

Grand design of novel spintronic, electronic and functional materials

by

Professor Xiaolin WANG

Associate Director (Research) & Professor, Institute for Superconducting and Electronic Materials, University of Wollongong, Australia

This talk will present a number of new strategies we have developed for the design of new class of materials and properties. We will discuss how new electronic materials can be designed by shaping electronic band structures. A number of emerging electronic materials such as topological insulators, Weyl metals, parabolic or Dirac type spin gapless semiconductors (SGSs) with exotic band structures, Dirac type system or topological Dirac system will be reviewed briefly. How to achieve dissipationless transport in spin gapless semiconductor and topological insulators will be presented for these system. Furthermore, the ultimate questions in material and property's design are raised: 1) How many new (electronic) materials or new (electronic) properties are still there? 2) What are they? 3) How to create them? A very simple model, the codes of matter/materials, based on the three ubiquitous and paramount attributes of all existing matter/materials, charge (Q), spin (S), and moment (K) will be introduced. We will introduce a new periodic table which consists of all codes responsible for physical properties. We will discuss the principles of the codes and how to use the new table of element of properties to design new materials and properties. Many new types of exotic physical states and their possible experimental realizations will be discussed.