Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Conductivity and Carrier Dynamics in Multilayer Molybdenum Disulphide (MoS_2) Measured by THz Time-Domain Spectroscopy JARED STRAIT, PARINITA NENE, FARHAN RANA, Cornell University — We present results on the ultrafast carrier dynamics and the frequency-dependent conductivity of multilayer MoS_2 using optical-pump terahertz-probe spectroscopy with sub-ps time resolution. Measurements done at various temperatures reveal that the photoexcited conductivity is well-described by the Drude model, with a mobility of 300 cm^2/V-s at 300 K increasing to 5200 cm^2/V-s at 30 K. We find that the Drude scattering rate increases linearly with temperature, which we attribute to phonon-dominated scattering. Various time scales are observed in the dynamics of photoexcited carriers. Immediately after photoexcitation, the conductivity takes $\sim$ 1-2 ps to reach its maximum value, as carriers undergo intraband relaxation, and then decays as they recombine. During the first 100 ps after photoexcitation, we observe $\sim$ 1/ns recombination rates with a linear dependence on the carrier density. Recombination rates become smaller and independent of carrier density as time progresses. Complete transients can last over tens of ns. Carrier dynamics are found to be temperature dependent, becoming faster at higher temperatures. We will present physical models that explain our data.

Jared Strait
Cornell University

Date submitted: 15 Nov 2013 Electronic form version 1.4