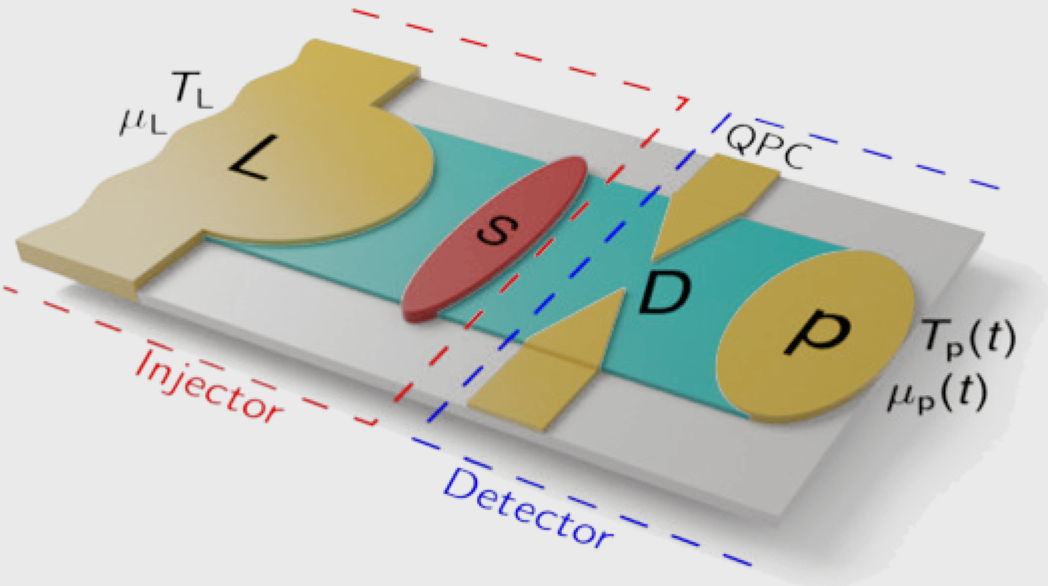
Charge and Energy Noise in ac-driven Conductors and their Detection from Frequency-resolved Potential and Temperature Fluctuations



Title: Charge and Energy Noise in ac-driven Conductors and their Detection from Frequency-resolved Potential and Temperature Fluctuations.
When: Tuesday, December 12, (2017), 12:00.
Place: Department of Theoretical Condensed Matter Physics, Faculty of Science, Module 5, Seminar Room (5th Floor).
Speaker: Janine Splettstoesser, Microtechnology and Nanoscience, Applied Quantum Physics Laboratory Department of Microtechnology and Nanoscience, Chalmers University of Technology, Göteborg, Sweden.

The time-dependent driving of nanoscale conductors allows for the controlled creation of single-electron excitations. This effect has been demonstrated experimentally both by application of time-dependent driving to gates coupled to confined systems, such as quantum dots [1], and by specifically shaped ac-driving of two-dimensional conductors [2,3].
However, the spectral properties of the injected signal are in general not known; moreover, the particle emission goes along with the excitation of electron-hole pairs with some unknown energy distribution. These issues can be addressed by studying fluctuations in the detected currents: not only do such fluctuations provide more insight into how to increase the precision of the single-particle emission, but also they allow for obtaining more information about the character of the emitted signal.
Here, I will present a theoretical study of charge and energy currents and their fluctuations in coherent conductors driven by different types of time-periodic bias voltages, based on a scattering matrix approach [4,5]. Specifically, we investigate the role of electron-like and hole-like excitations created by the driving in the charge

current noise, where they only contribute separately. In contrast, additional features due to electron-hole correlations appear in the energy noise.

We then compare two different types of driving schemes [6], that is for a driven mesoscopic capacitor [1] as well as for a Lorentzian-shaped bias voltage [3], which do not differ in the number of injected particles, but only in their energetic properties.

Finally, I will discuss proposals for the detection of charge and energy noise, either through power fluctuations [4], or via frequency-dependent temperature and electrochemical-potential fluctuations in a probe reservoir [7].

References

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