The Kondo exciton: a quantum quench towards strong spin-reservoir correlations

Hakan TURECI (tureci@phys.ethz.ch)
Institute for Quantum Electronics – ETH, Zurich, Switzerland

When a quantum system is subjected to a quantum quench, i.e. a sudden change of some parameters of the Hamiltonian, its subsequent dynamics is governed by energy scales that become ever lower with increasing time: whereas the transient behavior right after the quench depends on high-energy excitations, the asymptotic long-time evolution is determined by low-lying excitations close to the final ground state. Thus, time –or frequency- resolved probes of the dynamics after a quantum quench offers insight into the nature of the system's eigenstates across the entire energy spectrum.
I will present such an analysis for a semiconductor quantum dot coupled to a Fermionic reservoir, where a quantum quench can be induced by the sudden creation of an exciton via optical absorption of an incident photon of definite frequency. The subsequent emergence of correlations between the spin degrees of freedom of the dot and reservoir, ultimately leading to the Kondo effect, can be probed via a simple optical absorption experiment. The resulting lineshape is found to unveil three very different dynamical regimes, corresponding to short, intermediate and long times after the initial excitation, which are in turn described by the three renormalization group fixed points of the single-impurity Anderson Hamiltonian. At low temperatures and just beyond the absorption threshold, the lineshape is dominated by a power- law singularity, with an exponent that is a universal function of magnetic field and gate voltage.