**Poster-1-6**

# Carrier dynamics in semiconductor InSb and topological material $ZrTe_5$, studied with ultrafast terahertz time-domain spectroscopy

Elodie Iglesis,[1,2] Alexandr Alekhin,[1] Li Qiang,[3,4] Genda Gu,[4] Alain Sacuto,[1] Niloufar Nilforoushan,[1] Yann Gallais,[1] and Sarah Houver[1]

[1] *Université Paris Cité, CNRS, Matériaux et Phénomènes Quantiques, F-75013, Paris, France*
[2] *Department of Physics and Fribourg Center for Nanomaterials, Université de Fribourg, Fribourg 1700, Switzerland*
[3] *Condensed Matter Physics and Materials Science Division, Brookhaven National Laboratory, Upton, New York 11973-5000, USA*
[4] *Department of Physics and Astronomy, Stony Brook University, Stony Brook, New York 11794-3800, USA*

Topological materials gather a lot of interest for their remarkable properties [1], [2], [3]. Due to the strong intertwinement between their electronic, structural, and topological degrees of freedom, a light-induced control of their structure would open the possibility to tune their properties and topological phase. A first step towards this exciting possibility is to understand carrier and phonon dynamics in such systems.
The development of the Terahertz Time-Domain Spectroscopy (THz-TDS) technique has opened many possibilities to characterize modes in matter that were until then inaccessible [4], [5]. By integrating this time-resolved technique into a pump-probe configuration, one can investigate the ultrafast transient photoconductive response and carrier dynamics of a broad range of materials. We developed such set-up to conduct optical pump - THz probe measurements on several samples.
I will first present a study of photo-induced carrier dynamics in a low bandgap semiconductor Indium Antimonide (InSb) and I will discuss and model the influence of pump fluence on these dynamics. In a second part, I will report similar pump-probe measurements on the topological semi-metal zirconium pentatelluride ($ZrTe_5$), that allowed the study of its ultrafast carrier dynamics. If time, I will complement these results with a study of its structure's dynamics conducted by time-resolved Raman spectroscopy.

[1] Chandra Shekhar and others, 'Extremely Large Magnetoresistance and Ultrahigh Mobility in the Topological Weyl Semimetal Candidate NbP', Nature Physics, 11.8 (2015).
[2] Edbert J. Sie and others, 'An Ultrafast Symmetry Switch in a Weyl Semimetal', Nature 565.7737 (2019).
[3] Jiantian Zhang and others, 'Colossal Room-Temperature Terahertz Topological Response in Type-II Weyl Semimetal NbIrTe4', Advanced Materials 34.42 (2022).
[4] Xinwei Li and others, 'Observation of Dicke Cooperativity in Magnetic Interactions', Science, 361.6404 (2018).
[5] S. Houver and others, '2D THz Spectroscopic Investigation of Ballistic Conduction-Band Electron Dynamics in InSb', Optics Express, 27.8 (2019).