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Shedding Light on the Emission Mechanisms of $In_{0.54}Ga_{0.46}N$ Disks in GaN Nanowires Using C.W. Non-Linear Spectroscopy[1]

CAMERON NELSON, ALBERT LIU, SANIYA DESHPANDE, SHAFAT JAHANGIR, PALLAB BHATTACHARYA, DUNCAN STEEL, University of Michigan, Ann Arbor: EECS Department — Linear and non-linear spectroscopy has been performed on an ensemble of 3 nm thick $In_{0.54}Ga_{0.46}N$ disks grown in self-assembled GaN nanowires ($\sim$ 30 nm diameter). PLE measurements nearly resonant with the PL show a mostly broad, featureless spectrum with a linear increase in absorption as a function of energy, similar to InGaN/GaN quantum wells. Unlike InGaN quantum wells, the centroid of the PL spectrum shows a negligible intensity-dependent shift in PL emission wavelength. Further, the non-linear optical spectrum is dominated by excitonic resonances with line widths $\sim$ 20-30 meV in the same region as the PLE data. Distinguishable peaks in the PL spectrum overlap with the non-linear resonances. Continuous -wave nearly degenerate pump-probe absorption measurements show no evidence of spectral hole burning within the resonances; however there is evidence of population pulsations in the 3^{rd} order signal. This data shows evidence consistent with regular excitonic saturation and two beam coupling similar to that expected in discrete (e.g. 2 or 3 level systems). The excitonic behavior is also consistent with anti-bunching seen in g2 measurements from single dots.

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