Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

First hyperpolarizability (β) of bare and polymer protected copper nanoparticles PUSPENDU DAS, MANABENDRA CHANDRA, Indian Institute of Science — We have prepared bare as well as polyvinyl pyrrollidone (PVP) capped Cu nanoparticles (NPs) of <10 nm size by laser ablation and measured their first hyperpolarizabilities (β values) using the hyper-Rayleigh scattering technique in solution. The β values for the bare and capped NPs are 414 ($\pm$19) x $10^{-30}$and 808 ($\pm$12) x 10^{-30}esu/atom$^{1/2}$, respectively. The bare NPs are stable in isopropanol for weeks but are short-lived compared to the capped particles. Our results of capped NPs having a β value twice as high compared to the bare NPs of the same size show that surface capping is necessary for enhancing β in noble metal NPs. In addition to the bulk and surface quadrupolar contributions which exist in bare NPs, dipolar contribution to β becomes important for the capped NPs due to the destruction of centro-symmetry at the surface, leading to a significant increment in β. Experiments with smaller size NPs show that β goes down with size. The bulk quadrupolar polarization which decreases with particle size, perhaps, rationalizes the size dependence of β.

Puspendu Das
Indian Institute of Science

Date submitted: 11 Jan 2006 Electronic form version 1.4