

# SINAM NANO SEMINAR

Center for Scalable and Integrated NANO  
Manufacturing (SINAM) Presents:



## Near-Field Imaging with a Localized Four-Wave Mixing Photon Source

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Tuesday, September 30th, 2008

1:00 PM - 2:00 PM

3110 Etcheverry Hall

### Abstract

We demonstrated high-resolution near-field imaging and spectroscopy using the nonlinear optical response of sharp gold tip and gold colloidal dimers as an excitation source. Femtosecond pulses at two different frequencies in the near infrared region are overlapped at the gold tip apex in order to generate highly localized nonlinear four-wave mixing (4wm) emission. 4wm emission is tuned such that it coincides with characteristic absorption wavelengths of the target molecules on the sample surface. The scheme works in both extinction and fluorescence mode.

The experimental setup is schematically depicted in Fig. 1a. Laser pulses from a Ti:Sapphire laser and from an OPO are focused with a high-NA objective lens. The fields are combined at the tip apex where they generate a nonlinear response of second and third order. The spectrum emitted from a metal tip is plotted in Fig. 1a. We select tips that produce a strong 4wm signal. An optical image is recorded by raster scanning the sample and detecting the emitted photons at the emission frequency, pixel by pixel. Spectral information (sample extinction spectra) are recorded by tuning the excitation wavelength and hence scanning the 4wm wavelength over extinction features of the sample.

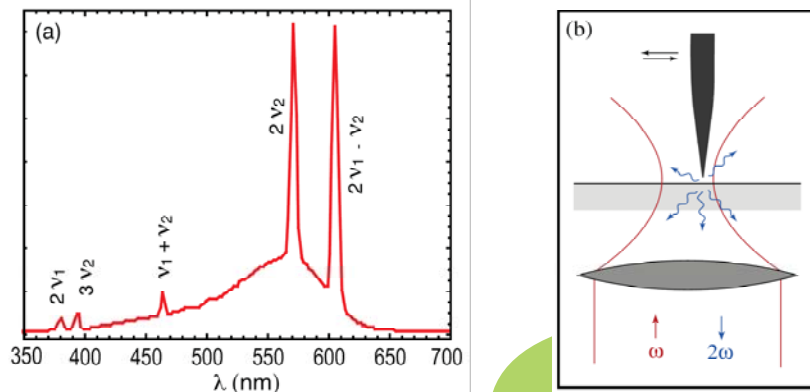


Fig 1. (a) Spectrum of photons emitted from a sharp gold tip when irradiated with laser pulses of wavelengths  $\lambda_1 = 780$  nm and  $\lambda_2 = 1160$  nm. (b) Schematic of the experiment. A sharp gold tip is placed into a tightly focused laser beam. The resulting 4wm emission is used as a local excitation source for the sample placed in close proximity.

### Biography

Stefano received his PhD from the University of Birmingham, UK, on nano-photonics and biophysics with size-selected clusters. He will focus his future research on non-linear plasmonics.

### *Refreshments Provided*

Hosted By: Professor Xiang Zhang, 3112 Etcheverry Hall  
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