Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Three-dimensional Fourier-transform spectroscopy of potassium vapor HEBIN LI, ALAN BRISTOW, MARK SIEMENS, GALAN MOODY, STEVEN CUNDIFF, JILA, University of Colorado and National Institute of Standards and Technology, Boulder, CO 80309 — We have implemented three-dimensional (3D) Fourier-transform spectroscopy to study potassium vapor contained in a $\sim$20 μm transmission cell with argon buffer gas. The four-wave mixing signal is measured in three time dimensions corresponding to the delays between three $\sim$100 fs, phase-stabilized excitation pulses that are arranged in the box geometry. The emission is detected using a phase-stabilized reference pulse by spectral interferometry, and other time axes are Fourier transformed to construct the 3D spectra. The 3D spectra contain the full information of third-order coherent response of the vapor, yet the contribution from each of the single-quantum excitation pathways is unambiguously isolated. Projecting a 3D spectrum onto a specific two-dimensional (2D) plane retrieves rephasing, non-rephasing, and T-scan 2D spectra, as well as the spectra that are not accessible by conventional 2D scans. The spectral features which overlap in congested 2D spectra can be isolated for studying unique processes represented by a single pathway.

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Date submitted: 23 Nov 2010 Electronic form version 1.4