Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Multifunctional Diagnostic, Nanothermometer and Photothermal Nano-devices KORY GREEN, MEGAN O'CONNOR, PARMINDER KAUR, HONG WANG, SHUANG FANG LIM, North Carolina State University — In this study, the known therapeutic capabilities of gold nanorods (AuNRs) have been combined with the diagnostic and nanothermometer abilities of upconversion nanoparticles (UCNPs) to develop a system for simultaneous biological imaging, photothermal therapy, and nanothermal sensing. Both the excitation of UCNPs and the finely tuned longitudinal surface plasmon resonance (LSPR) mode of AuNRs lay in a window of relatively high light penetration of tissue in the infra-red. The nanothermometer property of the UCNPs allows direct quantification of the localized temperature of the photothermally heated AuNRs chemically adsorbed to their surface and is free from the bleaching problems inherent in dye thermal sensing systems, especially at high laser fluences required to kill tissue. Spectroscopy on single particles, verified by transmission electron microscopy (TEM), has been performed at varying temperatures to confirm 1) the thermal sensing properties of UCNPs and 2) to finely tune their upconversion enhancement arising from the LSPR coupling of the AuNRs. Preliminary quantification of the localized AuNR temperatures upon photothermal heating will be confirmed through single particle spectroscopy of the attached UCNPs. HeLa cell viability studies have also been performed.

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Date submitted: 16 Nov 2014 Electronic form version 1.4