**WK8: Tipping X-ray - Comprehensive Nanoscale Characterization with Multimodal X-ray Imaging**
**Organizers:** Haidan Wen and Volker Rose (APS/ANL)
**Location:** Bldg. 401, Room A5000

A deeper understanding of energy conversion and transport in real-world materials and devices requires multimodal imaging capabilities to visualize rich, localized physical and chemical processes. These processes can be delicate and need to be measured in situ to capture the evolution of nanoscale objects, ranging from correlated electronic phases in quantum materials to defects at electrochemical interfaces. To meet this challenge, major instrumentation initiatives that integrate scanning near-field optical microscopy and scanning tunneling microscopy with x-ray beamlines (SX-STM) are under rapid development at the Advanced Photon Source. These new instruments open up opportunities to investigate localized nanoscopic phenomena with unprecedented comprehensive information including chemical sensitivity, local structure distortion, and electronic heterogeneities. The world's first user program in SX-STM will soon become available at the new XTIP beamline. This workshop will gather world-leading researchers in the field of nanoscale characterization to identify new scientific opportunities, cultivate user community, and form international collaborations.

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| 9:00—9: 15 | Haidan Wen and Volker Rose (Argonne National Laboratory)<br>*Welcome and Workshop Charge* |
| 9:15—9:20 | Jonathan Lang and Stefan Vogt (Argonne National Laboratory)<br>*Introductory Remarks* |
| 9:20—9:40 | Qian Li (Argonne National Laboratory)<br>*Development of a Time-resolved Multimodal Imaging Platform* |
| 9:40—10:00 | Nozomi Shirato (Argonne National Laboratory)<br>*XTIP – A Dedicated New APS Beamline for Synchrotron X-ray Scanning Tunneling Microscopy* |
| 10:00—10:30 | Break |
| 10:30—11:00 | Jeremy Levy (University of Pittsburgh)<br>*One-dimensional Transport at the $LaAlO_3/SrTiO_3$ Interface* |
| 11:00—11:30 | Sergei Kalinin (Oak Ridge National Laboratory)<br>*Deep Learning in Atomically Resolved Imaging: From Mechanisms of Solid State Reactions to E-beam Atomic Fabrications* |
| 11:30—12:00 | Mengkun Liu (Stony Brook University)<br>*Recent Development in Scattering-type Scanning Near-field Optical Microscope* |
| 12:05—1:30 | Lunch |

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| 1:30—2:00 | Tyler Cocker (Michigan State University)<br>*Ultrafast Terahertz Microscopy: From Near Fields to Single Atoms* |
| 2:00—2:30 | Woei Wu Larry Pai (National Taiwan University)<br>*Spectro-microscopy at Nanoscale with Combined STM and Synchrotron Techniques- Case Studies of Charge Density Wave Visualization and Novel Instrumentation* |
| 2:30—3:00 | TeYu Chien (University of Wyoming, Laramie)<br>*Cross-sectional Scanning Tunneling Microscopy and Spectroscopy for Complex Oxide Interfaces and Beyond* |
| 3:00—3:30 | Break |
| 3:30—4:00 | Didier Tonneau (Aix-Marseille Université – CINaM)<br>*Visible Nanophotonics for High Lateral Resolution X-ray Based Techniques* |
| 4:00—4:30 | Eli Rotenberg (Lawrence Berkeley National Laboratory)<br>*MAESTRO: Investigating the Electronic Structure of Materials with Multimodal Growth and Characterization at the ALS* |
| 4:30—5:30 | Panel Discussion<br>*How Can X-ray Help? Scientific Drivers and Technical Wish List* |