

# **Information-theoretic imaging of layered quantum materials**

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Scanning microwave impedance microscopy (MIM) probes the local complex conductivity of a material, providing a spatially resolved view of electronic states and their evolution. In recent years, MIM has emerged as a powerful tool for investigating topological phases and correlated quantum matter. In this talk, I will discuss new approaches that extend the information accessible through the microscopy of quantum materials. First, I will describe a layer-resolved imaging technique that resolves electronic states on individual atomic planes within van der Waals heterostructures at temperatures down to 50 mK. By visualizing charge disorder across different atomic layers, we investigate how surface impurities and electrostatic screening influence the formation of fractional quantum Hall states. I will then discuss an approach that combines microscopy with tools from information theory to quantify spatial complexity and hidden order directly from images. Together, these developments illustrate how spatially resolved measurements can provide new perspectives on disorder, quantum criticality, and the microscopic nature of electronic phase transitions.