

**Krakov School of Interdisciplinary PhD Studies <KISD>**  
invites PhD students and members of the research staff  
to attend the series of guest lectures given by:

## **Prof. Lukas M. Eng**

**Dresden University of Technology, Germany**

# Advanced optical, electronic and magnetic methods in Nanoscale Material Research

Systems encompassing tens to several thousands of atoms form mesoscopic objects, such as ferroic domains and artificial nanomaterials. Their main characteristic is the presence of boundaries, i.e. surfaces and interfaces, which modify significantly their dynamics giving rise to states localized near to these defects. The recent development of nanotechnology stimulated experimental methods of detecting and characterising the localized states. Of special interest are exceptionally stable configurations protected by topology, e.g. magnetic skyrmions. The course includes:

- 1. Far- and Near-Field Optical Methods for Nanoscale Material Analysis:** Linear and nonlinear optics: SHG, Cherenkov, Raman, FTIR, CARS, Near-field Optics: IR & THz s-SNOM, nano-FTIR, TERS, Analysis of structure, chemistry, 3D morphology, Examples: organic, inorganic, 2D materials, etc.
- 2. Domains and Domain Walls in Ferroelectrics:** Introduction into Ferroelectrics (FEs); Phase Transitions, Properties of Domains and Domain Walls (DWs), Visualizing and Analyzing Domains and DWs, Impact of Temperature and Mechanical Stress, Examples: BaTiO<sub>3</sub>, LiNbO<sub>3</sub>, TFLN.
- 3. Topology in Materials:** Topology: what is it?, Topology in Electronics, Magnetism, and Optics, Magnetic Skyrmion, More Examples.

### **Schedule:**

- **Monday, 02.09.2024, 11.00-12.30 am.**  
*IFJ PAN, MSD room, 1st floor*
- **Thursday, 05.09.2024, 11.00-12.30 am.**  
*IFJ PAN, Auditorium, 1st floor*
- **Friday, 06.09.2024, 11.00-12.30 am.**  
*IFJ PAN, MSD room, 1st floor*

***Professor Lukas M. Eng** is a Head of the Department of Experimental Physics/ Photophysics at the Institute of Applied Physics at the Technical University of Dresden, Germany. His current research focuses on: SNOM - Optical Near-Field Microscopy, SKY - Structural Properties at Low Temperatures, Ferroics, Nonlinear Optical Excitation. In Prof. L. Eng's group, nanometer-scale material characterization is combined with advanced materials science, covering many research areas such as photophysics, nano-optics, plasmonics, nanometer-resolution scanning probe spectroscopy, and materials science. Prof. Eng is the author or co-author of 354 documents, and his work has been cited 11,357 times in 8,988 documents, which translates into an h-index of 48. He was the manager of numerous grants. Professor Eng also conducts a number of activities for students, including lectures, seminars and laboratory internships: Bachelor courses, Master courses, PhD-level; fundamental lectures, specialization lectures.*