Visualizing the sub-moiré polarization of the topological bands of twisted Molibdenium ditelluride with STM

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Résumé

The recent discovery of fractionalized anomalous quantum Hall effect in twisted Molibdenium ditelluride (tMoTe2) is a landmark in condensed matter physics (1-2-3). Electrical transport and optical spectroscopy measurements have shown that devices where two layers of MoTe2 are twisted by around 4 degrees exhibit fractionally quantized resistance, in the abscence of a magnetic field. These physics occur in the valence flat bands of the system, that arise from the moiré superlattice of the 2D crystals. Additionally, these flat bands feature berry curvature at the origin of the quantized anomalous Hall effect. Since this non-trivial topology is intimatey tied to the microscopic details of the moiré superlattice, we use scanning tunneling microscopy (STM) measurements of high quality tMoTe2 devices to investigate these microscopic details. I will explain the fabrication of these devices as well as decribe how STM/S measurements are performed reliably on this semiconductor. By having access to the density of states, we are able to investigate the energy dependent polarization of the wavefunctions. Our results (4) help shed light on the origins of the FQAH physics and inform future studies of this system.
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