Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Scattering Intensity and Directionality Probed Along Individual Semiconducting Oxide Nanorods with Precisely Controlled Light Polarization and Nanorod Orientation DANIEL S. CHOI, MANPREET SINGH, JONG-IN HAHM, Georgetown University — We elucidate the light-matter interaction properties of individual semiconducting oxide nanorods (NRs) with a monochromatic beam of linearly polarized light that scatters elastically from the NRs by performing forward scattering in a dark-field setting. Specifically, individual NRs of ZnO, SnO_2, ITO, and ZTO are probed. We precisely control the electric field vector of the incident light and the NR orientation within the plane of light interaction, and spatially resolve the scattering response from different interaction points along the NR long axis. We then discern the effects of light polarization, analyzer angle, and NR orientation on the intensity and directionality of the optical responses both qualitatively and quantitatively along the length of the single NRs. We identify distinctive, forward scattering profiles from individual NRs subject to various incident light polarizations and NR orientations. Fundamental light interaction behavior of the NRs is likely to govern their functional outcomes in photonics, optoelectronics, and sensor devices. Hence, our efforts providing much needed insight into unique optical responses from individual 1D semiconducting oxide nanomaterials can be highly beneficial in developing next-generation optoelectronic systems and optical biodetectors with improved device efficiency and sensitivity.

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Date submitted: 15 Oct 2015 Electronic form version 1.4