The role of spin-orbit coupling in iron-based superconductors

The elucidation of the normal state properties of the iron-based superconductors is an essential step towards the understanding of their unconventional superconducting state. Recent angle-resolved photo-emission spectroscopy measurements revealed that a sizable spin-orbit coupling, with an energy scale comparable to that of the superconducting gap or the ferro-orbital order splitting, is present in many iron pnictides and chalcogenides. In this talk, I will employ a general microscopic itinerant model to discuss the impact of the spin-orbit coupling on the electronic, magnetic, and superconducting properties of iron-based materials. First, I'll show how one can disentangle the signatures of spin-orbit coupling and of nematic order on the electronic spectrum by analyzing the splittings of different doublet states at high-symmetry points of the Brillouin zone. I'll also demonstrate that spin-orbit coupling alone can account for the magnetic anisotropy experimentally observed in the iron pnictides, including the transition from in-plane to out-of-plane magnetic moments observed upon hole doping. Finally, I'll discuss the key role played by spin-orbit coupling in lifting the degeneracy of the superconducting state promoted by nematic fluctuations, which may be relevant to certain FeSe-based compounds whose Fermi surfaces contain only electron pockets.