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Many-body two-quantum coherences in 2DFT spectra of semiconductors DENIS KARAISKAJ, University of South Florida, A. BRISTOW, X. DAI, JILA, CU and NIST, L. YANG, S. MUKAMEL, University of California Irvine, R. MIRIN, NIST Boulder, S. CUNDIFF, JILA, CU and NIST — Investigating the correlations of multiple excitons in semiconductors is a challenging many-body problem that has drawn considerable experimental and theoretical attention over the last two decades. Nonlinear four-wave mixing (FWM) experiments have long been known to provide direct probes for the many-body effects in the ultrafast dynamics of excitons in quantum wells. However, it is very difficult to separate the different contributions such as excitation induced dephasing, excitation induced shift, local field effects, and multiple exciton correlations. With the advent of two-dimentional Fourier-transform (2DFT) spectroscopy, the biexcitonic contributions could be isolated and the many-body contributions could be identified. Phase-resolved 2DFT spectra for the negative delay FWM signal will be presented which show interesting diagonal and off-diagonal peaks. The energy positions, line shapes, and the complexity of the 2D peaks indicate significant many-body coherences and reinforce the ability of 2DFT to disentangle two-quantum transitions (D. Karaiskaj, *et al.*, Phys. Rev. Lett. **104**, 117401 (2010)).

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