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Microscopic origin of the 0.7-anomaly in quantum point

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The conductance of a quantum point contact exhibits an unexpected shoulder at ~0.7 (2e^2/h), known as the "0.7-anomaly", whose origin is still subject to debate. Proposed scenarios for explaining it have evoked spontaneous spin polarization, ferromagnetic spin coupling, the formation of a quasi-bound state leading to the Kondo effect, Wigner crystallisation, various treatments of inelastic scattering, and a smeared van Hove peak in the local density of states.

In my talk, I will argue that the 0.7-anomaly arises from "slow spin fluctuations" in the quantum point contact. The microscopic origin of these slow (ferromagnetic) spin fluctuations is the presence of a smeared van Hove peak in the local density of states at the bottom of the lowest one-dimensional subband of the point contact. This peak in the local density of states, which reflects the fact that electrons are being slowed down while they cross the 1D barrier constituting the QPC, amplifies interaction effects and enhances the magnetic spin susceptibility and inelastic scattering rate. I will present theoretical calculations and experimental results that show good qualitative agreement for the dependence of the conductance on gate voltage and magnetic field, including the behavior of the effective low-energy scale that governs the strength of the magnetic response.
Finally, I will argue that "slow spin fluctuations" can be viewed as the common ground shared by several of the seemingly contradictory scenarios for explaining the 0.7-anomaly that are currently on the market. In particular, slow spin fluctuations arise also in the scenarios evoking a quasi-bound state, ferromagnetic spin coupling and Wigner crystallization. Common ground can also be found with the spin polarization scenario if one is willing to reinterpret ``spontaneous spin polarization'' to mean a slowly fluctuating ferromagnetic spin configuration that looks static on short time scales, but averages to zero over longer times.