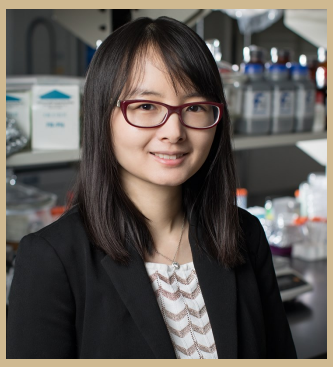
FALL 2022

MSE 690 SEMINAR SERIES

Monday, November 7th, 2022 - 3:30pm to 5:00pm

ARMS 1010



QIAN CHEN

Associate Professor & Racheff Scholar in the Materials Science and Engineering Department at University of Illinois at Urbana-Champaign (UIUC)

"Cinematography" of soft, biological, and energy matter at the nanoscale"

Abstract: I will discuss my group's recent progress on adapting a suite of electron microscopy methods (e.g., liquid-phase TEM, electron tomography, 4D-STEM) and machine-learning based data-mining to synthetic soft, biological, and energy related systems. In the first system, we focus on the phase behaviors of nano-sized building units as they are dispersed in solution. As a proof-of-concept, we directly image the crystallization pathways of nanosized colloids into superlattices, where the discreteness and multi-scale coupling effects complicate the free energy landscape. Single particle tracking and simulations combined unravel a series of interesting pathways at this length scale, such as non-classical crystallization, capillary waves, and a layer-by-layer growth mode, enabling advanced crystal engineering. In the second system, we study membrane proteins in their native lipid and liquid environment at the nanometer resolution. The proteins exhibit real-time "fingering" fluctuations, which we attribute to dynamic rearrangement of lipid molecules wrapping the proteins. The conformational coordinates of protein transformation obtained from the movies are used as inputs in our molecular dynamics simulations, to verify the driving force underpinning the function-relevant fluctuation. In the third system, we further push direct imaging to separation membranes and multivalent ion batteries, where the strain embedded heterogeneously within leads to morphogenesis and distinct charge transport properties. We foresee our suite of "cinematography" tools to provide crucial and complementary insights in various materials systems, with the common theme of imaging and manipulating materials in space and time at the nanoscale.

Biography: Prof. Qian Chen is currently an Associate Professor and Racheff Scholar in the Materials Science and Engineering Department at University of Illinois at Urbana-Champaign (UIUC). She obtained her PhD from the same department with Prof. Steve Granick (2012) and did her postdoc with Prof. Paul Alivisatos at UC Berkeley under Miller Fellowship. She joined the faculty of UIUC in 2015 and since then has received awards for the research in her group including Victor LaMer award in ACS (2015), Forbes 30 under 30 Science List (2016), Air Force Office of Scientific Research YIP award (2017), National Science Foundation CAREER award (2018), Sloan Research Fellow in Chemistry (2018), Unilever award in ACS (2018), and Dean's Award for Excellence in Research (2020&2022), and the Hanwha-TotalEnergies IUPAC Young Scientist Award. The research in her group focuses on the broad scheme of imaging, understanding and engineering soft materials at the nanoscale, including systems such as colloidal self-assembly, protein aggregation, advanced battery devices, and energy-efficient separation strategies.

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