Title: Electron transfer across thermal gradients

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Recent advances in observing and manipulating charge and heat transport at the nanoscale, and recently developed techniques for monitoring temperature at high temporal and spatial resolution, imply the need for considering electron transfer across thermal gradients. Here, a theory is developed for the rate of electron transfer and the associated heat transport between donor-acceptor pairs located at sites of different temperatures. The electron transfer rate is obtained as a Marcus-type expression with an effective temperature in which the temperatures of the two sites are weighted by the corresponding reorganization (or small polaron formation) energies. The energy transferred per electron transfer event is calculated and the resulting contribution to the heat conductivity in a system where electronic transport is dominated by electron hopping between polaronic sites is evaluated. Furthermore in a system with three or more sites this kinetics is shown to lead to thermal transistor effects and to steady states characterized by circular electronic currents.