

## **Imaging and spectroscopy of nematic quantum Hall phases and their boundary modes**

Two-dimensional (2D) electron systems subject to large magnetic fields have provided an enduring platform to explore novel many-body interaction effects. In this talk, I will discuss a series of scanning tunneling microscope experiments in which we examine bismuth surface states in the quantum Hall regime. By combining spectroscopy and imaging, we show that the valley degeneracy in this material is lifted by electron-electron interactions at high field to produce different classes of broken-symmetry quantum Hall states. Mapping individual anisotropic wave functions allows us to directly visualize domains of nematic behavior in which rotational symmetry is spontaneously broken. At the boundaries between different nematic domains, we observe valley-polarized 1D edge states. I will describe how we tune the number of edge modes at the domain walls and thereby switch between metallic and insulating behavior in this new type of interacting Luttinger liquid.

