Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Plasmonic bonding and anti-bonding forces in a bisphere TSZ FAI (JACK) NG, C.T. CHAN, The Hong Kong University of Science and Tehnology — By exciting the surface plasmon resonance of a pair of nanoparticles using intense laser illumination, one can exert huge optical forces on the nanoparticles. We calculate such resonant optical force using a multiple scattering and Maxwell stress tensor formalism, which is "exact" within the classical electrodynamics. It is shown that the full electrodynamic calculation can give results that differ significantly from those obtained by the quasi-static approximation. As the pair of nanoparticles approach each other, the individual particle's plasmonic modes hybridize and split into bonding and anti-bonding modes, which induced attraction and repulsion respectively. At very small separations, the bonding (anti-bonding) modes are forced to curve downward (upward) in frequency significantly, resulting in the formation of a low frequency attractive (high frequency repulsive) band. Consequently, a low frequency laser illumination will induce strong attraction, promoting particle-clustering, and a high frequency illumination will induce strong repulsion, preventing particle aggregation. With high intensity, these resonant forces can dominate over the other relevant forces, including the van der Waals force, when the separation between the particles is several nanometers.

Jianwei Zhang
HKUST

Date submitted: 26 Nov 2007 Electronic form version 1.4