Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Transient Rayleigh Scattering Spectroscopy measurement of Carrier Dynamics in Zincblende and Wurtzite Indium Phosphide nanowires[1]
YUDA WANG, MOHAMMAD MONTAZERI, HOWARD JACKSON, LEIGH SMITH, JAN YARRISON-RICE, University of Cincinnati, TIM BURGESS, SURIATI PAIMAN, HOE TAN, QIANG GAO, CHENNUPATI JAGADISH, Australian National University — Pump-probe transient Rayleigh spectroscopy is used to study the carrier dynamics of ZB & WZ InP nanowires. Utilizing a wavelength-tunable pulse laser as probe and by adjusting the pump-probe pulse time delay, the change of the Rayleigh scattering efficiency as a function of excitation energy and time delay is measured from a single nanowire. The results are analyzed using an absorption coefficient calculated by a band-to-band transition model and the index of refraction obtained by the Kramers-Kronig relation. The temperature of the electron-hole plasma (EHP) cools via the emission of longitudinal optic (LO) and acoustic phonons. The LO phonon cooling dominates at early times when the carrier temperatures are high, after which the acoustic phonon interactions begins to dominate. The carrier concentrations of the split-off band in ZB InP and C band in WZ InP appears to be 1-2 orders of magnitude smaller than that of the HH, LH or A, B valence bands. Such measurements provide a detailed picture of electron and hole densities and temperatures as a function of time after excitation.

[1]We acknowledge the NSF through DMR-1105362, 1105121 and ECCS-1100489, and the Australian Research Council.

Howard Jackson
University of Cincinnati

Date submitted: 14 Nov 2013 Electronic form version 1.4