Emerging localized states and alternating Kondo effects in quantum point contacts

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Quantum point contacts (QPCs), are the basic building blocks of any mesoscopic structure, and display quantized conductance, reflecting the quantization of the number of transparent channels. An additional feature, coined the "0.7 anomaly", has been observed in almost all QPCs, and has been a subject of intensive debate in the last couple of decades. In the past we have attributed this feature to the emergence of a quasi-localized state at the QPC, which explains all the phenomenology of the effect. In this talk I will describe two new experiments, and relevant theories, one which measured the thermoelectric power through the QPC, and another which measured the conductance through length-tunable QPC. The experimental findings support the picture of the localized state(s). Interestingly, with increasing QPC length, it was found that both the 0.7 anomaly and the zero bias peak in the differential conductance oscillate and periodically split with channel length, supporting the idea that the number of the localized state increases with length, leading to an alternating Kondo effect.