

# Colloquium Notice

## German Kolmakov

City Tech, CUNY

### *Optical manipulation of entanglement in excitonic qubits*

In collaboration with Argonne National Lab (S. Gray, M. Otten, X. Ma), we studied the effects of quantum entanglement in two physical realizations of the excitonic systems: (a) plasmonically coupled quantum dots in an optical cavity and (b) quasi-two-dimensional CdSe/CdS nanoplatelets (NPLs). Cavity quantum electrodynamics calculations show that upon optical excitation by a femtosecond laser pulse, entanglement of the quantum dot excitons occurs, and the time evolution of the  $g^{(2)}$  pair correlation function of the cavity photons is an indicator of the entanglement. We also show that the degree of entanglement is conserved during the time evolution of the system. Furthermore, if coupling of the photonic cavity and quantum dot modes is large enough, the quantum dot entanglement can be transferred to the cavity modes to increase the overall entanglement lifetime. This latter phenomenon can be viewed as a signature of entangled, long-lived quantum dot exciton-polariton formation. The preservation of total entanglement in the strong coupling limit of the cavity/quantum dot interactions suggests a novel means of entanglement storage and manipulation in high-quality optical cavities. We also find that, due to formation of biexcitons in an NPL and their subsequent decay, the emitted pairs of cavity photons are entangled at temperatures below 20 K. Under favorable conditions the photon pair can be nearly maximally entangled with the relative photon pair population  $\sim 0.5$ . Finally, we discuss possible experiments, in which the NPL generated photon pair entanglement can be observed, as well as potential applications in integrated quantum photonics.

Monday

**May 6, 2019**

Starts at 12:15 PM

Coffee at 12:00 PM

Physics Conference Room, SB B326