

DMSE Fall 2022 Seminar Series

Dr. Xijie Wang

SLAC National Accelerator
Laboratory



Mapping Structure Dynamics and Energy Flow in Materials Using MeV Electron

Most innovation in materials science and engineering resides in our ability to understand and control the intimate relationship between the structure of materials and their properties. The traditional route of discovering innovative new material properties has been to explore the structural and compositional phase space that is accessible at (or near) thermodynamic equilibrium. The characterization, manipulation and, ultimately, control of material properties far from equilibrium offers almost completely untapped possibilities for uncovering novel states/phases of materials; many without equilibrium analogs. MeV ultrafast electron scattering has become a new frontier in materials science due to its capability of following dynamics on femtoseconds scale with the high spatial resolution and sensitivity. Furthermore, MeV electrons experience less multiple-scattering, and possess “real” flat Ewald-sphere; MeV ultrafast electron diffraction (MeV-UED) is an ideal tool to explore material structure and dynamics using total scattering technique. MeV-UED had broad and transformative impact on ultrafast science, such as the first 2-D materials ultrafast structure dynamics, light-induced transient states of quantum materials, the first direct imaging of fundamental chemical processes and hydrogen bond dynamics in liquid water. After briefly review MeV ultrafast electron scattering, I will highlight couple materials science and engineering examples enabled by MeV-UED, such as the first operando experiment in ultrafast, mapping energy and charge flow in nano-scale heterostructures and ultrafast visualization of incipient plasticity in dynamically compressed matter.

Xijie Wang is a distinguished scientist at SLAC National Accelerator Laboratory and the pioneer of MeV-UED. Dr. Wang obtained the PhD in accelerator physics from UCLA in 1992. He has more than 30 years research experience in accelerator physics, free electron laser, and ultrafast science and technology. He made major contributions to the technologies enabling the X-ray free electron laser (XFEL). He established the world first ultrafast electron scattering user facility– SLAC MeV-UED in 2019. Under Dr. Wang’s direction, SLAC has become the world leader in ultrafast electron scattering technologies. Dr. Xijie Wang is a recipient of inaugural SLAC Director Award in 2016, and 2021 IEEE Particle Accelerator Science and Technology Award. He produced over 350 publications, 8 in Science, 2 in Nature, and 10 in Nature family journals, and 25 in PRLs. Xijie Wang can be reached by e-mail: wangxj@slac.stanford.edu.

**Wednesday
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2:30 PM
Shaffer Hall Room 3**

Email DMSE@jhu.edu for Zoom Link