MBL-mobile: Many-body-localized engine

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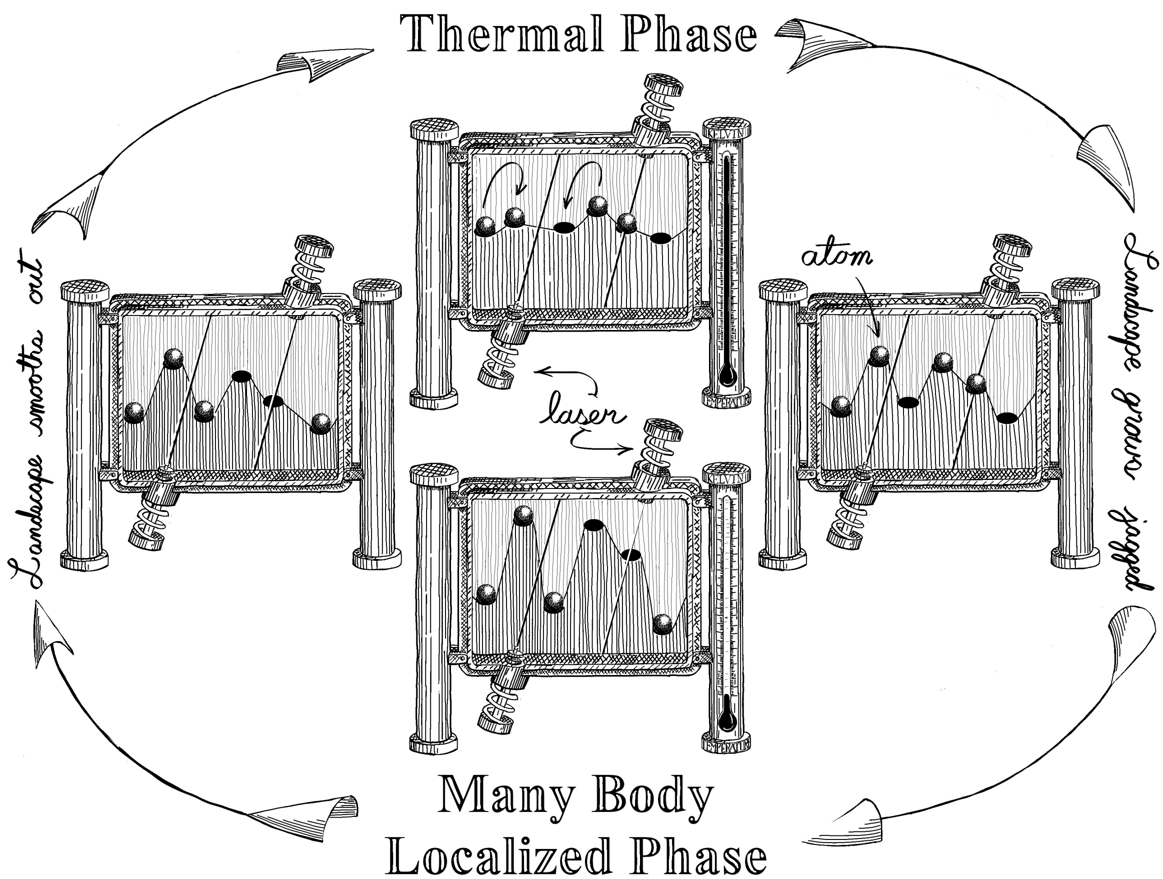

Many-body-localized (MBL) systems do not thermalize under their intrinsic dynamics. The athermality of MBL, we propose, can be harnessed for thermodynamic tasks. We illustrate this ability by formulating an Otto engine cycle for a quantum many-body system. The system is ramped between a strongly localized MBL regime and a thermal (or weakly localized) regime. The difference between the energy-level correlations of MBL systems and of thermal systems enables mesoscale engines to run in parallel in the thermodynamic limit, enhances the engine's reliability, and suppresses worst-case trials. We estimate analytically and calculate numerically the engine's efficiency and per-cycle power. The efficiency mirrors the efficiency of the conventional thermodynamic Otto engine. This work introduces a thermodynamic lens onto MBL, which, having been studied much recently, can now be leveraged in thermodynamic tasks.

Reference: NYH, White, Gopalakrishnan, and Refael, Phys. Rev. B **99**, 024203 (2019) https://dx.doi.org/10.1103/PhysRevB.99.024203.

Casual reference: NYH, “Quantum Steampunk,” *Sci. Am.* (May 2020) https://www.scientificamerican.com/article/quantum-steampunk-19th-century-science-meets-technology-of-today/.