

# Krakowska Interdyscyplinarna Szkoła Doktorska

## Opis przedmiotu/ course description

<b>Przedmiot/ Course :</b>	Współczesne metody eksperymentalne i teoretyczne fizyki ciała stałego / Modern experimental and theoretical methods of solid state physics
<b>Moduł kształcenia/ Training module:</b>	Moduł specjalistyczny
<b>Okres realizacji/ Implementation period :</b>	II rok, semestr letni
<b>Język wykładowy/ Language:</b>	angielski lub polski / English or Polish
<b>Prowadzący/ Lecturer:</b>	dr hab. inż. Michał Krupiński, prof. IFJ PAN, dr hab. Magdalena Fitta, prof. IFJ PAN, dr hab. Andrzej Ptok, prof. IFJ PAN.
<b>Wymiar godzin przedmiotu/duration :</b>	30 godzin
<b>Forma prowadzenia zajęć/ Form of teaching :</b>	Np. Wykład/ ćwiczenia/ seminaria (liczba godzin wykładu: 18, ćwiczeń: 12, seminaria -)
<b>Opis przedmiotu/ course content:</b>	<p>The course will introduce selected modern experimental and theoretical methods of condensed matter physics. The main aspects of the techniques and methods will be discussed, i.e. their possibilities, limitations, and requirements. The discussion will be supported by results that have been recently obtained, showing what questions can be answered by the presented approaches. In the frame of the course, we offer scientific visits to laboratories (e.g. AGH Academic Centre for Materials and Nanotechnology, National Synchrotron Radiation Centre SOLARIS, and selected laboratories in the Institute of Nuclear Physics PAN). These visits will supplement information covered in lectures and demonstrate how specific techniques are applied in laboratory practice.</p> <p>Topics:</p> <ul style="list-style-type: none"> <li>- ab initio (DFT) techniques and correlation problem (within DFT+U and DMFT manner)</li> <li>- investigation of localized states and surface topology by scanning tunneling spectroscopy (STS)/scanning tunneling microscopy (STM)</li> <li>- electronic band structure and angle-resolved photoemission spectroscopy (ARPES)</li> <li>- lattice dynamics (phonons) and inelastic x-ray scattering (IXS)</li> <li>- microscopic techniques for studying the structure and magnetism of materials: scanning electron microscopy, transmission electron microscopy, Lorentz microscopy,</li> </ul>

	<p>atomic force microscopy, magnetic force microscopy, scanning magnetoresistive microscopy, magneto-optic Kerr microscopy</p> <ul style="list-style-type: none"> <li>- magnetometry methods (SQUID magnetometry, MOKE magnetometry, magnetotransport measurements)</li> <li>- spectroscopic methods for the analysis of chemical structure</li> <li>- X-ray sources and spectroscopic methods using X-rays</li> <li>- neutron sources, diffraction, and spectroscopic methods using neutrons</li> </ul>
<p><b>Efekty uczenia się wg 8PRK zgodnie z Programem kształcenia KISD/ learning outcomes at level 8 of the PRK according to the KISD Training Program:</b></p>	<p>EU1, EU2, EU3, EU8, EU13</p>
<p><b>Forma weryfikacji efektów uczenia się/ Method of verification of learning outcomes:</b></p>	<p>Egzamin w formie dyskusji omawianych zagadnień / Examination in the form of a discussion of the issues covered in the course</p>
<p><b>Wymagania wobec uczestników/ Requirements for participants:</b></p>	<p>Uczestnictwo w wykładach i ćwiczeniach. Podstawowa wiedza z zakresu fizyki materii skondensowanej i mechaniki kwantowej / Participation in lectures and exercises. Understanding of foundations of solid state physics and quantum mechanics.</p>