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Allgemeines Physikalisches Kolloquium

Donnerstag, 20.05.2021 um 16 Uhr c.t.
Online-Kolloquium

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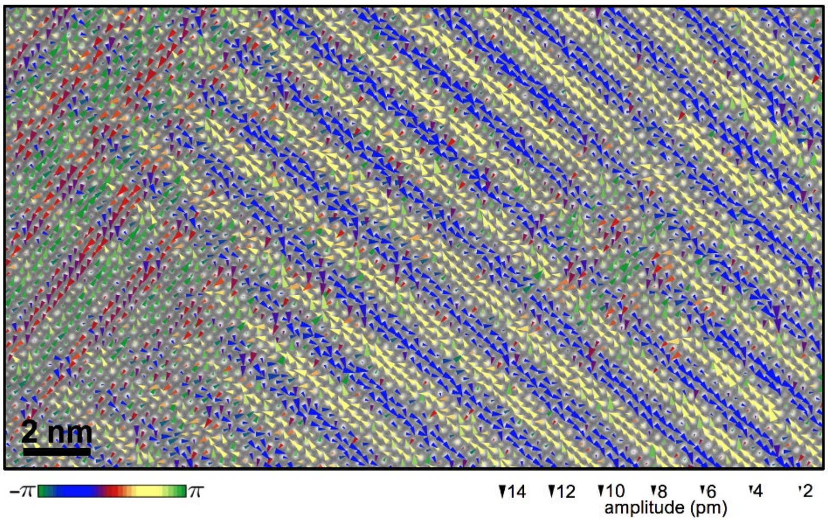
Cryogenic electron microscopy for probing quantum and energy materials



Electron microscopy has enabled imaging of our natural word with exceptional detail. Today, the three-dimensional structure of biomolecules can be studied down to the atomic scale and single defects present in atomically thin materials can not only be identified but also spectroscopically probed. The developments that have enabled these successes in the life sciences and the physical sciences have been recognized by the 2017 Nobel Prize in Chemistry for cryogenic electron microscopy of biomolecules and the 2020 Kavli Prize in Nanoscience for sub-Ångstrom imaging enabled by aberration correction.

Despite these breakthroughs in imaging there are entire classes of materials and devices that have not been able to be explored at the relevant microscopic length scales. In this talk, I will discuss our developments of cryogenic scanning transmission electron microscopy (cryo-STEM) which have opened a new window to probing phenomena in quantum and energy materials that have not been accessible before. Focus will be on two areas, lithium metal batteries and their complex electrode/electrolyte interfaces, and charge-ordered phases which permeate the phase diagrams of strongly correlated systems such as layered transition-metal dichalcogenides, colossal magnetoresistive manganites and cuprate high-temperature superconductors. Cryo-STEM provides a real space probe to map local lattice symmetries in these charge ordered phases. Using half-doped manganites as a model system, we demonstrate the importance of lattice coupling for understanding and manipulating the character of electronic self-organization.

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