UC RIVERSIDE UNIVERSITY OF CALIFORNIA | Mechanical Engineering

The Department of Mechanical Engineering Presents

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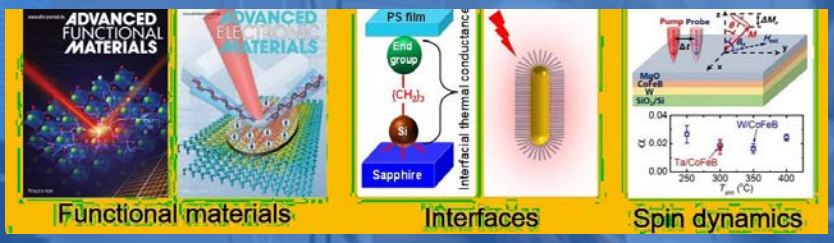
Title: Study of Thermal and Magnetic Transport in Functional Materials Enabled by Ultrafast Optical Metrology

Abstract: Transport phenomena play an important role in designing and engineering materials with tailored functionalities. This is especially true for materials with reduced dimensions. Thermal conductivity and interfacial thermal conductance, as basic transport properties of materials and interfaces, can provide a wealth of information on the fundamental scattering processes of charge and thermal carriers with structural defects, boundaries, and interface imperfection. In this talk, I will share our group's recent progress on utilizing state-of-the-art ultrafast optical metrology to study the thermal and magnetic properties of functionalized materials spanning a wide range of applications. This will include: (1) creating the ultralow thermal conductivity using single crystals of correlated perovskite oxides; (2) revealing the 3D anisotropic thermal transport in black phosphorus, as the next-generation of "wonder materials" for the semiconducting industry; (3) engineering interfacial thermal transport across the solid- solid interface between sapphire and polystyrene, and across the solid-liquid interface between functionalized nanoparticles and water; (4) developing low-damping and high-thermal stability materials with perpendicular magnetic anisotropy for spintronic applications. Last but not least, I will highlight our recent work on manipulating spin precession using optically launched acoustic strains at ultra-high frequencies (~60 GHz). The structure-property relationships of functional materials revealed by the ultrafast pump-probe technique opens up opportunities of tailoring material properties by structural engineering at the atomic and molecular levels. Ultimately, such an understanding can be leveraged to guide the design and optimization of materials, as promising building blocks for high-performance electronic devices, thermal management, solid-state energy conversion, and hard-disk data storage.



About the Speaker: Prof. Xiaojia Wang started her official appointment as an assistant professor in the Department of Mechanical Engineering at the University of Minnesota, Twin Cities in 2014. Prior to this, she was a postdoctoral research associate in the Department of Materials Science and Engineering at the University of Illinois at Urbana-Champaign. She received her Ph.D. in Mechanical Engineering from the Georgia Institute of Technology in 2011, and her M.S. in 2007 and B.S. in 2004 from Xi'an Jiaotong University, China, all in Mechanical Engineering. For details, please visit her research group website: http://www.me.umn.edu/labs/mnttl/.

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