Quantum-enhanced performance of nanoscale thermoelectrics
JUSTIN BERGFIELD, CHARLES StaffORD, University of Arizona — In a recent paper, we predicted that the linear thermoelectric response of a nanoscale junction is strongly enhanced by quantum interference in the vicinity of a transmission node.\(^1\) In this talk, we use our nonequilibrium many-body transport theory\(^2\) to investigate the performance of thermoelectric devices based on single-molecule junctions, determining the thermodynamic efficiency and power at finite bias. By comparing the linear and nonlinear device characteristics, the applicability of the dimensionless thermoelectric figure-of-merit $ZT$ to predict device performance at the nanoscale is tested. Finally, we report on a class of high-impedance nanoscale devices which possess additional quantum-enhancement, and exhibit high thermodynamic efficiency and $ZT > 10$ limited only by the coherence length.

\(^1\)J. P. Bergfield and C. A. Stafford, Nano Letters 9, 3072 (2009).