Physics AT QUEENS COLLEGE

Colloquium Notice

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Optical Multi-dimensional Fourier Transform Spectroscopy

The concept of multi-dimensional Fourier transform spectroscopy originated in nuclear magnetic resonance (NMR) where it revolutionized NMR studies of molecular structure and dynamics and led to the Nobel Prize in Chemistry in 1991. In the past decade, the same concept has been implemented in the optical region with femtosecond lasers. In the experiment, the nonlinear response of a sample to multiple laser pulses is measured as a function of time delays. A multi-dimensional spectrum is constructed by taking a multi-dimensional Fourier transform of the signal with respect to multiple time delays.

In this presentation, I will introduce optical multi-dimensional Fourier transform spectroscopy and its applications to study a potassium (K) vapor and semiconductor nanostructures. The K vapor provides a simple test model to validate the method, while the obtained 2D spectra reveal the surprising collective resonance due to the dipole-dipole interaction in a dilute gas. By extending the technique into a third dimension, 3D spectra can unravel different pathways in a quantum process and provide complete and unambiguous information to construct the full Hamiltonian of the system. Besides atomic/molecular systems, optical multi-dimensional Fourier-transform spectroscopy is also a powerful tool for studying many-body dynamics and coupling in solid-state systems such as semiconductor nanostructures. I will present several applications in semiconductor quantum wells and self-assembled quantum dots, where unique information about the systems can be obtained from 2D spectra.

Monday
March 11, 2013
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326