SEMINAIRE ISMO

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Electronic structure of exotic states in correlated-fermion materials

The physics of strongly interacting fermions is the common thread in several challenging open problems at all scales, from the description of compact nuclear and sub-nuclear matter to the behavior of electrons in a large class of solids in which low dimensional or correlated behavior is present.

Specifically, in transition-metal oxides (TMOs) and f-electron systems, strong correlations lead to a wide realm of phase transitions and exotic, often poorly understood, states of matter showing remarkable properties –such as high-temperature superconductivity, large magneto-resistance, multiferroicity, or photo-catalytic behavior. To understand such novel states of matter, and guide potential applications, it is essential to study their microscopic electronic structure, which is ultimately responsible for their macroscopic behavior.

In this talk, I will present an overview of our group's current research on the electronic structure of some correlated-electron materials. I will focus on two systems: the two-dimensional electron gases (2DEGs) at the surface of TMOs, which are promising for the realization of oxide-based devices showing properties beyond standard semiconductor electronics, and the puzzling 'hidden-order' phase transition at THO = 17.5 K in URu_2Si_2, whose microscopic origin and associated broken symmetries and order parameter have challenged researchers for over 30 years. I will show how, using angle-resolved photoemission spectroscopy (ARPES), we can directly image the band structure of these systems, the effects of many-body interactions (electron, phonon, electron-electron, etc.), and the changes in electronic structure induced by phase transitions, and thus obtain essential information about the microscopic origin of their behavior.

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