



复旦大学物理系 物质科学报告

Time: 2:00pm, Tuesday, 2019.12.17

Location: Room C108, Jiangwan Physics Building

Title: Advances in femtosecond electron imaging and spectroscopy with high-brightness beams

Speaker: Chong-Yu Ruan

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Abstract: The advances of ultrafast imaging and spectroscopy technologies in the last decades have enabled a new perspective in understanding the fundamental processes at far from equilibrium. Ranging from molecular assemblies to systems on the nanometer scale, visualizing the transient evolution involving coupling between photon field, charge carrier and the lattice degrees of freedom allows the interaction hierarchy to be analyzed. These photoinduced nonequilibrium dynamics are not only central for understanding the complex interactions, but also may yield new ways for controlling the processes. An emerging area is to directly resolve the relevant processes in an ultrafast electron microscope where the local properties and morphology can be distinguished from the ensemble averages, relevant for more precise material design and integration with many technical implications. I will discuss the progresses using electron-based approaches to image the bond breaking, transient carrier and field dynamics, and non-equilibrium thermal and quantum phase transitions in nanostructures and 2D materials. I will also discuss methods to combine diffraction, imaging, and spectroscopy in a single setup to follow many key degrees of freedom at once as a next step to resolve complex dynamics in the development of high-intensity ultrafast electron microscopy systems.

Chong-Yu Ruan is a professor in the Department of Physics and Astronomy at Michigan State University. He got his PhD degree in physics from the University of Texas at Austin in 2000. As a postdoctoral scholar, he worked with Ahmed Zewail and contributed to the gas phase ultrafast electron diffraction and ultrafast electron crystallography initiatives during 2000-2004. His team later extended the technology to development ultrafast electron nanocrystallography system at Michigan State University. For related work, he was the recipient of Sidhu award and the Outstanding Young Researcher Award of the International Organization of Chinese Physicists and Astronomers. Currently, in collaboration with the National Superconducting Cyclotron Laboratory, his team is merging the adaptive accelerator optics and electron microscopy methodology for the development of table-top femtosecond electron microscope and angle-resolved electron energy loss spectroscopy systems with high-brightness photoelectron sources. Ruan helped draft the US DOE report on the Future of Electron Scattering in 2014.