Minicolloque n° OPS27 **X Oral**

Unveiling the unoccupied band structure of the ferroelectric Rashba semiconductor α-GeTe(111) by time- and angle-resolved photoemission spectroscopy

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α-GeTe(111) is a bulk ferroelectric Rashba semiconductor which exhibits the largest Rashba-type spin splitting of so-far known materials, one of the most promising mechanism to reversibly manipulate spin polarization. Its electronic structure in the occupied states has been studied by Angle-Resolved Photoemission Spectroscopy (ARPES) and Spin ARPES (SARPES), the key technique to understand the spin texture of materials. Using operando SARPES, it has been demonstrated that it is possible to reversibly manipulate spin polarization by an external electric field in α-GeTe(111) [1] ; a promising behavior for spintronics applications.

Nevertheless, the electronic structure in the unoccupied states has not been addressed experimentally, although its knowledge is essential to determine the dispersions around the Fermi level and to understand how the electrons can be excited in momentum space.

In this presentation, we will show that it can be done by using femtosecond time-resolved ARPES (trARPES) at 21.7 eV, where photoexcitation using 1.55 eV pulses allows us to study the transiently populated band structure above the Fermi level and the out-of-equilibrium dynamics at the femtosecond to picosecond timescales. The use of a large probe energy, as well as the combination of a momentum microscope and a hemispherical analyser [2] give us both an overview of the electronic structure dynamics in the full first Brillouin zone and fine details along the high symmetry directions of interest (Figure 1).

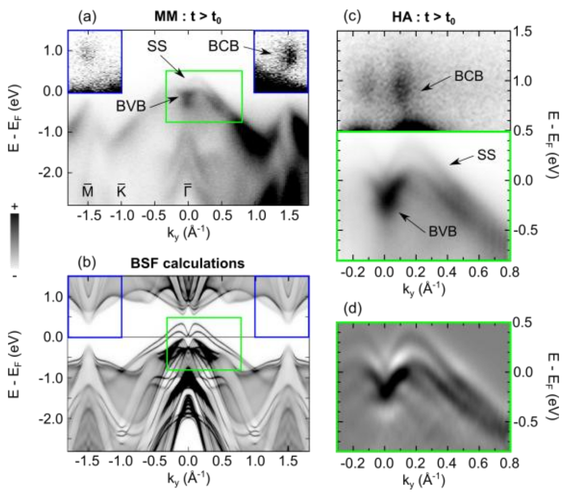

Figure 1 : (a) TrARPES map along the M-K-Γ direction obtained at a positive pump probe delay with a momentum microscope (MM) and (b) corresponding Bloch spectral function (BSF) calculations, for GeTe(111). (c) Zoom around the Γ point with a hemispherical analyser (HA) and (d) corresponding second derivative in the green rectangle.

[1] J. Krempaský et al., Phys. Rev X 8, 021067 (2018)
[2] J. Maklar et al., Rev. Sci. Instrum. 91, 123112 (2020)