Abstract Submitted
for the OSS12 Meeting of
The American Physical Society

Picosecond transient Rayleigh scattering spectroscopy: probing band structure and carrier dynamics of single semiconductor nanowires[1]

HOWARD JACKSON, MOHAMMAD MONTAZERI, University of Cincinnati, AARON WADE, University of West Florida, MELODIE FICKENSHER, LEIGH SMITH, University of Cincinnati, JAN YARRISON-RICE, Miami University, QIAN GAO, H. TAN, C. JAGADISH, Australian National University — We present picosecond pump-probe measurements of Rayleigh scattering from GaAs nanowires which show that these differential spectra are sensitive indicators of both the density and temperature of electron-hole pairs in a single nanowire. The probe pulse measures the change in the Rayleigh scattering as a function of time after excitation by the pump pulse. Because the Rayleigh scattered signal depends sensitively on both the real and imaginary parts of the dielectric response, these measurements provide direct insight into the nonlinear changes induced by both many body effects and state filling. Measurements on high quality single core-shell GaAs/AlGaAs nanowires were carried out at low temperature. Maps of the differential Rayleigh scattering spectra as a function of time are generated and interpreted using a semi-phenomenological model of these nonlinear effects. We show that both the photoexcited carrier density and the carrier temperature as a function of time can be directly obtained from the transient Rayleigh scattering data.

[1]We acknowledge the support of the National Science Foundation through grants DMR-0806700, 0806572, 1105362, 1105121, and ECCS-1100489, the Australian Research Council and the Australian National Fabrication Facility.

Howard Jackson
University of Cincinnati

Date submitted: 09 Mar 2012 Electronic form version 1.4