Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Magnetic Brightening of Dark Excitons in Carbon Nanotubes at Ultralow Temperatures L.G. BOOSHEHRI, S.Y. JONG, T.A. SEARLES, J. KONO, Rice University, J. HAYAKAWA, G. YUSA, Tohoku University, J.A. FAGAN, E.K. HOBBIE, NIST — Although progress has been made in understanding the role of dark excitons in single-walled carbon nanotubes (SWNTs), current theory at low temperatures is still unconfirmed. In particular, at low temperatures where the thermal energy is less than the dark-bright splitting energy, all excitons should populate the lowest dark excitonic state and cause the disappearance of photoluminescence (PL). Here, we utilize a fiber-optic-equipped dilution refrigerator and superconducting magnet system to measure temperature dependent magnetic brightening of the PL of DNA-wrapped CoMoCAT SWNT thin films in a polyacrylic acid matrix. Measuring the magnetic field dependence to 5 T at 50 mK and 4.3 K with an excitation of 670 nm, we obtained an unexpected PL for 50 mK at zero-field comparable to zero-field PL at 4.3 K. Also, the magnitude of magnetic brightening does not change between 50 mK and 4.3 K. Such results are contrary to current theory, and we will discuss possible explanations such as a non-thermal distribution of excitons and defect-induced partial brightening of the dark state.

Layla Booshehri
Rice University

Date submitted: 10 Dec 2009 Electronic form version 1.4