UNIVERSITÄT DUISBURG ESSEN

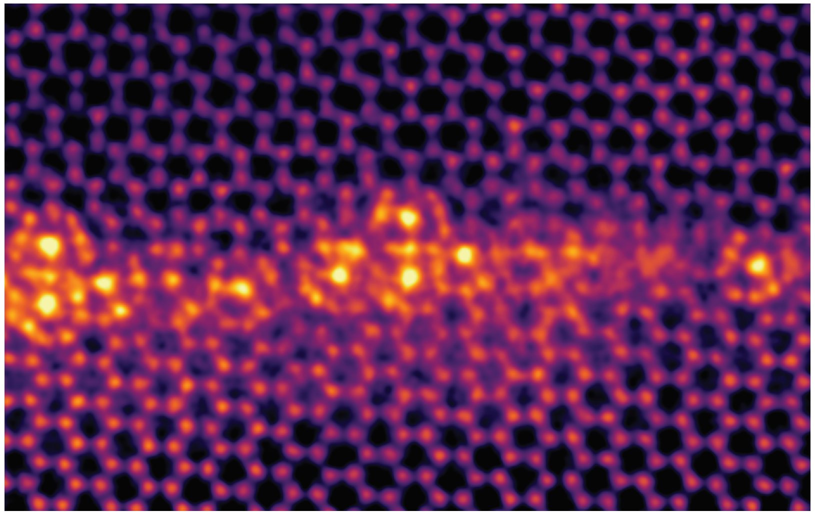
PHYSIK

Physikalisches Kolloquium

Mittwoch, 16.04.2025
13:00 Uhr
MC 122 und Zoom

https://uni-due.zoom-x.de/j/64228670246?pwd=RjVQeFNIUkRKRkpiNVpKYXhJaFNLdz09 (gilt für alle Vorträge)

Seeing is understanding - a deep look into the atomic structure of complex materials



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Tailoring the properties of materials by design is becoming a viable route to establish devices with novel functionalities. However, an understanding of the underlying atomic nature is a prerequisite for advancing material behavior and ultimately sculpting new materials. Advanced transmission electron microscopy offers unprecedented insights into the atomic level and is one of the most important tools to uncover the inner workings of matter.

We will introduce different methodologies in the scanning transmission electron microscope enabling a quantitative understanding of complex materials and interfaces down to the atomic level. We use aberration-corrected scanning transmission electron microscopy to explore phase transformations at crystal interfaces at atomic resolution in metallic systems. Our observations reveal that the interface itself can exist in multiple phase states and can undergo phase transformation. By combining atomic-resolution imaging with advanced atomistic simulations we are even able to shed light on the 3D atomic structure of novel aperiodic structures found at grain boundaries in titanium.
The emergence of pixelated direct electron detectors with fast readout speeds has enabled entirely novel imaging modalities, where full diffraction information is captured in each real space probe position termed four-dimensional scanning transmission electron microscopy (4D-STEM). We will show how first-moment measurements can resolve complex magnetic textures in Fe-Co-Ge-Ti alloys under magnetic field-free conditions. By forming an atomic resolution probe, we observe intricate configurations in $NaNbO_3$ thin films showing complex oxygen octahedral tilting patterns that govern the electrical properties of the material.