Distinguished Lectures
Fall 2015

Colorado State University’s Information Science and Technology Center (ISTeC) presents two lectures by
Monica Olvera de la Cruz
Lawyer Taylor Professor of Materials Science & Engineering
Professor of Chemistry, Physics and Astronomy, and Chemical and Biological Engineering
Northwestern University

ISTeC Distinguished Lecture
In conjunction with the Department of Chemistry,
Computer Science, and Electrical and Computer Engineering
Polyhedral Crystalline Membranes
Monday, September 14, 2015
Reception with refreshments: 10:30 am
Lecture: 11:00 am - 12:00 noon
Morgan Library Event Hall
Department of Chemistry, Computer Science, and Electrical and Computer Engineering Special Seminar Sponsored by ISTeC

“DNA-functionalized nanoparticle assembly”
Monday, September 14, 2015
Reception with refreshments: 3:45 pm
Lecture: 4:00 pm - 5:00 pm
Chemistry, Room A101

Department of Chemistry, Computer Science, and Electrical and Computer Engineering Special Seminar

Upcoming Distinguished Lectures
October 19
“From GPS and Google Maps to Spatial Computing”
11:00 am - 12:00 noon
Morgan Library Event Hall
Shashi Shekhar

Abstracts
Polyhedral Crystalline Membranes
Polyhedral geometries have beguiled scientists and mathematicians for millennia. In recent times polyhedral shapes have been identified at the microscopic level in crystalline shells such as fullerenes, virus capsids and protein-based bacterial organelles. The most frequently found polyhedron in homogenous crystalline shells is the icosahedron. We demonstrate that other geometries arise spontaneously in shells formed by more than one components. We provide computational and experimental evidence of the spontaneous buckling of closed shells of oppositely charged molecules, where electrostatics drives their co-assembly, and orders the assembly into faceted ionic structures with various crystalline domains. Our work explains the existence of various regular and irregular polyhedral shells found in nature, and provides the principles for designing nanocontainers with specific shapes and symmetries for numerous applications in material and life sciences.

DNA-functionalized nanoparticle assembly
The selectivity of DNA recognition inspires an elegant protocol for designing versatile nanoparticle (NP) assemblies. We use molecular simulations to study dynamic aspects of the assembly process and identify ingredients that make the process robust. We present a coarse-grained model that accurately captures the relevant contributions to the kinetics of the DNA hybridization process and is able to recover at experimental rates the time scales of superlattices. With multi-scale modeling we show that precise DNA hybridization can assemble into superlattices with a specific crystal habit, providing a nanoscale analogue to the crystallization behavior exhibited by conventional atomic crystals.

Speaker Biography:
Monica Olvera de La Cruz obtained her B.A. in Physics from the Universidad Nacional Autonoma de Mexico in 1981, and her Ph.D. in Physics from Cambridge University in 1985. She is the Lawyer Taylor Professor of Materials Science & Engineering, and Professor of Chemistry, of Physics and Astronomy, and of Chemical & Biological Engineering at Northwestern University. Her research is focused on understanding and optimizing the physical properties of complex systems including molecular electrolytes, monolayer membranes, responsive nano-containers and functionalized nanoparticles. She is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and a Fellow of the American Physical Society.

To arrange a meeting with the speaker, please contact Prof. Martin McCullagh (Martin.McCullagh@colostate.edu, (970) 491-3572).