CONDENSED MATTER SCIENCES SEMINAR

Professor Mumtaz Qazilbash

College of William & Mary

Host

Dr Guangxin Ni

Title

Novel insights into the metal-insulator transition of vanadium dioxide (VO2)

Friday, April 19th, 2024

1st Floor – B101

15:00-16:00

Abstract

Metal-insulator transitions are among the most fascinating and least understood phenomena in condensed matter physics. Metal-insulator transitions lead to significant changes in the electronic conductivity and optical properties, and are generally accompanied by structural and magnetic transformations due to a complex interplay between charge, spin, orbital, and lattice degrees of freedom. The thermally-driven metal-insulator transition (MIT) in bulk vanadium dioxide (VO2) is accompanied by a structural distortion that leads to pairing of all the vanadium atoms in the insulating phase. This V-V pairing has long been thought critical to the emergence of insulating behavior. We shall present our latest experiments on ultrathin VO2 films grown on TiO2 substrates. We demonstrate that the MIT in ultrathin VO2 films occurs without the V-V structural distortion. Our results establish a route to a purely electronic MIT that is driven by electron-electron interactions. We shall also present our recent experiments and results on infrared nano-imaging and nano-spectroscopy of VO2 films. The development of table-top, broadband infrared light sources in my lab has enabled nano-spectroscopy experiments on VO2 and other materials.

Bio

Mumtaz Qazilbash obtained his Ph.D. in physics at the University of Maryland at College Park. After a postdoc position at the University of California-San Diego and a second postdoc position at Los Alamos National Lab, he joined the Physics Department at the College of William & Mary in 2010 as a full-time faculty member. He is presently Professor of Physics at William & Mary. His current research interests include metal-insulator transitions, high-temperature superconductivity, light-matter interactions, and nano-optics.