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'Kondo Blockade' due to quantum interference in single-molecule transistors ANDREW MITCHELL, University College Dublin, Ireland, KIM PEDERSEN, RWTH Aachen, Germany, PER HEDEGAARD, Niels Bohr Institute, University of Copenhagen, Denmark, JENS PAASKE, Center for Quantum Devices, Niels Bohr Institute, University of Copenhagen, Denmark —
Molecular electronics offers unique scientific and technological possibilities resulting from both the nanometer scale of the devices and their reproducible chemical complexity. Two fundamental yet different effects, with no classical analogue, have been demonstrated experimentally in single-molecule transistors: quantum interference due to competing electron transport pathways, and the Kondo effect due to entanglement from strong electronic interactions. In this talk I discuss recent progress in unifying these phenomena within an exact theoretical framework, showing how quantum interference leads to new types of Kondo-mediated transport beyond the standard single-orbital paradigm. Conductance can be strongly enhanced by the Kondo effect, but can take a different universal form from that of magnetic impurities or quantum dots. By contrast, we prove that a quantum interference node in exchange cotunneling leads to a novel 'Kondo Blockade' mechanism, resulting in an exact node in the total conductance at low temperatures. Analytic results are supported by full numerical renormalization group calculations for simple molecular junctions where efficient transistor function is predicted, exploiting gate-controllable tuning between Kondo resonance and Kondo blockade.

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