Toolbox of dichroic markers in angle-resolved photoemission: from spectra to wave-functions

Michael Schüler[1], Samuel Beaulieu[2]

[1]*Condensed Matter Theory Group, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland*
[2]*Université de Bordeaux - CNRS - CEA, CELIA, UMR5107, F33405, Talence, France*

Author Email: michael.schueler@psi.ch

Angle-resolved photoemission spectroscopy (ARPES) is the most powerful technique to investigate the electronic band structure of crystalline solids. To completely characterize the electronic structure of topological materials, one needs to go beyond band structure mapping and access information about the momentum-resolved Bloch wave-function, such as orbital texture and Berry curvature. Information on the initial wave-functions is encoded in the complicated structure of the photoemission matrix elements. This complexity — which was often neglected in the past — can indeed be harnessed to extract information on the quantum nature of the Bloch states by controlling the polarization of the light and the crystal orientation. In particular, we show how circular dichroism in the angular distribution allows of extracting orbital angular momentum and Berry curvature [1], which also introduces a new hallmark of light-induced topological states [2,3]. We also discuss how the intrinsic linear dichroism upon sample rotation in prototypical two-dimensional materials provides insights into the underlying orbitals and their interference [4,5]. Finally, we demonstrate how full continuous control of the light polarization allows for genuinely new dichroic observables that complement circular dichroism, finally getting within reach of "measuring" the Bloch wave-function [6].

The total length of the abstract including figures and references must not exceed one 8.5"x11" page.

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