

Washington University in St. Louis

Washington University Open Scholarship

Volume 12

Washington University
Undergraduate Research Digest

Spring 2017

Exploring Experimental Parameters for the Realization of a One-Photon and One-Qubit Heat Engine

Caroline Sullivan

Washington University in St. Louis

Follow this and additional works at: https://openscholarship.wustl.edu/wuurd_vol12

Recommended Citation

Sullivan, Caroline, "Exploring Experimental Parameters for the Realization of a One-Photon and One-Qubit Heat Engine" (2017). *Volume 12*. 184.

https://openscholarship.wustl.edu/wuurd_vol12/184

This Abstracts S-Z is brought to you for free and open access by the Washington University Undergraduate Research Digest at Washington University Open Scholarship. It has been accepted for inclusion in Volume 12 by an authorized administrator of Washington University Open Scholarship. For more information, please contact digital@wumail.wustl.edu.

EXPLORING EXPERIMENTAL PARAMETERS FOR THE REALIZATION OF A ONE-PHOTON AND ONE-QUBIT HEAT ENGINE

Caroline Sullivan

Mentor: Kater Murch

Quantum systems are deeply influenced by thermodynamics on the microscopic level. A common macroscopic system, the heat engine, uses a thermodynamic cycle to produce work. A macroscopic quantum heat engine can be created by coupling a resonant microwave cavity to a single superconducting transmon qubit and varying the magnetic flux over the system, which uses the coupled eigenstates of the cavity and qubit as the work-generating “stroke” of a thermodynamic cycle. This study examines the theory behind such a system, as well as examples of quantum heat engines using other techniques such as trapped ions, for the purpose of determining a useful and realizable set of parameters to create a one-photon one-qubit heat engine in our own laboratory environment. Further, operating the cycle in reverse would create a heat pump, which under appropriate conditions could have the ability to pull energy from a secondary system in a thermally observable way.