ISTeC
The Information Science and Technology Center

Colorado State University

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

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, viral capsids and protein-based bacterial organelles. The most frequently found polyhedron in homogeneous crystalline shells is the icosahedron. We demonstrate that other geometries arise spontaneously in shells formed by more than one component. 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 dynamics simulations to analyze dynamic aspects of the assembly process and identify ingredients that are key to a successful assembly of NP superlattices through DNA hybridization. A scale-accurate coarse-grained model faithfully captures the relevant contributions to the kinetics of the DNA hybridization process and is able to recover all experimentally reported to date binary
superlattices. With multi-scale modeling we show that through very slow cooling, DNA functionalized nanoparticles 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, multicomponent 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).

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

ISTeC (Information Science and Technology Center) is a university-wide organization for promoting, facilitating, and enhancing CSU's research, education, and outreach activities pertaining to the design and innovative application of computer, communication, and information systems. For more information please see ISTeC.ColoState.edu.