Fluctuation-driven Coulomb drag in interacting quantum dot systems

Miguel A. Sierra[1], David Sánchez[1], Antti-Pekka Jauho[2], and Kristen Kaasbjerg[2]

[1]*Instituto de Física Interdisciplinar y Sistemas Complejos IFISC (UIB-CSIC), E-07122 Palma de Mallorca, Spain*

[2]*Department of Physics, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark*

Coulomb drag between nanoscale conductors is of both fundamental and practical interest. Here, we theoretically study drag in a double quantum-dot (QD) system consisting of a biased drive QD and an unbiased drag QD coupled via a direct interdot Coulomb interaction. We demonstrate that the Coulomb drag is driven by the charge fluctuations in the drive QD, and show how the properties of the associated quantum noise allow to distinguish it from, e.g., shot-noise driven drag in circuits of weakly interacting quantum conductors. In the strong-interaction regime exhibiting an orbital ("pseudospin") Kondo effect, the drag is governed by charge fluctuations induced by pseudospin-flip cotunneling processes. The quenching of pseudospin-spip processes by Kondo correlations are found to suppress the drag at low bias and introduce a zero-bias anomaly in the second-order differential transconductance. Finally, we show that the drag is maximized for values of the interdot interaction matching the lead couplings. Our findings are relevant for the understanding of drag in QD systems and provide experimentally testable predictions in different transport regimes.