Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Accessing the Dark Exciton States in Semiconducting Single-Walled Carbon Nanotubes with Terahertz Pulses LIANG LUO, IOANNIS CHATZAKIS, JIGANG WANG, Department of Physics and Astronomy, Iowa State University and Ames Laboratory-U.S. DOE, DR WANG TEAM — Singled-walled carbon nanotubes (SWNTs) represent a model system to systematically investigate correlated charge excitation in 1-D limits. One of the most outstanding issues both in fundamental nanotube physics and for their technological development is to detect and understand optically-forbidden, dark collective states. Thus far supporting evidence of dark states has been demonstrated in static magneto-optics and light scattering. However, the unique internal transitions from dark excitonic ground states and their dynamic evolution remain highly elusive. We report our investigation of this problem using optical pump, terahertz probe spectroscopy of (6,5) and (7,5) SWNTs. We measure transient THz conductivity from 0.5-2.5 THz (2-10.5 meV) at low temperature down to 5 K with resonant and off-resonant excitation at the E_{22} transitions of (6,5) and (7,5) nanotubes. These results reveal, for the first time, dynamics of lowest dark excitons and density-dependent renormalization of these many-particle states. The internal-excitonic spectroscopy with THz pulses represents a fundamentally new spectroscopy tools to study dark excitons and shine new lights on the correlation physics of excitonic ground states.

Liang Luo
Department of Physics and Astronomy, Iowa State University
and Ames Laboratory-U.S. DOE

Date submitted: 15 Nov 2013 Electronic form version 1.4