INTERFERENCE BETWEEN THE $5d_{5/2} - 5p_{3/2}$ AND $5p_{3/2} - 5s_{1/2}$ COHERENCES (386.4 AND 384.1 THz) IN Rb OBSERVED BY ULTRAFAST FOUR-WAVE MIXING SPECTROSCOPY

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Coherences at 386.2 THz and 384.1 THz, corresponding to the $5d_{5/2} - 5p_{3/2}$ and $5p_{3/2} - 5s_{1/2}$ difference frequencies, respectively, have been established in the Rb atom during pump-probe experiments involving pairs of identical 150 fs pulses produced by a Ti:$Al_2O_3$ laser and a Michelson interferometer. The interference between the two coherences within the atom is observed through a parametric four-wave mixing process in Rb and detection of the signal wave intensity at 420 nm. Scanning the time delay between the pump and probe pulses over a 600 ps interval produces a sampling rate over 300 THz and allows for a spectral domain resolution of 0.05 $cm^{-1}$ to be achieved. The figure at right shows several spectra recorded near 2.1 THz, the $(5d_{5/2} - 5p_{3/2})$ - $(5p_{3/2} - 5s_{1/2})$ difference frequency, with varying angle between the pump and probe pulses (i.e., the phase matching angle) and varying Rb background density. A Fano interference window is clearly observed, and analysis of these and similar spectra demonstrates that the amplitude and phase of the coherently-coupled, three Rb state system can be controlled precisely.