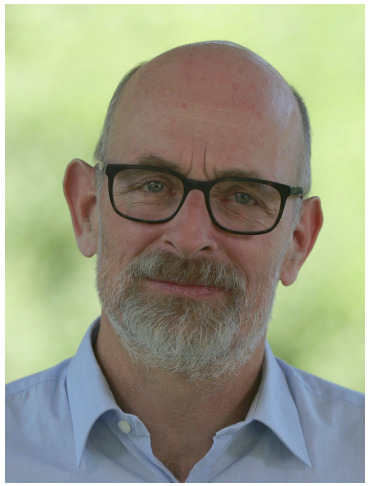
Physikalisches Kolloquium

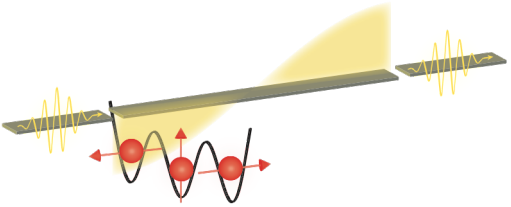
Universität Konstanz

Di 26.11.19
15:15 Uhr
14:45 Uhr, Kaffee/Tee
R 513



Prof. Dr. Klaus Ensslin
ETH Zürich

Coupling of photons, charges and spins in semiconductor quantum dots



Charge qubits in semiconductors are straightforward to realize using quantum dots, but they suffer from short coherence times. Spin qubits consisting of a single spin (electron) in a quantum dot or two electrons in two quantum dots (singlet-triplet) offer larger coherence times, but are more difficult to manipulate and to couple to superconducting microwave resonators. Using quantum dots in AlGaAs heterostructures we prepare so-called resonant exchange qubits, which consist of three electrons in three quantum dots. The spin configuration in the triple dot systems can be tuned by exchange interactions controlled by a set of gate voltages. This way we demonstrate the strong coupling regime between a spin qubit and a microwave photon. In another configuration one can place a single electron in three tunnel-coupled quantum dots and couple a microwave resonator to the quadrupole moment of the charge configuration rather than the diploe moment. Other interesting dot, charge and spin configurations can be realized in the well-controlled AlGaAs system thus using qubit systems to probe new physics. Novel 2D material systems such as bilayer graphene and TMDCs offer prospects for other complex charge and spin qubits.