Abstract Submitted
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Dynamics of Quantum Superposition States and Quantum Beating in Rubidium Vapor[1] WILLIAM GOLDSHLAG, GARY EDEN, University of Illinois at Urbana-Champaign — We have developed a high-resolution all-optical experimental technique for studying dynamics of coherent atomic superposition states. Coherent superpositions of pairs of low quantum number ($n = 5 - 8$) states were formed in heated Rb vapor with ultrafast laser pulses, and their dynamics was observed with nearly ps resolution by an all-optical technique of parametric four-wave mixing (PFWM). Observed phenomena and behaviors included concurrent formation of multiple superposition states and interactions between them, nonlinear oscillations inside an atom, atomic oscillator frequency pulling and quantum beat revivals. A regeneratively amplified Ti:sapphire laser produced 60 fs pulses centered near 770 nm and having the bandwidth of 20 nm. Pairs of interferometrically cloned pulses excited and subsequently probed the region near the $7S_{1/2}$ and $5D_{5/2}$ states in Rb vapor, which was sealed in a cylindrical cell and heated to achieve number densities between 10^{14} and 10^{16} cm^{-3}. Coherent emission at 420 nm from the $6P_{3/2} \rightarrow 5S$ transition was generated by PFWM, and its intensity, recorded as a function of pump-probe delay, displayed Ramsey fringes resulting from quantum beating. Dynamics of state interactions were observed with time-frequency analysis.

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