Westfälische Wilhelms-Universität Münster

Fachbereich Physik

› Allgemeines Physikalisches Kolloquium

› Donnerstag, 01.02.2018 um 16 Uhr c.t.

Dr. Philip King

Universität St. Andrews

Controlling quantum materials

The development of an ever-increasing ability to control the behavior of electrons in semiconductor materials has driven more than half a century of relentless progress in technology. Realizing similar levels of control over charge carriers in correlated solids, where the motion of an electron is inherently linked to those of its neighbors, promises enormous new possibilities for multi-functional technologies, but understanding, and ultimately engineering, their interacting electronic states has proved a major challenge. Recent years have nonetheless seen significant progress: approaches to manipulate charge carrier concentrations at surfaces and interfaces and to structure correlated electron systems on the atomic scale have opened new paradigms for tuning their functional properties [1-4]. Combined with advanced spectroscopic probes, such designer quantum materials provide a sensitive test-bed of the quantum many-body problem in solids, and open new routes to tune emergent states and phases. As an example to illustrate the potential of this approach, I will discuss our recent angle-resolved photoemission (ARPES) measurements on the surfaces of the delafossite oxides (Pd,Pt)CoO_2. I will show how self-doping due to the polar nature of these surfaces transforms the system from a single-band non-magnetic nearly-free electron metal in the bulk [5] to an itinerant ferromagnet with strong electron-magnon coupling [6], or to a correlated metal hosting a kinetic-energy-coupled inversion symmetry breaking [7] at their surfaces. The latter maximizes the influence of spin-orbit coupling, allowing this oxide surface to develop some of the largest Rashba-like spin splittings that are known, ultimately suggesting new routes to designing spintronic materials.

Key collaborators in this work include Veronika Sunko, Federico Mazzola, Helge Rosner, Pallavi Kushwaha, Seunghyun Khim, and Andy Mackenzie from the University of St Andrews and the Max-Planck Institute for the Chemical Physics of Solids, Dresden.

[1] Ahn *et al.*, Rev. Mod. Phys. 78 (2006) 1185
[2] Mannhart and Schlom, Science 327 (2010) 1607
[3] Zubko et al., Ann. Rev. Condens. Matter. Phys. 2 (2011) 141
[4] Hwang *et al.*, Nature Mater. 11 (2012) 103
[5] Kushwaha, Sunko *et al.*, Science Advances 1 (2015) e1500692
[6] Mazzola *et al.*, arXiv:1710.05392 (2017)
[7] Sunko et al., Nature 549 (2017) 492

Kolloquiums-Kaffee
ab 16 Uhr vor dem Hörsaal

Wilhelm-Klemm-Straße 10
Institutsgruppe 1 Hörsaal HS 2