Reversible work extraction in a hybrid opto-mechanical system

Cyril Elouard*[1], Maxime Richard[1], and Alexia Auffeves†[2]

[1]Institut Néel (NEEL) – CNRS : UPR2940, Université Grenoble Alpes – 25 rue des Martyrs - BP 166 38042 GRENOBLE CEDEX 9, France

[2]Institut Néel (NEEL) – CNRS : UPR2940 – 25 rue des Martyrs - BP 166 38042 GRENOBLE CEDEX 9, France

Abstract

With the progress of nano-technology, thermodynamics also has to be scaled down, calling for specic protocols to extract and measure work. Usually, such protocols involve the action of an external, classical field (the battery) of infinite energy, that controls the energy levels of a small quantum system (the caloric fluid). Here we suggest a realistic device to reversibly extract work in a battery of finite energy: a hybrid optomechanical system. Such devices consist in an optically active two-level quantum system interacting strongly with a nano-mechanical oscillator that provides and stores mechanical work, playing the role of the battery. We identify protocols where the battery exchanges large, measurable amounts of work with the quantum emitter without getting entangled with it. When the quantum emitter is coupled to a thermal bath, we show that thermodynamic reversibility is attainable with state-of-the-art devices, paving the road towards the realization of a full cycle of information-to-energy conversion at the single bit level. [C.E., M. Richard and A. Auffèves, New J. Phys., **17,** 055018 (2015)]

*Speaker

†Corresponding author: alexia.auffeves@neel.cnrs.fr