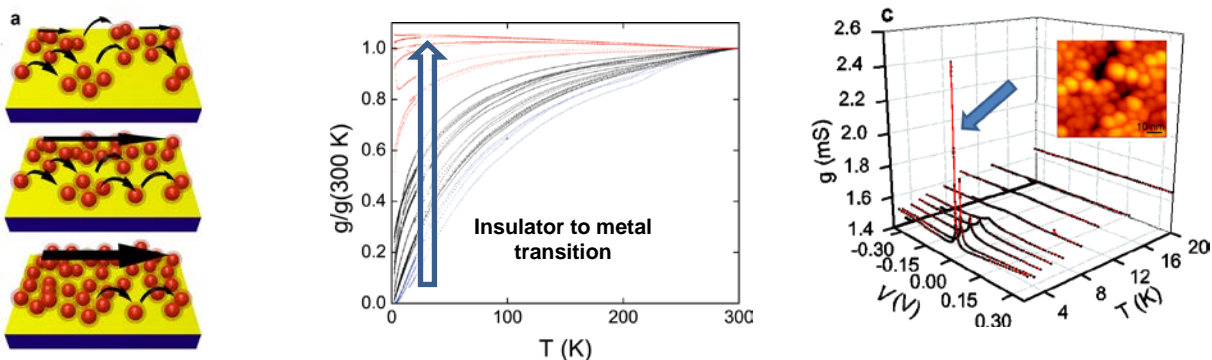


DHIRANI GROUP

Nanoengineering exotic quantum phenomena

There have been tremendous advances over the past few decades in the fabrication of various types of nanostructures. A theme of our research is to use nanostructures as building blocks to make new materials and devices. The motivation/goal is to take advantage of the range of nanostructures and control over their properties that are available to “nanoengineer” behaviour from the bottom up. This approach is of interest both in basic science (e.g. a new way to study exotic quantum effects previously only observed in more “traditional” systems – see below) and applications (e.g. energy storage, sensors for detecting heavy metals in drinking water, biosensors, more efficient solar cells, hyperthermal cancer therapy, etc).



Some recent results from the Dhirani group. Left panel. Self-assembling nanoparticles into films. Middle panel. Charges exhibit a transition to a delocalized state as the films grow. Right panel. Near the transition, film exhibit a resonance, signaling an exotic metallic state.

A number of exotic quantum phenomena are known to arise when unpaired, localized electrons spins interact with delocalized electrons; however, how this occurs is an open challenge in materials science. In this research opportunity, students will explore nanostructured materials that possess both these types of electrons. This project aims to take advantage of the tunability of nanostructures to better understand such phenomena.

DESCRIPTION OF STUDENT PARTICIPATION:

Students will begin by performing a literature review. They will then fabricate, characterize and study nanostructured material properties.

MAXIMUM NUMBER OF STUDENTS: Two