Searching for the Excitonic Insulator State in Quantum Materials

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The excitonic insulator is an electronically driven phase of matter that emerges upon the spontaneous formation and Bose condensation of excitons. Detecting this exotic order in candidate materials is a subject of paramount importance, as the size of the excitonic gap in the band structure establishes the potential of this collective state for superfluid energy transport. However, the identification of this phase in real solids is hindered by the coexistence of a structural order parameter with the same symmetry as the excitonic order. Only a few materials are currently believed to host a dominant excitonic phase, Ta_2NiSe_5 being the most promising. In this talk, I will describe how advanced protocols based on time- and angle-resolved photoemission spectroscopy can shed light on primary order parameter of a candidate excitonic insulator [1]. Finally, I will discuss the opportunities offered by the development of novel momentum microscopy tools to extend these studies to the realm of two-dimensional material flakes that may host similar physics.

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