Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Exploring the Nature of Exciton Localization in Quasi One-Dimensional GaAs/AlGaAs Quantum Well Tube Nanowires[1] HOWARD JACKSON, BEKELE BADADA, TENG SHI, LEIGH SMITH, Department of Physics, University of Cincinnati, CHANGLIN ZHENG, Monash Centre for Electron Microscopy, Monash University, JOANNE ETHERIDGE, Monash Centre for Electron Microscopy and Department of Materials Engineering, Monash University, NIAN JIANG, HOE TAN, CHANNUPATI JAGADISH, Department of Electronic Materials Engineering, Australian National University — We explore the nature of exciton localization in single GaAs/AlGaAs nanowire quantum well tube (QWT) devices using photocurrent (PC) spectroscopy combined with simultaneous photoluminescence (PL) and photoluminescence excitation (PLE) measurements. Excitons confined to GaAs quantum well tubes of 8 and 4 nm widths embedded into an AlGaAs barrier are seen to ionize at high bias. Spectroscopic signatures of the ground and excited states confined to the QWT seen in PL, PLE and PC data are consistent with simple numerical calculations. The demonstration of good electrical contact with the QWTs enables the study of Stark effect shifts in the sharp emission lines of excitons localized to quantum dot-like states within the QWT. Atomic resolution cross-sectional TEM measurements, an analysis of the temperature dependence of PL and time-resolved PL as well as the quantum confined Stark effect of these dots provide insights into the nature of the exciton localization in these nanostructures.

[1]We acknowledge the financial support of NSF DMR 1507844, DMR 151373 and ECCS 1509706 and the Australian Research Council.

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Date submitted: 06 Nov 2015 Electronic form version 1.4