

Abstract Submitted  
for the MAR16 Meeting of  
The American Physical Society

**Local temperatures and voltages in quantum systems far from equilibrium**<sup>1</sup> ABHAY SHASTRY, CHARLES STAFFORD, University of Arizona, DEPARTMENT OF PHYSICS COLLABORATION — We show that the local measurement of temperature and voltage for a quantum system in steady state, arbitrarily far from equilibrium, with arbitrary interactions within the system, is unique when it exists. This is interpreted as a consequence of the second law of thermodynamics. We further derive a necessary and sufficient condition for the existence of a solution. In this regard, we find that a solution occurs whenever there is no net population inversion. However, when there is a net population inversion, we may characterize the system with a (unique) negative temperature. These results provide a firm mathematical foundation for our measurement protocol, and sound meaning to such measurements in the thermodynamic sense.

<sup>1</sup>Research supported by the US Department of Energy, grant DE-SC 0006699

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Date submitted: 06 Nov 2015

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