Exploring the spin-orbital texture in a Dirac heavy metal by spin-resolving Momentum Microscopy

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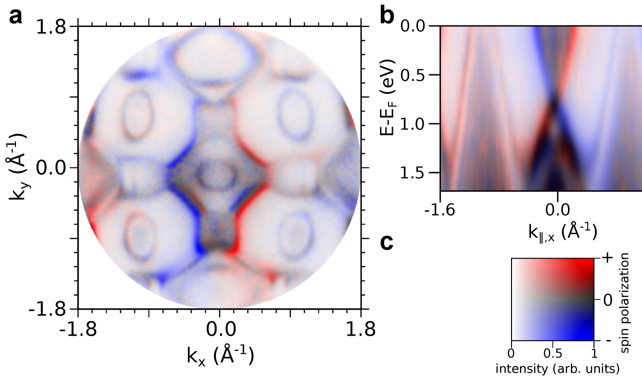
Entanglement of spin and orbital degrees of freedom in strongly spin-orbit coupled materials creates exotic spin/orbital textures in momentum space such as Rashba and topological protected surface states [1]. Dichroism in spin-polarized photoemission plays a crucial role in quantum-mechanical understanding the influence of spin-orbit coupling on the electronic wave functions. By virtue of the recent invention of the spin-resolving Momentum Microscope, the spin-detection efficiency and momentum resolution has been improved tremendously [2]. This development makes it now possible to probe the photoelectron spin polarization as well as linear and circular dichroism in the angular distribution (LDAD and CDAD) over the whole Brillouin zone [3]. Here we employ state-of-the-art momentum microscopy, together with the recently installed imaging spin filter setup [4] at the NanoESCA beamline at the Elettra synchrotron (Trieste, Italy) [5], to directly characterize the momentum-dependent spin-orbital entangled states on W(110) throughout the entire surface Brillouin zone by using differently polarized light. In addition to the *d*-electron-drived Dirac-type helical spin texture on W(110), our results demonstrate newly found light-polarization-dependent spin-orbital textures over the entire two-dimensional momentum plane in a wide range of binding energy by utilizing spin-resolving momentum microscopy.



(a) Spin-resolved photoemission momentum maps of the W(110) at the Fermi energy measured at $h\nu$=50 eV. (b) Spin-resolved Dirac-cone-like linear dispersion along the horizontal axis (k_y=-0.4 Å^{-1}) with the p-polarized photon beam incident in the k_y-k_z plane. The two-dimensional color code is shown in (c). Red and blue colours denotes a spin polarization pointing along the positive/negative y axis and colour strength indicates the photoemission intensity.

References

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