The 1st mini-workshop on 2nd November 2022

Place: Institute of Physics, 3rd Wing small seminar room 145

Program

10:00 opening

10:10 Petar Popčević

"Crystal and electronic structure interplay in complex metallic systems"

10:15 Naveen Singh Dhami

"High-pressure techniques in strongly correlated materials"

10:30 Seyed Ashkan Moghadam Ziabari and Yuki Utsumi Boucher

"Synchrotron experiment and synthesis of transition metal phosphides"

10:45 Mirta Herak

"Probing the magnetic symmetry with torque magnetometry"

11:00 Virna Kisiček

"Linear magnetoelectric coupling in multidomain antiferromagnet Cu_3TeO_6 revealed by static electric polarization measurements"

11:15 free discussion

11:45-13:30 lunch time

13:30 PPMS & MPMS3 laboratory tour by Mirta Herak and Tomislav Ivek

Crystal and electronic structure interplay in complex metallic systems

Petar Popčević

Group for research of complex and strongly correlated functional materials,
Institute of Physics, Bijenička c. 46, HR-10000 Zagreb, Croatia

I will give short overview of interplay between complex crystal and electronic structures in several classes of materials. I will start with aperiodic crystals and their approximant periodic phases and show the importance of local disorder over lack of periodicity for electronic transport. In cuprate high-temperature superconductors, complex phase diagram has very simple explanation hidden by local disorder. And eventually, in intercalated transition metal dichalcogenides magnetic and metallic subsystems are intertwined and crystals of highest quality are required to address phenomena found here.

High-pressure techniques in strongly correlated materials

Naveen S. Dhami

Group for research of complex and strongly correlated functional materials,
Institute of Physics, Bijenička c. 46, HR-10000 Zagreb, Croatia

High-pressure physics emerged as a promising branch of physics with many interesting phenomena, like high-temperature superconductivity, heavy fermion state, metal to insulator transition, and many more. As pressure is one of the best external tools to tune systems' properties. In strongly correlated systems, pressure leads to much more intriguing phenomena due to the interaction between localized4*f* and itinerant electrons like valence fluctuation, unconventional superconductivity, etc. In this talk I will present the results from high-pressure studies on non-centrosymmetric Eu*T*Ge_3 (*T* = Co, Rh & Ir) compounds, which includes x-ray spectroscopy, x-ray diffraction and electrical resistivity measurement under high pressure.

Synchrotron experiment and synthesis of transition metal phosphides

Seyed Ashkan Moghadam Ziabari and Yuki Utsumi Boucher

Group for research of complex and strongly correlated functional materials,
Institute of Physics, Bijenička c. 46, HR-10000 Zagreb, Croatia

The first half of the presentation will be given by Yuki Utsumi Boucher. The recent results of the synchrotron experiments, specifically using angle-resolved photoelectron spectroscopy, on the transition metal intercalated NbS_2 and strongly correlated 4*f*-electron system will be presented. In the 2nd part of the presentation, Seyed Ashkan Moghadam Ziabari will present the latest progress in synthesis of transition metal phosphides, Fe_2P and Mn_2P.

Probing the magnetic symmetry with torque magnetometry

Mirta Herak

Department for research of materials under extreme conditions, Institute of Physics, Bijenička c. 46, HR-10000 Zagreb, Croatia

Torque magnetometry is a sensitive experimental technique for probing the macroscopic magnetic anisotropy of magnetic materials. In this short talk I will present the advantages of studying the ground states and magnetic-field-induced spin reorientations in antiferromagnets by torque magnetometry. I will show how a simple approach can be used to extract the magnetic symmetry of the ground state and the field-induced states, and briefly discuss what advantages this can bring in the study of magnetoelectrics.

Linear magnetoelectric coupling in multidomain antiferromagnet Cu_3TeO_6 revealed by static electric polarization measurements

Virna Kisiček

Institute of Physics, Bijenička cesta 46, HR - 10 000, Zagreb, Croatia

Magnetoelectric coupling in materials enables electric charge control by a magnetic field and spins by an electric field. The determination of their electric and magnetic properties in extreme conditions is essential to the future development of spintronic devices but also has significant importance in fundamental research of dynamical processes and quantum effects. In this short talk I will present the discovery of a new magnetoelectric material Cu_3TeO_6, revealed by static electric polarization measurements in an external magnetic field up to 12 T. Below T_N = 62 K, electric polarization linearly increases with the magnetic field but only when those two fields are perpendicularly oriented, which is at odds with the allowed magnetic point group. Together with a simple model and magnetization study, this suggests the existence of ferrotoroidic order as the mechanism behind observed magnetoelectricity.