

Abstract Submitted  
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**Experimental test of Jarzynski equality in a quasi-open quantum system using a trapped ion** YAO LU, SHUOMING AN, XIANG ZHANG, JING-NING ZHANG, Center for Quantum Information, IIIS, Tsinghua University, H.T. QUAN, School of Physics, Peking University, A.M. SMITH, Department of Physics, University of Maryland, College Park, CHRISTOPHER JARZYNSKI, Department of Chemistry and Biochemistry, Institute for Physical Science and Technology, University of Maryland, College Park, KIHWAN KIM, Center for Quantum Information, IIIS, Tsinghua University — We report on an experimental test of the Jarzynski equality in a quantum system consisting of a single  $^{171}\text{Yb}^+$  ion that undergoes dephasing. The Jarzynski equality, which relates equilibrium free energy differences to nonequilibrium work distributions [1], has been tested in many classical open systems and recently in isolated quantum systems [2]. For open quantum systems, however, the definitions of work and heat are not fully settled, which hinders experimental verification. Here, we study a quantum system that interacts with an environment which causes dephasing (or decoherence) without dissipation. We observe that although the work distribution varies with the strength of dephasing, the Jarzynski equality remains valid. Our investigation constitutes the first experimental test of the quantum Jarzynski equality in an effectively open quantum system. [1] C. Jarzynski, *Phys. Rev. Lett.* 78, 2690 (1997). [2] S. An, et al., *Nature Physics*, doi:10.1038/nphys3197 (2014). This work was supported by the National Basic Research Program of China under Grants No. 2011CBA00300 (No. 2011CBA00301), the National Natural Science Foundation of China under Grants No. 11374178 and 11375012, and the US National Science Foundation under Grant No. DMR 1206971.

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