

Plenary Talk

PV II Mon 9:00 Audimax 2

Quantum thermodynamics - superconducting circuit approach — JUKKA PEKOLA — QTF Centre of Excellence, Aalto University, Helsinki, Finland

I start by introducing ideas and principles of how to realize thermodynamic phenomena and devices in circuits composed of superconducting elements, including qubits, combined with heat baths formed of on-chip electronic reservoirs. This way we have demonstrated quantum limited heat transport by microwave photons [1,2], quantum heat valves [3] and rectifiers [4] and ultrasensitive calorimetric detectors [5]. Towards the end of the talk I present progress in realizing quantum heat engines and refrigerators based on thermodynamic cycles [6], and

results on ultimate energy resolution of nanocalorimeters [5,7,8].

[1] M. Meschke, W. Guichard, and J. P. Pekola, *Nature* 444, 187 (2006). [2] A.V. Timofeev, M. Helle, M. Meschke, M. Möttönen, and J.P. Pekola, *Phys. Rev. Lett.* 102, 200801 (2009). [3] A. Ronzani, B. Karimi, J. Senior, Y.-C. Chang, J. T. Peltonen, C. Chen, and J. P. Pekola, *Nat. Phys.* 14, 991 (2018). [4] J. Senior, A. Gubaydullin, B. Karimi, J. T. Peltonen, J. Ankerhold, and J. P. Pekola, *Comm. Phys.* 3, 40 (2020). [5] B. Karimi, F. Brange, P. Samuelsson, and J. P. Pekola, *Nat. Commun.* 11, 367 (2020). [6] B. Karimi and J. P. Pekola, *Phys. Rev. B* 94, 184503 (2016). [7] Bayan Karimi, Jukka P. Pekola, *Phys. Rev. Lett.* 124, 170601 (2020). [8] B. Karimi, D. Nikolic, T. Tuukkanen, J. T. Peltonen, W. Belzig, and J. P. Pekola, *Phys. Rev. Appl.* 13, 054001 (2020).