SLAC COLLOQUIUM SERIES

Megaelectronvolt ultrafast electron probe: science & challenges

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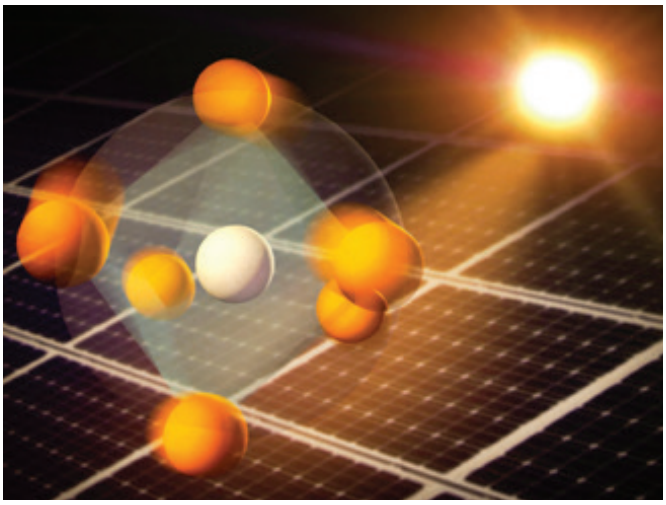
Abstract:
Electron microscopes achieve sub-Å spatial resolution through the introduction of the cold field-emitter and aberration correction optics. It is the interplay between atomic-scale structure and the associated ultrafast dynamics that governs the macroscopic functionality observed in matter. Ultrafast electron probe is the new frontier for electron scattering instrumentations. The development in high-brightness electron beams made it feasible to explore for megaelectronvolt electrons for Ultrafast Electron diffraction (MeV-UED). In this talk, I will discuss the science enabled by the MeV-UED and technical challenges facing next-generation electron instruments. Recent developments in MeV-UED have enabled broad scientific opportunities in ultrafast material science and chemical dynamics, such as revealing the energy flow in superconductors and atomic movie of light-induced structural distortion in the perovskites solar cell. Single-shot MeV-UED was successfully employed for the first observation of heterogeneous melting. In the gas phase UED, we have successfully made the transition from proof-of-principle experiments to investigating the unknown dynamics in chemical interesting systems, such as making a real space movie of a nuclear wavepacket passing through conical intersections. To probe and control electron motion within a molecule and image bio-molecules in its natural environments, new generation electron scattering instruments with better time resolution, higher sensitivity and real space imaging are needed. I will briefly outline SLAC's strategy for next-generation ultrafast electron instruments based on the superconductor RF gun.



November 12, 2018, Kavli Auditorium, Refreshments and Colloquium Start at 3:00 pm