Surface Plasmon Spectroscopy of Metal Nanoparticles

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Nanoscale metal nanocrystals exhibit size dependent absorption, scattering and emission spectra. While there are many applications for these materials as ensembles, increasing interest has focussed on the potential optoelectronic applications for single nanocrystals in single molecule sensing, high density information storage, high-throughput DNA screening and plasmonic imaging. In this talk, we will present the first work demonstrating quantitative self-assembly and patterning of single nanocrystals from the nanometre lengthscale to the centimetre lengthscale. We will discuss several methods including capillary force assembly, chemical assembly and electrophoretic assembly. The third of these is particularly flexible. We present the first optical image created from single nanoparticles. Up to 10^{10} particles may be put down over a square centimetre substrate with fidelity > 95%.

We will also present results on hydrostatic pressure on gold nanoparticle ensembles, potential scanning electrochemical sensing with single particles, and experiments to wards single electron detection using surface plasmons. Finally we consider the emission of hot electrons from small gold particles and their potential use in photovoltaic cells.

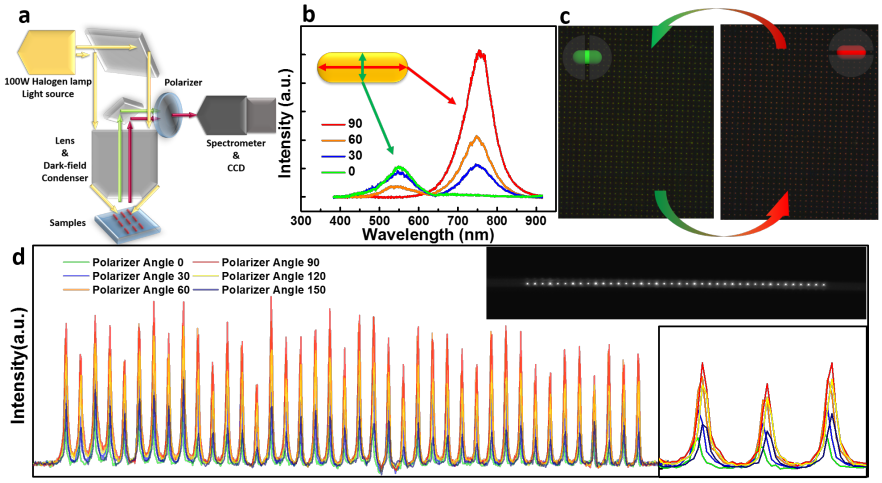

Fig. 1 Left- Experimental dark-field microscope set-up for single particle spectroscopy. Top Right: Deposited gold rods are aligned and exhibit ensemble-averaged polarisation-dependent spectra. Bottom: Intensity map across a row of gold rods as a function of polariser angle showing uniform alignment.

Acknowledgements: The support of the ARC through the ARC Centre of Excellence in Exciton Science (CE170100026) and the Swiss NSF for a Fellowship to Dr. Calum Kinnear are gratefully acknowledged.