INVITATION

Department of Condensed Matter Physics

Is pleased to invite you to the lecture

Epitaxial films of topological materials based on $Pb_{1-x}Sn_xSe$ and Sn

by

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Time: **11:00**

Venue: **Lecture room F1, Building 6, Faculty of Science, Kotlářská 2, Brno**

Topological materials are promising candidates for future electronics and spintronics as well as of great interest for fundamental condensed matter physics.

In this talk, we will discuss epitaxial films of topological materials produced by molecular beam epitaxy (MBE) in form or orientation which is difficult to achieve in bulk. The results of growth, structural characterization, transport properties and angular resolved photoemission spectroscopy investigations of their band structure will be presented.

In the first part of the talk, we will consider (111)-oriented topological crystalline insulator (TCI) films based on $Pb_{1-x}Sn_xSe$ solid solution. By tuning temperature and Sn content, we drive a topological-to-normal insulator transition, with weak antilocalization (WAL) persisting even in trivial films, challenging its role as a topological phase marker. Spin-resolved ARPES (SR-ARPES) confirms helical spin polarization in both phases, while transition metal deposition induces a band gap through surface composition changes rather than magnetism. Additionally, we demonstrate tunable Rashba spin splitting in asymmetric $Pb_{1-x}Sn_xSe$ quantum wells (QWs) and achieve a high-quality two-dimensional hole gas in symmetric QWs, as evidenced by Shubnikov-de Haas oscillations and quantum Hall effect. A four-band $k \cdot p$ model was employed to interpret our findings and allowed to obtain the topological phase diagram with alternating normal insulator – quantum spin hall insulator phases.

In the second part, we will focus on Dirac and Weyl semimetal phases in gray tin (α-Sn) epitaxial films synthesized on (001) insulating CdTe/GaAs substrates.

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Literature
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