18èmes Journées de la Matière Condensée
22-26 août 2022, Lyon

Société Française de Physique

"Angle-resolved photoemission spectroscopy and band structure calculations of quantum materials"

1. **Organisateurs : Evangelos Papalazarou (Laboratoire de Physique de solides, Université Paris Saclay), Luca Perfetti (Laboratoire des Solides Irradiés, Institut polytechnique de Paris).**

2. **Parrainage ou lien avec des sociétés savantes, des GDR ou autres structures : GDR MEETICC**

3. **Résumé de la thématique du minicolloque :**

The way we think about manifestations of quantum physics in materials has recently undergone a profound change of perspective. Although materials scientists and engineers have long exploited quantum effects in a range of electronic devices the past decade has seen a dramatic increase in our understanding of how subtle quantum effects control the macroscopic behavior of a whole range of different materials. Broadly speaking, we refer here to strongly correlated phases of matter, states with nontrivial topology, strong relativistic effect or reduced dimensionality. The capability to synthesize new compounds and interfaces, or to apply external stimuli, has broadened the spectrum of quantum materials that could be explored. Some examples are systems where strong correlations are modulated by Moirée superstructures, interfaces hosting edge states with spintronic functionalities, Mott insulators that can be tuned via mechanical deformation, or magnetic doping which can gap Dirac states and lead to chiral edges and various Hall states, including quantized anomalous Hall Effect.

In this respect, Angle-resolved photoemission spectroscopy (ARPES) plays a central role in the discovery, characterization, and understanding of the electronic structure in momentum space. Moreover, technological developments, have increased the potentials of this technique that now can cover nanometric mapping of surfaces, ultrafast measurements of transient states and spin resolution of the detected photoelectrons.

It is acknowledged that first-principles calculations play an essential role in bridging theory and experiments. The refined treatment of correlation effects or coupling between single particle and collective excitations have improved our understanding of spectral properties. In the case of weak correlations, the unified concepts of topological states and band inversion scenario can be successfully employed to predict topological materials.

The purpose of this mini-colloquium will be to survey the recent research advancements in ARPES experiments and ab-initio simulations, aiming to point out future perspectives in the design of quantum materials. It also aims at gathering the main players in the field in the French and European panorama to foster collaborations and to build up a tighter community.

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