The Effect of Symmetry on Photoemission Observables

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Abstract. Angle-resolved photoemission spectroscopy can provide complex information about the electronic wave functions in the momentum space or real space of crystalline solids. The orbital and spin textures are particularly relevant in providing information about the electronic wave functions in the momentum space of crystalline solids and topological semimetals [1]. Recent studies have discussed how the relative ratio between the strength of spin-orbit coupling in comparison to the energy scale of the inversion-symmetry-breaking potential play a distinct role in determining the symmetry of linear dichroism (LD) and that both LD and circular dichroism (CD) can thus allow for a better understanding of the photoelectron spin polarization signal and its relation to the spin and orbital nature of the initial states [2,3]. We have extended these studies by introducing intrinsic dichroic observables – time-reversal dichroism in angular distribution (TRDAD) [4] and intrinsic linear dichroism in angular distribution (iLDAD) [5] – that may provide an even more direct access to the electronic initial-state properties. We have also discussed another symmetry-related phenomenon – geometry induced spin filtering effect which introduces additional asymmetries to the measured spin-polarization signal which is not present in the initial state spin texture with time-reversal and crystal lattice mirror symmetries [6]. Here we will present our most recent results related to the a/symmetries in both orbital and spin texture of several materials and their relation to the observables of photoemission experiment.

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