Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Quantum Virtual Cooling JORDAN COTLER, Stanford University, SOONWON CHOI, University of California, Berkeley, ALEXANDER LUKIN, Harvard University, HRANT GHARIBYAN, Stanford University, TARUN GROVER, University of California at San Diego, M. ERIC TAI, MATTHEW RISPOLI, ROBERT SCHITTKO, Harvard University, PHILIPP PREISS, Harvard University and Heidelberg University, ADAM KAUFMAN, Harvard University and JILA, MARKUS GREINER, HANNES PICHLER, Harvard University, PATRICK HAYDEN, Stanford University — We propose a quantum information based scheme to reduce the temperature of quantum many- body systems, and access regimes beyond the current capability of conventional cooling techniques. We show that collective measurements on multiple copies of a system at finite temperature can simulate measurements of the same system at a lower temperature. This idea is illustrated for the example of ultracold atoms in optical lattices, where controlled tunnel coupling and quantum gas microscopy can be naturally combined to realize the required collective measurements to access a lower, virtual temperature. Our protocol is experimentally implemented for a Bose-Hubbard model on up to 12 sites, and we successfully extract expectation values of observables at half the temperature of the physical system. Additionally, we present related techniques that enable the extraction of zero-temperature states directly.

Jordan Cotler
Stanford University

Date submitted: 30 Jan 2019 Electronic form version 1.4