1\% \) that is in agreement with a previous measurement. Our results suggest that the excited state lifetime can be determined to a precision of \( \sim 0.25\% \) by additional data accumulation and by a more comprehensive study of systematic effects.

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