Finite temperature entanglement in the electronic two-particle interferometer

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We will discuss a theory for entanglement generation, characterization and detection in fermionic two-particle interferometers at finite temperature.
The motivation for our work is provided by the recent experiment by the Heiblum group [1] realizing the two particle interferometer proposed in [2]. The experiment displayed a clear two-particle Aharonov-Bohm effect, however with an amplitude suppressed due to finite temperature and dephasing. This raised qualitative as well quantitative questions about entanglement production and detection in mesoscopic conductors at finite temperature. As a response to these questions, in our recent work [3], we presented a general theory for finite temperature entanglement in mesoscopic conductors. Applied to the two-particle interferometer we showed that the emitted two-particle state in the experiment was clearly entangled. Moreover, we demonstrated that the entanglement of the reduced two-particle state, reconstructed from measurements of average currents and current cross correlations, constitutes a lower bound to the entanglement of the emitted state.

[1] Neder et al, Nature 448, 333 (2007), [2] Samuelsson, Sukhorukov, and Buttiker, Phys. Rev. Lett. 92, 026805 (2004).
[3] Samuelsson, Neder, and Buttiker, Phys. Rev. Lett. 102, 10680 (2009).