复旦大学物理系物质科学报告

Physics Department Colloquium

Spin-Orbit Interaction Rediscovered in Heavy Transition Metal Oxides

Professor Gang Cao

Center for Advanced Materials and Department of Physics and Astronomy
University of Kentucky Lexington, Kentucky, USA

Abstract: The 5d-transition metal oxides have become a fertile ground for studies of new physics driven by ***spin-orbit interactions***. It is commonly expected that iridium oxides or iridates are more metallic and less magnetic than their 3d and 4f counterparts because of the extended nature of the 5d orbitals or reduced Coulomb interactions. In marked contrast, many iridates are magnetic insulators that exhibit a large array of phenomena seldom or never seen in other materials. The most profound result of the spin-orbit interaction on iridates is the ***J_{eff}=1/2 insulating state***, a quantum state that represents the novel physics in the 5d-based systems. The spin-orbit interaction vigorously competes with Coulomb interactions, non-cubic crystal electric field and Hund's rule coupling, and critically biases their mutual competition to stabilize ground states with exotic behavior, which sharply contrasts with traditional models. In this talk, we review the underlying physical properties of the iridates, and report recent results of our study that emphasizes spin-orbit-tuned ground states stabilized by chemical doping, application of pressure and magnetic field; these weak perturbations are capable of directly affecting the role of the spin-orbit interaction so as to rebalance comparable interactions to generate a rich phasediagram of strongly competing ground states.

Time：2:00 pm, Tuesday, 2014.5.13
Location：Physics Building, Room 221B
(Cookies and coffee are served from 1:30 pm)