ANNOUNCEMENT - TALK

Title: Transient states in polar semiconductors

Abstract:

α-GeTe(111) is a polar semiconductor that exhibits the largest known Rashba-type spin splitting of so-far known materials. Moreover, due to its ferroelectric properties, it is possible to reversibly manipulate the spin polarization of its low-energy electronic structure by an external electric field [1], a promising behavior for spintronics applications. A natural question is to investigate whether it is possible to coherently modify the ferroelectric properties of GeTe with light pulses.

In the first part of my talk, I will show how we can use infrared light pulses to transiently enhance the polar distortion of GeTe [2]. Using time-resolved angle-resolved photoemission spectroscopy (ARPES), we reveal that the Rashba splitting of its bulk states is enhanced 200 fs after photoexcitation. I will explain how a surface photovoltage induced by the charge carrier excitation is at the origin of this counter-intuitive effect.

In the second part of my talk, I will switch to the isostructural compound SnTe. This material undergoes a polar structural distortion at about 100 K. At room temperature, it has been proposed to be a topological crystalline insulator in the undistorted phase [3]. However, the presence of topological surface states is intimately linked to the occurrence of the polar distortion.

First, I will show how static ARPES data acquired as a function temperature allow us to follow the evolution of the Rashba splitting induced by the structural distortion in the bulk bands, revealing substantial deviations from a mean-field-like transition [4].

Then, I will elaborate on the implications of our results for the topological nature of the surface states in SnTe. Using time-resolved ARPES data, I will show how tailored light pulses can be used to photoinduce a transient topological state in SnTe in the absence of any structural change. I will argue that a strong light-matter interaction is the relevant mechanism.

[1] J. Krempaský, S. Muff, J. Minár, N. Pilet, M. Fanciulli, A.P. Weber, E.B. Guedes, M. Caputo, E. Müller, V.V. Volobuev, M. Gmitra, C.A.F. Vaz, V. Scagnoli, G. Springholz, and J.H. Dil, Phys. Rev. X 8, 021067 (2018).

[2] G. Kremer, J. Maklar, L. Nicolaï, C.W. Nicholson, C. Yue, C. Silva, P. Werner, J.H. Dil, J. Krempaský, G. Springholz, R. Ernstorfer, J. Minár, L. Rettig and C. Monney, Nature Commun. 13:6396 (2022).

[3] E. Plekhanov, P. Barone, D. Di Sante and S. Picozzi, Phys. Rev. B 90, 161108(R) (2014).

[4] F. Chassot, A. Pulkkinen, G. Kremer, T. Zakusylo, G. Krizman, M. Hajlaoui, J. H. Dil, J. Krempasky, J. Minar, G. Springholz and C. Monney, Nano Letters 24, 82 (2024).

Date/Time: **THURSDAY, NOVEMBER 14 at 11:00**

Location: **MPSD Building 900, EG 136**

Speaker: **PROF. DR. CLAUDE MONNEY** (University of Fribourg, Switzerland**)**