## SEMINAR ON MAGNETISM AND SUPERCONDUCTIVITY

We kindly inform You that on Wednesday

# April 9<sup>th</sup> at 10:00

### there will be a seminar in room 203, building I,

where

# Jakub Polaczyński

(International Research Center MagTop, Institute of Physics, Polish Academy of Sciences)

## will deliver a lecture on:

# "Strain-engineered topological phases in epitaxial layers of grey tin"

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Grey tin, also known as  $\alpha$ -Sn, is a nominally zero-gap semiconductor stable below 13°C, in which various topological phases can be induced by external strain [1, 2]. In particular, the application of biaxial compressive strain transforms  $\alpha$ -Sn into a topological Dirac semimetal (DSM), which can be further converted into a Weyl semimetal (WSM) via an external magnetic field. One effective method of strain engineering is molecular beam epitaxy (MBE) on a lattice-matched substrates, which also stabilizes the  $\alpha$ -Sn phase at room temperature and above.

During this seminar, we will present comprehensive experimental results on both DSM and WSM phases observed in epitaxial layers of grey tin grown by MBE on hybrid CdTe/GaAs substrates. Compressive strain and high crystalline quality of the samples were confirmed by X-ray diffraction, transmission electron microscopy, and atomic force microscopy. The DSM phase was verified by band structure calculations based on magneto-optical measurements and directly observed via angle-resolved photoemission spectroscopy.

A rich set of magnetotransport phenomena was observed, highlighting the topologically non-trivial nature of the charge carriers. We will focus on Shubnikov-de Haas oscillations exhibiting a  $\pi$  Berry phase, as well as the observation of negative longitudinal magnetoresistance - both consistent with the presence of the chiral anomaly in the WSM phase [3]. Additionally, we will present anisotropic magnetoresistance and the planar Hall effect, further supporting the topological character of the material.

Altogether, our findings establish grey tin as a model system for studying 3D topological semimetals, with potential applications in spintronics and topological electronics.

- [1] Liang Fu and Charles Kane, Phys. Rev. B 76 (2007), 045302
- [2] Huaquing Huang and Feng Liu, Phys. Rev. B 95 (2017), 201101(R)
- [3] Jakub Polaczyński et al., Materials Today 75, 135 (2024)

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The lecture will be in Polish on-site in room 203, the slides will be in English. ZOOM transmission will be available too - link is provided on the IP PAS website.

### We sincerely invite You

Roman Puźniak / Andrzej Szewczyk / Henryk Szymczak