The Department of Electrical and Computer Engineering Presents

Faculty Candidate:

Xi Chen

Heat and Spin Transport in Bulk and Nanostructured Quantum Materials

Abstract

Engineering of materials at quantum scales shows great potential to revolutionize energy and information technologies. Understanding the microscopic transport mechanisms and energy dispersion relationship of magnons, spinons, and phonons in these materials is crucial to develop high performance quantum devices for computation, sensing, and energy storage and conversion. In this talk, I will present heat transport measurements and neutron scattering as useful tools to probe these quasiparticles in several systems for thermal management and energy conversion devices. I will first discuss large spin-mediated thermal conductivity in the antiferromagnetic (AFM) spin ladder compound Sr14Cu24O41 and spin chain compound Ca2CuO3, whose unique quasi-low dimensional substructures are potential candidates for quantum information channels. Thermal measurements on bulk single crystals, polycrystals, and micro-rods are used as a powerful tool to reveal the elusive coupling of spin with impurities, grain boundaries, and phonons in these low-dimensional magnets. I will also introduce inelastic neutron scattering studies on phonon and magnon dynamics in AFM spin ladders and thermoelectric higher manganese silicides with incommensurate crystal structures. Some lattice vibration modes, such as the sliding mode and twisting mode, have been identified for the first time to be responsible for the heat transport in these complex structures. In addition, I will introduce semiconducting cubic boron arsenide (BAs) crystals that achieve ultrahigh thermal conductivity from a unique phonon band engineering approach. These findings not only provide a better understanding of the structure-property relationships in complex quantum materials, but also offer new insights important for devising more efficient quantum systems.

Biography

Xi Chen is currently a postdoctoral fellow in the Laboratory of Quantum Materials for Sustainable Technologies at The University of Texas at Austin. His research focuses on developing advanced materials and devices for spin caloritronics, thermoelectrics, thermal management, and lithium ion batteries. He earned his Ph.D., M.S., and B.S. in Materials Science and Engineering from The University of Texas at Austin in 2014, Zhejiang University in 2010, and Southeast University in 2007 (with honors), respectively. He is a recipient of the Professional Development Award from The University of Texas at Austin.

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WCH 205/206

Seminar: 11:10 A.M. - 12:00 P.M.
*** Vision Talk: 12:00 P.M. - 12:30 P.M.**

*Faculty Only