Search for interesting behaviors beyond iron-based materials in tetragonal pnictides

After the discovery of high-temperature superconductivity (SC) in the iron-based tetragonal compound LaFeAsO$_{1-x}$F$_x$ in 2008, a worldwide effort began to understand the mechanism of SC and to discover other new superconductors in the related structures. This effort quickly led to the discovery of SC in structurally related 122-type iron-arsenides where the parent compounds with the composition of $A$Fe$_2$As$_2$ ($A = Ca$, Sr and Ba) crystallize in tetragonal ThCr$_2$Si$_2$-type structure. Soon the interest expanded beyond the iron-based compounds and some exciting observations were made in other arsenide materials. Our stimulating observations of unexpected stripe-type antiferromagnetic correlations in SrCo$_2$As$_2$ and the discovery of a novel magnetic ground state in hole-doped BaMn$_2$As$_2$, where half-metallic itinerant ferromagnetism of doped holes coexists with a local-moment antiferromagnetism of Mn lattice, hint toward the abundance of possibilities contained in the transition metal-pnictide systems. I shall discuss some of our recent works on SrCo$_2$As$_2$ and hole-doped BaMn$_2$As$_2$ and their possible impact on the future research in this field. I will also briefly discuss about a new family of layered transition metal-pnictide materials recently discovered by us.