

Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

**Optical properties of semiconductor-metal nanocrystal molecules:
Exciton-plasmon interactions** WEI ZHANG, ALEXANDER O. GOVOROV,
Department of Physics and Astronomy, Ohio University, GARNETT W. BRYANT,
NIST, Atomic Physics Division — Motivated by recent experiments on bio-
conjugated semiconductor-metal hybrid nanocrystal superstructures, we develop a
theory to describe a system composed of a semiconductor quantum dot (QD) and a
metal nanoparticle (NP) in the presence of external electric fields. The interaction
between exciton (in QD) and plasmon (in NP) leads to interesting optical proper-
ties. We explore both the linear regime (for weak external field) and the non-linear
regime (for strong external field). The interference between the external field and
the induced internal field results in strong enhancement of energy absorption (com-
pared with the energy absorption of QD in the absence of a metal NP) and also
leads to an asymmetric peak and valley in the total energy absorption (Fano-like
shape). We also consider Rayleigh scattering which also reveals this type of behav-
ior. Our theory is useful for understanding present experimental results and can
give guidance for future experiments, which may have important applications.

Wei Zhang
Department of Physics and Astronomy, Ohio University

Date submitted: 21 Dec 2005

Electronic form version 1.4