Nonequilibrium dissipative quantum dots: I-V curves and quantum critical points

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Many-body systems that are driven far from equilibrium exhibit a complex interplay between the many-body correlations and the driven degrees of freedom. I shall discuss quantum dot systems that are particularly advantageous for studying these effects: they exhibit impurity quantum criticality, they are amenable to detailed experimental study, and they are simple enough theoretically that detailed numerical results (as well as some analytical results) can be obtained. First, I present the experimental system: it consists of a quantum dot or metallic grain connected to resistive leads via tunable tunnel barriers. A quantum critical point (QCP) occurs when a level in the dot is resonant with the leads and the dot is symmetrically coupled to them. Second, I present a summary of our theoretical results for the nonlinear I-V curve, both as the system flows into the QCP and for the crossover away from the QCP. The theory and experiment are compared in a parameter free way, and the agreement is excellent.