北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Four-circle single-crystal X-ray diffractometry of functional materials

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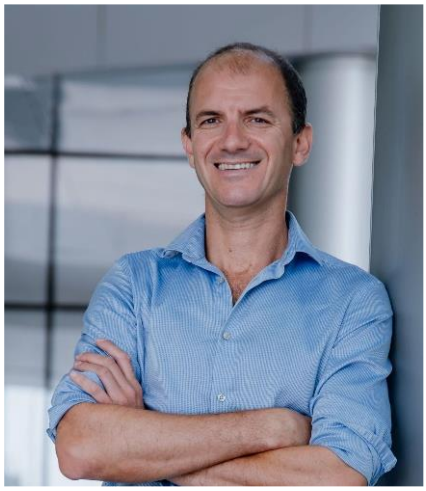

Time: 10:00 am, Oct. 30, 2024 (Wednesday)

时间：2024年10月30日 （周三）上午10:00

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Since Max von Laue's discovery in 1912, X-ray diffraction has remained the leading experimental technique for the non-destructive characterization of solids. Traditional X-ray structure analysis evolved as a tool for determining lattice parameters, space symmetry groups, positions of atoms in the unit cell, thermal motion, and electron density. In modern crystallography, there is a growing need to extend this scope to probing microstructure, domains, pair-distribution functions, and correlated disorder.

In this presentation, we will cover single-crystal X-ray diffraction experiments relevant to the crystallography of functional materials. We will start by describing a dedicated, custom-built four-circle X-ray diffractometer at Tel Aviv University, integrating traditional crystallographic functionalities with science-oriented capabilities. The robust and modular design, cutting-edge X-ray beam generation, conditioning, and detection technologies enable the implementation of this single instrument for various tasks. These tasks range from determining crystal orientation, assessing crystal quality, mosaicity, strain distribution to texture, and characterizing domains in ferroelectric, ferroelastic, and martensitic materials. The instrument also allows in-situ probing of materials in response to alternating external electric perturbation. Our focus will be on the fine crystallography of ferroic (e.g., ferroelectric and ferroelastic crystals), which exhibit enhanced piezoelectricity and dielectricity. Such enhancements can originate from intrinsic (atomistic) and extrinsic (mesoscopic) factors, and we implement X-ray diffraction-based methods to investigate each contribution separately. Additionally, we discuss our recent work describing the orientation of permissible domain walls, which can connect ferroelastic domains mismatch-free.

About the speaker

Dr. Gorfman, an Associate Professor at TAU's MSE Department, received his MSc in Physics from Chelyabinsk State University, Russia, and a PhD in Physics from the University of Siegen, Germany. Prior to joining TAU in 2017, he was a postdoc at the University of Warwick, UK (2008–2011), and a lecturer at the Universities of Siegen and Freiburg, Germany (2011–2017). His research focuses on fundamental and X-ray crystallography, crystal properties, piezoelectrics, ferroelectrics, and in-situ X-ray diffraction studies. Dr. Gorfman conducts his research primarily at synchrotron radiation and neutron scattering facilities, with notable contributions in investigating ferroelectric perovskite oxides' fine structure, symmetry, and functionality.