

# Quantum thermodynamics in strongly coupled quantum dots

Thomas L. Schmidt and Patrick Haughian

*University of Luxembourg, 152a Avenue de la Faiencerie, L-1511 Luxembourg, Luxembourg*

It has emerged over the past years that it is not straightforward to find consistent definitions of thermodynamic quantities, such as heat and entropy, in driven quantum systems which are strongly coupled to reservoirs. In order to shed light on this question, we have investigated the simplest prototypical model, namely a noninteracting resonant level model coupled to fermionic reservoirs. Using an exact solution of the fully driven quantum mechanical model, we show how to define observable thermodynamical quantities which allow the derivation of a first and second law of thermodynamics.