TECHNISCHE UNIVERSITÄT DRESDEN

School of Science Faculty of Physics

PHYSICS COLLOQUIUM

Speaker:

Prof. Axel Lubk
Leibniz Institute for Solid State and Materials Research (IFW) Dresden /
Institute of Solid State and Materials Physics TU Dresden

Topic:

Advanced Electron Optics and Microscopy for Solid State Physics

(Inaugural lecture)

Time and place:

Tuesday, November 15, 2022, 4:40 pm – hybrid event
The colloquium will be held in REC/C213.
Online participation possible:
Zoom-Meeting: Meeting-ID: 631 3817 8900 / passcode: PK-WiSe22
https://tu-dresden.zoom.us/j/63138178900?pwd=RVVZM3N4azdmNmVJQ2RWUTZ0TkhXdz09

Host:

Prof. Carsten Timm (Dean of the Faculty of Physics)

Abstract:

Scattering experiments with charged particles are particularly well established within solid state physics, among them various forms of electron microscopy and spectroscopy (e.g., scanning electron microscopy (SEM), transmission electron microscopy (TEM), photoelectron spectroscopy (PES), electron energy loss spectroscopy (EELS). Here, the research and further development of charge particle optics (both theory- and instrumental-wise) play a central role in increasing the performance of existing instruments (e.g., spatial and energy resolution, brightness) and for the development of new instruments, thereby benefiting solid state research and materials characterization. Current research frontiers in the field of electron optics concern the development of novel aberration correctors (e.g., for correcting large fields of view), electron lenses (e.g., for high resolution imaging without exposing the sample to a magnetic field), pulsed electron sources (e.g., for ultrafast time-resolved TEM), energy-dispersive elements (e.g., for EELS with high energy resolution) and miniaturized devices, e.g., to facilitate in-situ TEM.

The talk discusses the fundamentals of charge particle optics employing Hamiltonian mechanics and gives a short overview over the above developments. Subsequently, we will discuss in more detail the development of: (A) miniaturized magnetostatic optics (lenses, dipoles, quadrupoles) for miniaturized electron microscopes, nanosecond time-resolved TEM, and improved electron guns; (B) ground potential magnetic monochromators for high-energy resolution EELS of low energy excitations in solids such as plasmons; and (C) in-situ tomography sample stages for high-resolution

tomography of magnetic vector fields with nanometer resolution. In that we always draw the connection to current questions in solid state physics.

Bio: 1999-2005: Diploma degree in physics at TU Dresden / 2005-2010: Doctoral degree in physics (summa cum laude) at TU Dresden, Institute for Structural Physics, "Quantitative Electron Holography and Multiferroic Interfaces", Supervisor: Prof. Dr. H. Lichte / 2010-2011: PostDoc at CEMES (CNRS), Toulouse, France in the workgroup of Electron Microscopy / Nanostrain (Dr. M. Hÿtch) / 2012-2017: Habilitations thesis at TU Dresden, Institute for Structural Physics, "Holography and Tomography with Electrons. From Quantum States to Three-Dimensional Fields and Back" / 2017-2022: ERC Starting Grant Junior group at IFW Dresden, "Advanced Holographic Tomographies for Nanoscale Materials, Revealing Electromagnetic and Deformation Fields, Chemical Composition and Quantum States at Atomic Resolution" / 2022-now: CEOS endowed chair for electron optics and group leader at IFW Dresden "Advanced Methods of Electron Microscopy".