Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

An alternative mechanism for surface enhanced spectroscopy: second harmonic surface plasmon resonance HSIA YU LIN, YANG FANG CHEN, Department of Physics, National Taiwan University — Strong ultraviolet luminescence having intensity comparable with device quality GaN epifilms has been observed in Au nanoparticles. It is identified that the luminescence involves radiative recombination of electrons in band 6 (sp conduction band) with holes in band 4 (secondary top d band), near the L symmetry point. We show that the strong emission is a consequence of the second harmonic surface plasmon resonance (SHSPR), which is an inherent nature of metallic nanoparticles with high density of surface plasmons. However, for SHSPR we only need a dim pumping source, which is used to trigger the second harmonic absorption of very dense quantum particles, such as surface plasmons in Au nanoclusters. Unlike in the conventional SHG process, the high density quantum particles responsible for the nonlinearity in the SHSPA process preexist in the studied material, which are not due to external perturbation. In addition to Au nanoparticles, we demonstrate that SHSPR provides a very efficient way to enhance the luminescence of a material incorporated with metal nanoparticles. As an example, incorporation of Au nanoparticles into SiO_2 nanoparticles can enhance the luminescence intensity of the SiO_2nanoparticles by a factor as large as 2 orders of magnitude. We thus point out that SHSPR can serve as one of the underlying mechanisms responsible for surface-enhanced nonlinear optical phenomena.

Hsis Yu Lin
Department of Physics, National Taiwan University

Date submitted: 04 Dec 2004 Electronic form version 1.4