Electronic dark states and Fermi arcs in cuprates

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In nature, there are many materials with more than one pair of sublattices in their primitive cell. These sublattices have been recognized as important in the study of graphene and other two-dimensional materials with the concept of pseudospin [1]. In strongly correlated systems, charge density waves or magnetism would naturally result in translational symmetry breaking, generating pairs of sublattices. However, the presence of these sublattices in the primitive cell has been ignored in theoretical models for the sake of brevity. In this talk, I will introduce our recent studies on the effect of quantum phases between sublattices (pseudospins) would affect angle-resolved photoemission spectroscopy (ARPES). We found the dark state of electrons in materials with two pairs of sublattices, where it means the dispersive band of electronic states is undetectable over the entire Brillouin zone at any experimental conditions including photon energy, polarization, and scattering geometry [2]. This dark-state model can be applied to Bi-based cuprates and used to explain their Fermi arcs. If time permits, I will also discuss on how the short-range order of dopants in a two-dimensional crystalline insulator affects their electronic structure in terms of pseudogap [3] and aperiodic (rotonic) dispersion [4].

REFERENCES

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