# APS WK8: Materials for Neuromorphic Computing: Operando Studies to Optimize Performance

**Organizers**: Joseph Strzalka, Qingteng Zhang, and Jie Xu

The growing ubiquity of Artificial Intelligence in many different applications is creating pressure for more efficient implementation of computing architectures for machine learning with the ability to operate in challenging environments such as the human body. Recently, Organic Mixed Ionic Electronic Conductor (OMIEC) materials are receiving increase interest because of their ability to efficiently implement neuromorphic circuits built up from organic electrochemical transistors (OECTs), as well as their biocompatibility and stretchability. In OECTs, doping of the OMIEC materials with ionic species from the surrounding electrolyte solution can modulate the charge mobility within the channel, analogous to tuning the transmission of electrical nerve impulses across synapse gaps between neurons by small-molecule neurotransmitters. As with organic semiconductors, Grazing-Incidence X-ray Scattering (GIXS) can help characterize the morphology and quantify the crystallinity of these materials. Operando scattering studies of OECT materials as a function of applied potential pose challenges with regard to sample cell design and experimental protocols but can offer insight into the mechanism of the adaptive charge transport properties of these materials. Grazing Incidence X-ray Photon Correlation (GI-XPCS) studies can reveal the dynamics of these materials, further advancing their rational design. This workshop will bring together participants in the field to discuss the role of OMIEC materials and OECT devices in neuromorphic computing, strategies to boost performance, fabrication techniques, and how best to address the needs for operando characterization of these materials.