

FACULTY  
OF MATHEMATICS  
AND PHYSICS  
Charles University

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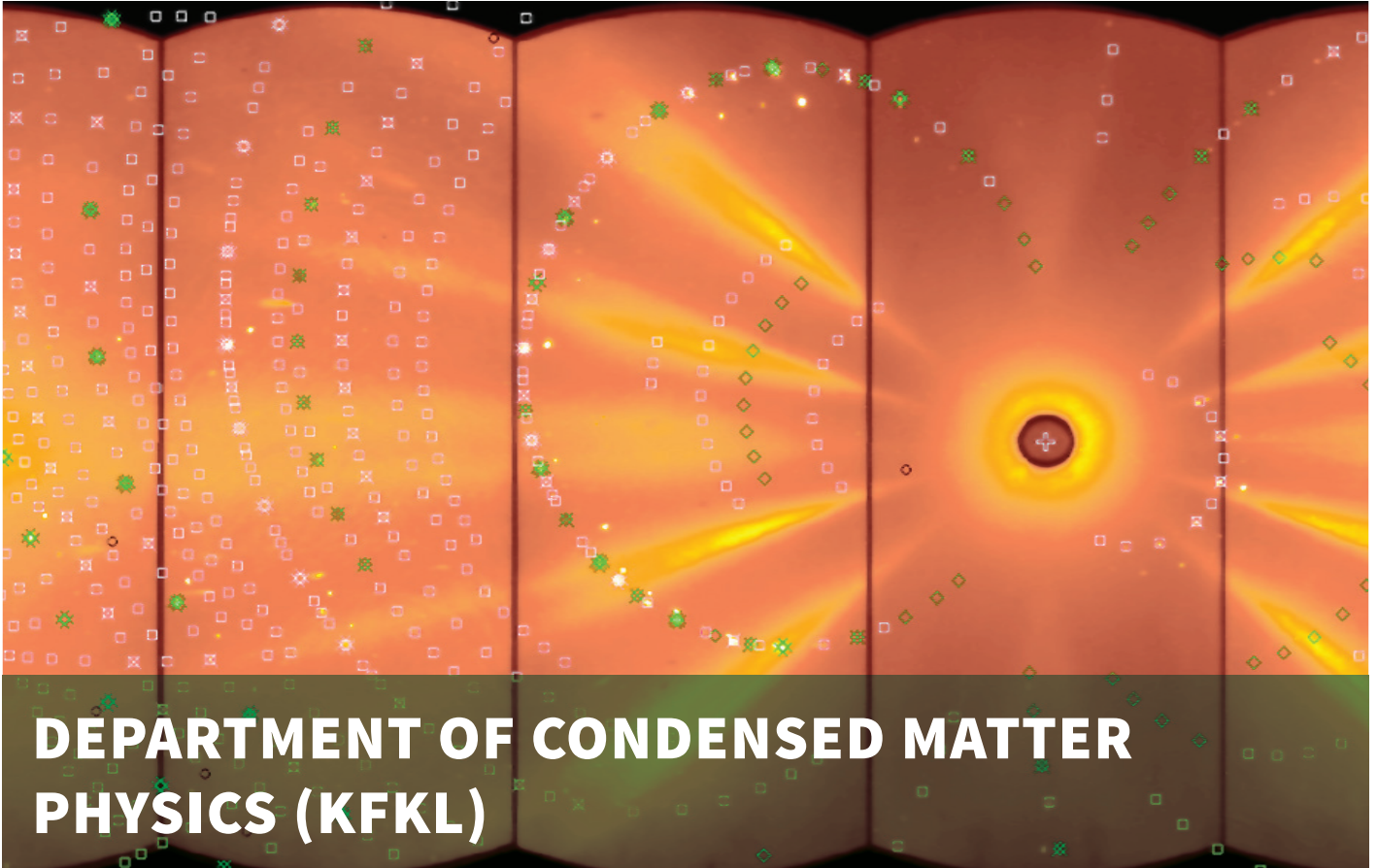
Department of Condensed Matter Physics (KFKL)

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## DEPARTMENT OF CONDENSED MATTER PHYSICS (KFKL)

### OFFER

- Crystal growth using various techniques (Czochralski, Bridgman, floating zone, flux).
- High-pressure studies of electronic properties of material.
- Measurements of magnetic properties at low temperatures and high magnetic fields.
- Neutron scattering techniques to study structure and dynamics in solids.
- Synthesis and physical properties of hydrides.
- X-ray scattering (diffraction in various geometries including grazing incidence, reflectivity, DAFS, EXAFS. etc.).
- X-ray powder diffraction (phase analysis, determination of microstrain, crystallite size, texture and residual stress).
- X-ray scattering theory (kinematical, dynamical).
- Investigation of self-organization during epitaxial growth (experiment and theory).

### EXPERTISE

- Study of physical properties of materials using a broad spectrum of techniques as magnetization, heat capacity, electrical resistivity, thermal expansion in a wide temperature range, in high magnetic fields and under high external pressures.
- Structural characterization of bulk crystalline samples as well as thin magnetic, ferroelectric and multiferroic layers or nanomaterials.
- *Ab initio* theory of electronic structure of solids.

## RESEARCH AREAS & EXCELLENCE

The Department main mission is the research and education in the field of solid state physics with emphasis on electronic properties of materials. This mission is realized by a broad spectrum of experimental and theoretical research topics with an essential involvement of students and intensive international collaboration, including active participation in European large research infrastructures.

## KEY RESEARCH EQUIPMENT

### SAMPLE SYNTHESIS EQUIPMENT

- SSE (Solid State Electrotransport) for materials Magnetization densities in magnetically ordered material purification.
- Tri-arc furnace for single crystal growth using the Czochralski technique.
- Optical furnace for single crystal growth.
- Induction furnace.
- Splat-cooling system for production of amorphous materials.
- Hydrogenation equipment.
- Vacuum unit and furnaces for flux growth.

### STRUCTURE ANALYSIS

- High-resolution x-ray diffractometer (high temperature chamber up to 800 °C).
- X-ray powder diffractometer (position sensitive detector, high-temperature chamber up to 1600 °C).
- Low-temperature X-ray diffractometer (closed cycle He cryostat).
- X-ray diffractometer with a large twodimensional detector for single-crystal diffraction.
- General purpose X-ray diffractometer (Rigaku SmartLab 9kW).
- SAXS X-ray diffractometer (Xeuss 2.0 SAXS/WAXS System).
- Universal static-dynamic deformation and fatigue machine (Instron ElectroPuls E10000).

### PHYSICAL PROPERTIES

- PPMS9, PPMS14, MPMS7XL Quantum Design instruments for various measurements in a wide range of temperatures and magnetic fields, dilution refrigerator (Tmin~30mK) for use in 9T magnet and 3He insert (Tmin~300mK) in 20T magnet.
- CCR (Closed-Cycle Cryocooler) for measurements of resistivity, heat capacity and thermal expansion.
- Several types of pressure cells for high-pressure measurements up to 15 GPa.
- Thermal analysis: DSC, DTA, TGA (SETSYS Evolution TGA-DTA/DSC SETARAM).

### LARGE INFRASTRUCTURE INSTRUMENTS

- ThALES (Three Axis Instrument for Low Energy Spectrometry), installed at ILL Grenoble.

## MAIN PROJECTS

- Research Infrastructure – Materials Growth and Measurement Laboratory.
- Coordinating the projects related to the participation of the Czech Republic in ILL Grenoble (Research Infrastructure project LM2015050 and INTER-TRANSFER project LTT1701 financed by Ministry of Education, Youth and Sports, Czech Republic).
- Center of spintronics, Project of Excellence No. 14-37427G, Czech Science Foundation, together with Department of Chemical Physics and Optics, the main coordinator is the Institute of Physics, Czech Academy of Science.
- NANOCENT – Nanomaterials Centre for Advanced Applications, reg. num. CZ.02.1.01/0.0/0.0/15\_003/0000485, Project funded by EU funds call – Excellent Research Teams, implemented together with Department of Physics of Materials.
- MATFUN – Physics Martensitic Transformations for the Functionality Enhancement of Crystalline Materials and Nanostructures, reg. num. CZ.02.1.01/0.0/0.0/15\_003/0000487.
- Project funded by EU funds call – Excellent Research Teams, implemented together with Institute of Physics of Charles University.

## ACADEMIC AND RESEARCH PARTNERS

### ACADEMIC PARTNERS

- Institut Laue-Langevin Grenoble
- Technische Universität Wien
- Uppsala University
- Advanced Science Research Center, Japan Atomic Energy Agency, Tokai
- Institute for Transuranium Elements, Karlsruhe
- Physikalisches Institut, Universität zu Köln
- National Institute for Materials Science, Tsukuba
- J. Kepler Universität Linz
- Helmholtzzentrum Dresden-Rossendorf
- Institute Rudjer Bosković, Zagreb
- Technical University of Freiberg
- Institute of Physics, Academy of Sciences of the Czech Republic, Praha
- Institute of High Pressure Physics UNIPRESS (Polish Academy of Sciences)

### INDUSTRIAL PARTNERS

- Vakuum Praha s.r.o., Czech Republic
- Dicont a. s., Czech Republic
- CRYTUR, spol. s. r. o., Czech Republic
- Added Value Industrial Solutions, Eibar, Spain
- Bisson Technology, France

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