CMP Seminar
Michigan State University

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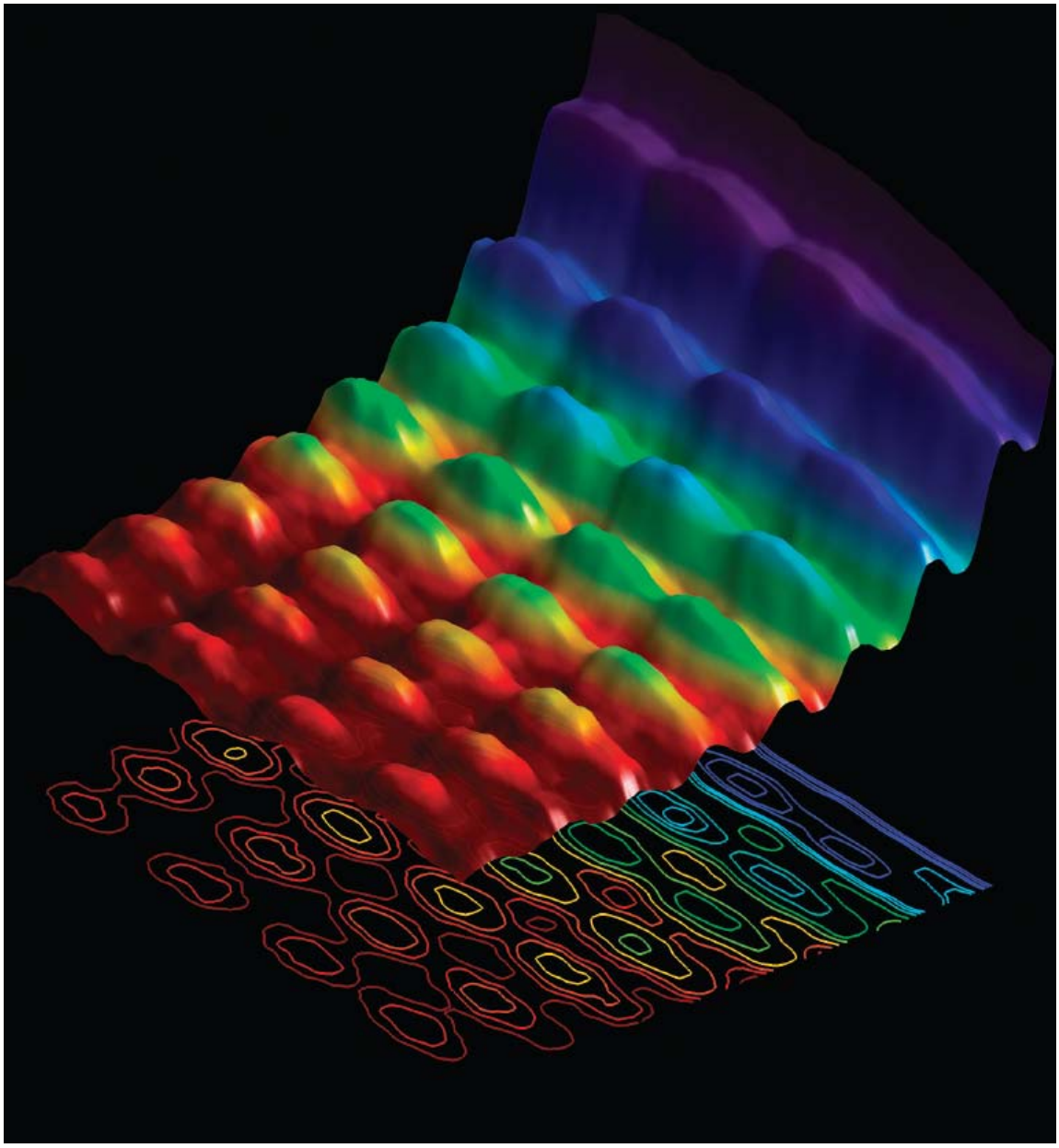
Capturing snapshots of quantum mechanics at work in plasmonic nanostructures with ultrafast electron microscopy

Ultrafast electron microscopy (UEM) has provided new insights into a variety of nanoscale dynamical phenomena, and has directly enhanced our ability to follow light/matter interactions with femtosecond and nanometer resolutions. In particular UEM has enabled a new technique dubbed photon-induced near field electron microscopy (PINEM), which is capable of controlling electromagnetic fields confined on the surface of nanostructures and image their properties with nm-resolution in direct space and fs-resolution in time. In this presentation, we will show some recent results where the standing wave formed by the plasmonic field confined on the surface of a single silver nano-wire was imaged, while simultaneously capturing it exchanging energy with the imaging electrons. In these results, both the interference and the quantization of the plasmonic near field could be imaged simultaneously, revealing both a quantum and a classical aspect of the electromagnetic field in one snapshot. The implications of these results will be discussed, and we will also present new ideas and methodologies to go beyond such an experiment and image the interaction between single electrons and single plasmons. We will also show that shaping the electron density in a thin film via light pulses is possible by taking advantage of the plasmon-plasmon interference and the ability of light polarization to control the excitation of different plasmonic field geometries in ad hoc designed nanostructures. Movies of the propagation of plasmons will also be presented, providing insights into their speed, propagation losses and the effect of confinement.



Monday, January 16, 2016
4:10 p.m.
BPS 1400
Prof. Chong-Yu Ruan - Host