

Cross-channel electron waiting times of a multi-terminal scatterer

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We investigate the cross-channel electron waiting time distribution (WTD) of systems with multiple transport channels and terminals. The position of the detectors and multiple times in each channel are considered. Based on previous work [1, 2], using a scattering matrix formalism, we obtain generalized expressions for the electron idle time, the first passage time, and the waiting time distribution functions in compact forms.

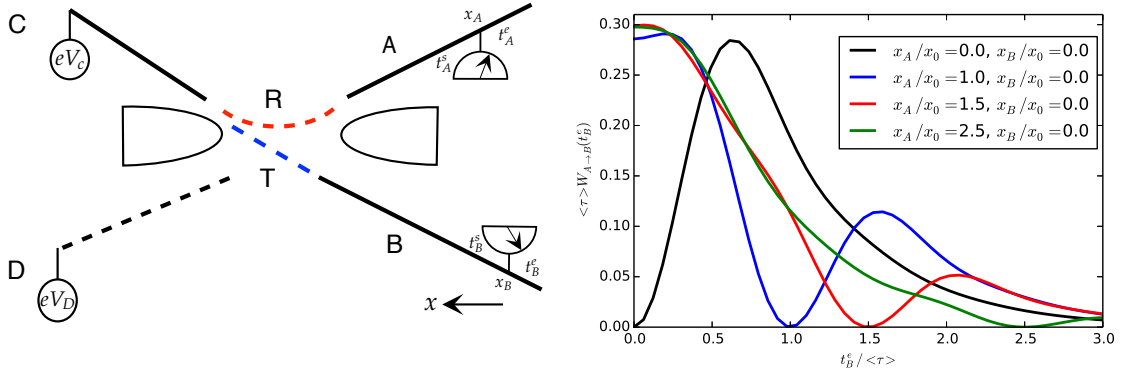


Figure 1: (Left) Electron beam splitter. (Right) Cross-channel WTD with different relative positions of the two detectors. The transmission and reflection probabilities are $T = 0.7$, $R = 0.3$.

We apply our theory to an electron beam splitter based on a quantum point contact (QPC) setup, where the incident electron wave packages can be either reflected or transmitted into different output channels with finite probability. We evaluate the distribution of waiting times between detections in each output channel. Our work shows that the zero-point of the cross-channel WTD is shifted with respect to the relative position of the detectors. This suppression is a direct consequence of the Pauli exclusion principle, where an electron can only occupy one transport state in either reflection or transmission channel at a given time. We are currently investigating WTDs in more complicated situations with multi-input and output channels such as spin-dependent scattering processes and Andreev reflections in superconducting systems [3].

- [1] G. Haack, M. Albert, and C. Flindt, "Distribution of electron waiting times in quantum-coherent conductors", *Phys. Rev. B* **90**, 205429 (2014).
- [2] D. Dasenbrook, P. P. Hofer, and C. Flindt, "Electron waiting times in coherent conductors are correlated", *Phys. Rev. B* **91**, 195420 (2015).
- [3] S. Mi and C. Flindt, in preparation (2017)