Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Ultrafast Two-Pulse Photocurrent Correlation Measurements of Single Atomic Layer MoS2 Photodetectors HAINING WANG, CHANGJIAN ZHANG, WEI-MIN CHAN, OKAN KOKSAL, SANDIP TIWARI, FARHAN RANA, Cornell Univ — We present, for the first time, results from ultrafast measurements of carrier transport and carrier dynamics in monolayer MoS2 photodetectors by time resolved two-pulse photocurrent correlation technique [1]. The photocurrent transient contains information on the recombination dynamics and transport physics of the photoexcited carriers and excitons. The measured photocurrent correlation data shows two distinct decay time constants: one fast around 5 ps and one much slower around 100 ps. The observed dynamics are largely independent of temperature (10K to 300K) and pump fluence (1 to 16 μJ/cm^2). The fast decay is attributed to the fast recombination of the photoexcited carriers rather than to the transport and extraction of the photoexcited carriers from the device. The decay time scales, the temperature and the pump fluence dependence of the observed dynamics are in good agreement with defect-assisted carrier recombination model via Auger scattering. The observed time scales also agree well with our all-optical pump-probe studies. The strong Coulomb interactions and resulting strong electron-hole correlations in monolayer MoS2, make carrier and exciton capture by defects the dominant carrier recombination mechanism.

[1] M. W. Graham, P. L. McEuen, Nat. Phys. 9, 103 (2013)

Haining Wang
Cornell Univ

Date submitted: 14 Nov 2014 Electronic form version 1.4