Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Minimal Ingredients for Orbital Texture Switches at Dirac Points in Strong Spin-Orbit Coupled Materials JUSTIN WAUGH, University of Colorado at Boulder, THOMAS NUMMY, University of Colroado at Boulder, STEPHEN PARHAM, DANIEL DESSAU, University of Colorado at Boulder —
Recent angle resolved photoemission spectroscopy measurements on strong spin-orbit coupled materials have shown an in-plane orbital texture switch at their respective Dirac points. This feature has also been demonstrated in a few materials (Bi_2Se_3, Bi_2Te_3, and BiTeI) though DFT calculations. Here we present a minimal orbital-derived tight binding model to calculate the electron wave-function in a two-dimensional crystal lattice. We show that the orbital components of the wave-function demonstrate an orbital-texture switch in addition to the usual spin switch seen in spin polarized bands. This orbital texture switch is determined by the existence of three main properties: local or global inversion symmetry breaking, strong spin-orbit coupling, and non-local physics (the electrons are on a lattice). Using our model we demonstrate that the orbital texture switch is ubiquitous and to be expected in many real systems. The orbital hybridization of the bands is the key aspect for understanding the unique wave function properties of these materials, and this minimal model helps to establish the quantum perturbations that drive these hybridizations.

Justin Waugh
University of Colorado

Date submitted: 06 Nov 2015 Electronic form version 1.4