

The Inaugural

ALDRICH LECTURE
Materials Science

March 30, 4:00 PM
127 Nieuwland Science Hall

*Gold Nanocrystals: Single Particle Catalysis, Energy Transfer
and Superlattice Dynamics*

Presented by:

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ABSTRACT

In this talk, Professor Mulvaney will provide an overview of some of his recent work on three aspects of the chemistry of gold nanocrystals. In the first part, we study chemical reactions on single nanoparticles. We show how electron transfer can be observed spectroscopically and how even processes such as hydrogen adsorption can be detected. We show that the interaction of the metal nanocrystal with the support matrix is crucial in determining reactivity. We will show a method called capillary force assembly for creating libraries of single catalyst particles.

In the second system, we study energy transfer from dye molecules to metal particles. We have used silica as a nanoscale spacer. We show that for small gold particles (15nm in size) the gold particle acts as a quencher at all separations. Full electrodynamic calculations agree well with the experiment and show that quenching obeys a d^{-4} distance dependence.

Finally, we describe NIPAM spacers as a temperature-tunable spacer. The use of polymer shells to control surface plasmon interactions is discussed and the possibility of light driven chemistry in plasmonic systems by local plasmonic heating. We demonstrate nanosecond based superlattice melting as a means to study the dynamics of colloidal crystal formation.

BIOGRAPHY

Paul Mulvaney is an ARC Laureate Fellow and Professor of Chemistry in the School of Chemistry and Bio21 Institute at the University of Melbourne. He received his PhD degree at the University of Melbourne in 1989, working on surface electron transfer reactions with Professor Franz Grieser.

His current interests include the optical properties of single quantum dots, surface plasmon spectroscopy of single metal particles, nanocrystal based electronics, nanomechanics and solar energy conversion. To date he has published some 230 scientific papers averaging around 90 citations per publication. The Nanoscience Laboratory at the University of Melbourne focuses on the chemistry and physics of nanoscale materials, particularly optical properties. The Laboratory has 4 postdoctoral researchers and 12 PhD students and group members come from numerous countries including Brazil, Venezuela, Germany, US, Singapore and Canada. Current funding comes from the Australian Research Council (ARC), DEST, Humboldt Foundation in Germany, ICI (UK) and the Ludwig Cancer Institute. The NSL collaborates with a number of Australian and international centres including the Technical University and the Frei University (Berlin), CSIRO, CSIC Madrid (Spain), Notre Dame (US), Padua (Italy) and Max-Planck Institute Potsdam.

Professor Mulvaney currently serves as an Associate Editor for the journal ACS Nano and is a member of the editorial advisory boards of Advanced Functional Materials, NanoToday, Journal of Physical Chemistry, Langmuir and PCCP.

<http://www.chemistry.unimelb.edu.au/professor-paul-mulvaney>

*Hosted by the Department of Chemistry and Biochemistry and the Center for Sustainable Energy at Notre Dame.
All Notre Dame faculty, students, and staff are welcome to attend.*