## Optimal Power and Efficiency of a Quantum-Dot Heat Engine

**M. Josefsson**, A. Svilans, A. M. Burke, E. A. Hoffmann, S. Fahlvik, C. Thelander, M. Leijnse, and H. Linke

NanoLund and Solid State Physics, Lund University, Lund, Sweden

Heat engines based on quantum dots (QDs) allow studying nanoscale thermodynamics as well as the fundamentals of steady-state energy conversion. We investigate the power and efficiency of an experimental implementation of a heat engine based on a QD embedded in an InAs/InP nanowire connected to electronic reservoirs. By combining experimental results and theoretical calculations we demonstrate an efficiency at maximum power close to the Curzon-Ahlborn efficiency and at the maximum efficiency (∼70% of Carnot efficiency) the QD still produces a significant amount of power.[1] Furthermore, we show that the external load that maximizes power output can be found by straight-forward current measurements, or by a simple analytic expression as non-linear and second order tunneling effects are found to have little impact on the optimal load. In contrast, we find that the efficiency is significantly reduced by second order tunneling processes, even for rather weak tunnel couplings, which is why the device studied here has a maximum efficiency of 70% of the Carnot efficiency.

[1]M. Josefsson et al. *A quantum-dot heat engine operating close to the thermodynamic efficiency limits*, Nature Nanotechnology **13**, 920 (2018).