“Electron transfer in thermally heterogeneous environments”

Electron transfer is a fundamental process that drives many physical, chemical, and biological transformations, as well as playing a ubiquitous role in the development of electronics and technologies for energy conversion. Recent advances in temperature measurement and control at the nanoscale allow thermal gradients and heat flow to be addressed at the molecular level, making it possible to observe electron transfer across thermal gradients. In this talk, I will discuss the development of a theoretical framework to describe electron transfer between donor and acceptor sites, where each site has a different local temperature. The transfer of charge across the resulting thermal gradient is found to be coupled with an energy transfer mechanism that may alter heat conduction between sites. Application of the developed theory suggests that emergent relations connecting thermal and electronic currents can be utilized to control energy conversion between redox molecular motifs, at molecule-metal interfaces, and in molecular junctions.