Backaction and Anderson overlap catastrophe in quantum dots

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In recent years significant experimental and theoretical progress has been made, enabling the measurements of entropy in mesoscopic systems, in the hope of critically testing the existence of exotic quasi-particles, such as Majorana fermions (MFs), in such systems. Some of these measurements rely on the Maxwell relation $\mathrm{dS}/\mathrm{d}\mu = \mathrm{dN}/\mathrm{dT}$, which requires measuring the charge in the system, using a nearby quantum point contact (QPC) or a quantum-dot detector. In this talk, I will briefly describe such measurements for single and double quantum dots in the Coulomb blockade regime and show how the formalism has been generalized to deduce the entropy from conductance measurements. Applying it to a setup where two and three-channel Kondo physics have been observed, this formalism yields the fractional entropy of a single MF and a single Fibonacci anyon. In the main part of the talk I will concentrate on the backaction of the detector on the system itself, demonstrating that the detector may lead to a localization transition in the measured quantum system, a manifestation of the Anderson overlap catastrophe and the quantum phase transition in the celebrated spin-boson model. We find a Kosterlitz-Thouless flow diagram, leading to a universal jump in the spin-bath interaction, reflected in a discontinuity in the zero temperature QPC conductance. Lastly, I show how by controlling the properties of the detector, one can generate exotic models, yet unrealized experimentally, such as the pseudo-gap Kondo model.