**Workshop Title:** Nanoscale Phenomena in Quantum Materials

**Organizers:** Mark Dean, Claudio Mazzoli, Elio Vescovo, Valentina Bisogni (Brookhaven National Laboratory)

Inhomogeneities are a widespread feature of many of the most interesting quantum materials, either due to intrinsic phase separation or deliberate fabrication of artificial heterostructures. Probing such behavior is often very challenging, but with the advent of NSLS-II’s high brightness, coupled with its unique instrumentation, such behavior can now we studied in greater detail than ever before. This workshop featured eight talks centered around this theme.

The first talk was by Prof. Kyle Shen of Cornell University who discussed artificial inhomogeneity deliberately created by growing thin films and heterostructures with oxide molecular beam epitaxy. He showed how Angle Resolved Photoemission (ARPES) can be used to understand the change in properties of rare-earth nickelate samples when they are grown as atomically thin layers. Dr. Aaron Bostwick from the Advanced Light Source showcased their micro- and nano-ARPES capabilities and how this can be used to map the electronic properties of few-layer-thick transition metal dichalcogenide samples. These systems show great potential for energy storage applications. The first talk on resonant x-ray scattering was given by Prof. Riccardo Comin of the Massachusetts Institute of Technology. He described soft x-ray nano-diffraction techniques implemented at the Coherent Soft X-ray (CSX) Beamline of NSLS-II which provided images of the intrinsic spin-density wave textures that occur in rare-earth nickelate systems including a “memory effect” in which the same structure re-form upon thermal cycling.

In the second half of the workshop Prof. Roopali Kukreja from the University of California, Davis studied orbital dynamics in magnetite. This exploits the ultra-high coherent flux produced by NSLS-II to study weak order parameters using x-ray photon correlation spectroscopy. Prof. Andrew Wray from New York University described studies of materials in which topology endows edge and defects states with novel electronic properties unveiled by micro-ARPES.

The following two talks described Resonant Inelastic X-Ray Scattering (RIXS) studies. Wei-Sheng Lee from SLAC National Accelerator Laboratory unveiled dispersive plasmons and phonon-CDW coupling in high temperature superconducting cuprates. Jason Hancock from the University of Connecticut described how RIXS can probe Kondo physics in Yb-based heavy fermion compounds.