The Huygens Principle of Angle-Resolved Photoemission

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Abstract

Angle-resolved photoemission spectroscopy (ARPES) measures the interference of dipole allowed Coulomb wavelets from the individual orbital emitters that contribute to an electronic band. If Coulomb scattering of the outgoing electron is neglected, this Huygens view of ARPES simplies to a Fraunhofer diffraction experiment, and the relevant cross-sections to orbital Fouriertransforms. This plane wave approximation (PWA) is surprisingly descriptive of photoelectron distributions, but fails to reproduce kinetic energy dependent final state effects like dichroism. Yet, Huygens principle of ARPES can be easily adapted to allow for distortion and phase shift of the outgoing Coulomb wave. This retains the strong physical intuition and low computational cost of the PWA, but naturally captures momentum dependent interference effects in systems that so far required treatment at the ab initio level, such as orbital angular momentum encoding linear dichroism in Rashba systems BiAg2 and AgTe.