

3-year funded joint Ph.D. thesis between Bordeaux University (France) and INRS-EMT (Montréal, Canada) starting in September/October 2022

Research project :

Floquet Engineering of Quantum Materials probed by Time- and Angle-Resolved Photoemission Spectroscopy (trARPES):

Ultrashort light pulses represent the most promising tool to control and tailor the electronic properties of matter in an ultrafast fashion, i.e. on the femtosecond timescale, paving the way for future transformative applications. In particular, the intrinsic time periodicity of intense ultrashort pulses can be used to engineer the electronic and/or topological properties of matter by folding the electronic band structure in energy, an approach known as Floquet-Bloch engineering [1]. The project aims to investigate the formation of Floquet-Bloch states in a wide variety of quantum materials and to develop new measurement strategies [2-7] to probe their emergence and their topological character using polarization-tunable trARPES. This project builds upon the complementary expertise of the two co-supervisors as well as taking advantage of their already established strong network of theory collaborations. Daily, the candidate will be involved in optical design and alignment (e.g. nonlinear optics, optical parametric amplifier, high-order harmonic generation), running the angle-resolved photoemission spectroscopy end-station (sample preparation, data acquisition, ultrahigh vacuum system maintenance), as well as being involved in data analysis, interpretation, and discussion with theory collaborators. The candidate will also actively participate in presenting his/her results in (international) conferences as well as writing scientific articles.

Host institutions :

The candidate will benefit from the long-standing collaboration between Université de Bordeaux and INRS, as well as the potential support of the International Associate laboratory (LIA) LUMière Matière FrAnce Québec (LUMAQ).

Centre Lasers Intenses et Applications (CELIA) - Bordeaux, France:

CELIA is a center of excellence in lasers and their interaction with matter. Research is performed on laser development and ultrashort laser-matter interactions with atoms, molecules, plasmas, and solids. The candidate will be hosted in a dynamic group of researchers and will benefit from the highly supportive environment at CELIA (emph{i.e.} experienced in-house laser, vacuum, and software engineers).

Institut National de la Recherche Scientifique (INRS) - Montréal, Canada:

At INRS, the candidate will work at the Advanced Laser Light Source (ALLS) laboratory, a world-class research center focused on generating a coherent rainbow of light with revolutionary applications. The candidate will have access to the numerous end-stations of the ALLS user facility and will primarily work on the next-generation high-harmonic-based tr-ARPES system with intense long-wavelength pump capabilities.

Candidate :

We are seeking highly motivated candidates, with good skills in experimental physics, data analysis, and collaborative work. An experience in ultrafast optics, strong-field physics, quantum materials, vacuum technology, or (angle-resolved) photoemission spectroscopy will be highly beneficial. Fluent English required.

Contacts :

The potential candidate should send us a CV, a motivation letter, and contact information of two references before 15/03/2022: Samuel Beaulieu (samuel.beaulieu@u-bordeaux.fr) and

Fabio Boschini (fabio.boschini@inrs.ca)

References :

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- [6] F. Boschini, E.H. da Silva Neto, E. Razzoli, et al., Nature Materials 17, 416-420 (2018).
- [7] M.X. Na, A.K. Mills, F. Boschini, et al., Science 366, 1231-1236 (2019).