# Spin-Orbit Coupling in Unconventional Superconductors via Circularly-Polarized Spin- and Angle-Resolved Photoemission Spectroscopy

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Experimental and theoretical evidence has mounted for the important role spin-orbit coupling (SOC) may play in modifying the low energy electronic structure of various unconventional superconductors and the implications this interaction bears for Cooper pairing[1,2,3]. The iron-based superconductors (FeSCs) are among these materials: a high density of Fe 3d states converging in energy and momentum near the Fermi level renders the FeSCs highly susceptible to perturbations such as nematicity and SOC.

To explore the influence of SOC on the electronic structure, we have employed Circularly Polarized Spin and Angle-Resolved Photoemission Spectroscopy (CPS-ARPES) to study LiFeAs and FeSe—canonical members of both the iron pnictide and chalcogenide families[5]. By combining the orbital selectivity of circularly polarized light with a spin-filtering VLEED detector, CPS-ARPES allows us to resolve orbital and spin vectors with the full momentum and energy resolution of conventional ARPES. We establish a momentum-dependent entanglement of the spin and orbital degrees of freedom on the hole pockets at the Brillouin zone centre, raising questions about the influence of SOC on the putatively spin-fluctuation based pairing mechanism in the FeSCs[2,4].

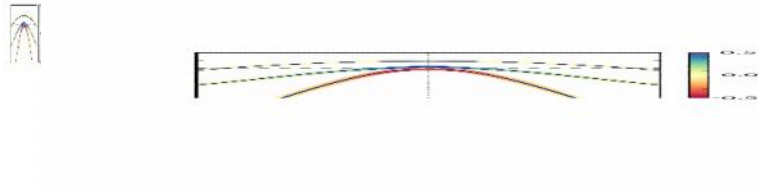

**Figure 1:** Tight-binding model of Fe-based superconductor LiFeAs near the zone centre. The colourscale reflects the expectation value of <LzSz>, illustrating the modification of the electronic eigenstates on the hole pockets near the zone centre, and the loss of independence in spin and orbital degrees of freedom due to SOC.

## References

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