

# **SEMINAR ON MAGNETISM AND SUPERCONDUCTIVITY**

We kindly inform You that on **Wednesday**

**January 10<sup>th</sup> at 10:00**

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

where

**dr Ashutosh S. Wadge**

*(International Research Centre MagTop, Institute of Physics, Polish Academy of Sciences,  
Aleja Lotnikow 32/46, PL-02668 Warsaw, Poland)*

will deliver a lecture on:

## **“Topological Lifshitz transition in Weyl semimetal NbP”**

NbP, a non-centrosymmetric topological Weyl semimetal, exhibits two key features: Weyl points (WP), which are protected within its bulk by time reversal symmetry (TRS), and their extensions on the surface, known as surface Fermi arcs [1]. The dynamic interplay between these surface Fermi arcs and Weyl fermions is the source of various extraordinary phenomena, such as extremely high magnetoresistance, remarkable mobility, quantum oscillations, and chiral magnetic effects. Therefore, understanding and strategically manipulating these Fermi arcs is of significant importance [1-3].

In our research, we conducted Angle-Resolved Photoemission Spectroscopy (ARPES) experiments to explore changes in the Fermi surface of NbP, a semimetal, following the evaporation of ultra-thin layers of lead (Pb) and niobium (Nb). We focused on pristine single crystals that cleaved at both phosphorus (P) and niobium (Nb) terminations on their (001) surfaces. Our observations showed that the P-terminated surfaces displayed unique spoon and bow-tie-shaped surface states, unlike the Nb-terminated surfaces which did not exhibit these characteristics. When we applied a single monolayer (ML) of Pb onto P-terminated NbP, we noticed a significant topological Lifshitz transition (TLT). This transition rearranged the pair of Weyl points that bridge adjacent Brillouin zones, altering the Fermi surface and causing a shift in the Fermi energy. Conversely, adding about 0.8 ML of Nb to P-terminated NbP brought its electronic structure close to the critical point of a TLT, leading to a partial transformation. Despite these modifications in the Fermi surface, the surface Fermi arcs continued to be connected to the topologically protected Weyl points. Furthermore, Nb-terminated NbP with a covering of 1.9 ML of Pb showed changes in its trivial surface states, which were the result of an Ordinary Lifshitz transition.

[1] H. F. Yang *et al.*, *Nat. Commun.* 10, 3478 (2019).

[2] A. Bedoya-Pinto *et al.*, *Adv. Mater.* 33, 2008634 (2021).

[3] S. Souma *et al.*, *Phys. Rev. B* 93, 161112(R) (2016).

**The seminar will be given in English on-site in room 203,  
though the ZOOM transmission will be available - link is provided on the IP PAS  
website.**

**We sincerely invite You**

**Roman Puźniak  
Andrzej Szewczyk  
Henryk Szymczak**