Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Stochastic Independence as a Resource for Small-Scale Thermodynamics MATTEO LOSTAGLIO, Imperial College London, MARKUS P. MUELLER, Western Ontario University and Perimeter Institute for Theoretical Physics, MICHELE PASTENA, Heidelberg University — It is well-known in thermodynamics that the creation of correlations costs work. It seems then a truism that if a thermodynamic transformation $A \to B$ is impossible, so will be any transformation that in sending A to B also correlates among them some auxiliary systems C. Surprisingly, we show that this is not the case for non-equilibrium thermodynamics of microscopic systems. On the contrary, the creation of correlations greatly extends the set of accessible states, to the point that we can perform on individual systems and in a single shot any transformation that would otherwise be possible only if the number of systems involved was very large. We also show that one only ever needs to create a vanishingly small amount of correlations (as measured by mutual information) among a small number of auxiliary systems (never more than three). The many, severe constraints of microscopic thermodynamics are reduced to the sole requirement that the non-equilibrium free energy decreases in the transformation. This shows that, in principle, reliable extraction of work equal to the free energy of a system can be performed by microscopic engines.

Matteo Lostaglio
Imperial College London

Date submitted: 26 Oct 2015 Electronic form version 1.4