The single ion heat engine — towards a sensitive quantum probe for non-classical baths

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Thermodynamic machines can be reduced to the ultimate atomic limit [1], using a single ion as a working agent. The confinement in a linear Paul trap with tapered geometry allows for coupling axial and radial modes of oscillation. The heat-engine is driven thermally by coupling it alternately to hot and cold reservoirs, using the output power of the engine to drive a harmonic oscillation [2]. From direct measurements of the ion dynamics, the thermodynamic cycles for various temperature differences of the reservoirs can be determined [3] and the efficiency compared with analytical estimates. I will describe how the engine principle can be exploited to implement a differential probe for non-classical baths.

References

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[2] O. Abah et al., Phys. Rev. Lett. **109**, 203006 (2012).
[3] J. Rossnagel et al., New J. Phys. **17**, 045004 (2015).

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