Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Nonlinear optics of hybrid nano-materials under strong coupling conditions MAXIM SUKHAREV, Arizona State University — Modern optics fueled with both tremendous advances in nano-fabrication and laser physics is currently experiencing significant growth. We are presently witnessing a unique situation - the research centered at interaction of matter with electromagnetic radiation is fully diving into nanoscale, where one considers purely quantum systems optically driven by nano-materials. The possibilities are vast ranging from fundamental ideas on single atom/molecule optical manipulation, through control of light far below the diffraction limit, to optical engineering and photonic circuitry. Despite progress, the research in optics of quantum media coupled to nano- materials is not complete. Many recent works consider just several quantum emitters driven by near-fields altered by plasmonic materials with a few very promising attempts to include collective effects, which as I will show in this talk play a pivotal role in quantum optics of nano-materials. I will discuss general concepts of nano- plasmonics (one of the most promising sub-fields of nano-optics) with several examples ranging from linear spectroscopy to nonlinear transient absorption.

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Date submitted: 13 Nov 2013 Electronic form version 1.4