Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Cooperative carrier dynamics in InGaAs/GaAs quantum wells in high magnetic fields JI-HEE KIM, TIM NOE, Dept. of Electrical & Computer Engineering, Rice University, YONGRUI WANG, ALEKSANDER K. WOJCIK, Dept. of Physics and Astronomy, Texas A&M University, STEPHEN A. MCGILL, National High Magnetic Field Laboratory, ALEXEY A. BELYANIN, Dept. of Physics and Astronomy, Texas A&M University, JUNICHIRO KONO, Dept. of Electrical & Computer Engineering, Rice University — Ultrafast spectroscopy in strong magnetic fields provides a powerful means for studying quantum coherence in many-body systems. A high magnetic field leads to tunable energy quantization, which in turn results in a substantial enhancement of densities of states and suppression of scattering. Here, we study superfluorescence (SF), i.e., cooperative spontaneous emission of ultradense electron-hole plasmas in InGaAs quantum wells in a perpendicular magnetic field up to 17.5 T. We observe SF both through time-resolved photoluminescence and differential transmission (DT) measurements. We create an ultradense electron-hole plasma with an intense femtosecond laser pulse, and after a certain delay, an ultrashort burst of coherent radiation emerges. At the same time, an abrupt decrease in population from full inversion to zero was observed through DT measurements. Furthermore, the DT signals strongly depended on the probe energy, showing an anomalous negative DT signal (i.e., induced absorption) under certain circumstances.

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Date submitted: 23 Nov 2011 Electronic form version 1.4