

# The 291<sup>st</sup> MANA Special Seminar



## Luminescent Clusters of Noble Metals

Chair: Dr. Ryutaro Souda (MANA Scientist)

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In this talk I shall present our most recent work on monolayer protected sub-nanometer clusters of gold and silver. All the clusters are molecule-like with well-defined absorption and emission features, spanning across the visible-near infrared window. In a few clusters, the emission is intense. In general, several clusters are prepared simultaneously by reduction of metal ions in presence of appropriate ligands and subsequently size separated. However, we have also developed new methods for fast and efficient synthesis of specific clusters. All of these clusters are stable, highly water-soluble and can be made in the solid state. The clusters have been characterized by electrospray ionization mass spectrometry which gives multiply charged species. Isotope patterns and theoretical mass spectra have been used to characterise the molecular composition. We have shown that fluorescence resonance energy transfer is possible in these clusters by linking appropriate fluorescent molecules to the cluster core. We have developed interfacial routes for the direct synthesis of silver clusters. More recent excitement in this category of materials is the creation of clusters in protein templates. Bio-mineralization of  $\text{Au}^{3+}$  by native lactoferrin (NLF) and bovine serum albumin (BSA) resulting in near infrared (NIR) luminescent gold QCs will be discussed. We show that it occurs through a protein bound  $\text{Au}^{1+}$  intermediate and subsequent release of free protein. The evolution was probed by diverse tools, principally, using matrix assisted laser desorption ionization mass spectrometry (MALDI MS), x-ray photoelectron spectroscopy (XPS) and photoluminescence spectroscopy (PL). We have also shown that it is possible to make clusters starting from colloids of noble metals. The synthesis of a diverse variety of clusters, their chemical stability and intense luminescence offer numerous applications in areas such as energy transfer, sensors, bio-labeling and metal ion scavenging. Several of these applications are described, especially in the context of biological imaging and sensing.

**Venue: Auditorium, 1F, WPI - MANA Bldg.**

**Namiki site**

**Date: October 19<sup>th</sup>, Friday Time: 11:00am-11:45am**

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