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## Electrons in quantum dots - one by one

Quantum dots, or artificial atoms, confine charge carriers in three-dimensional islands in a semiconductor environment. Detailed understanding and exquisite control of the charge and spin state of the electrically tunable charge occupancy have been demonstrated over the years. Quantum dots with best quality for transport experiments are usually realized in n-type AlGaAs/GaAs heterostructures. Novel material systems, such as graphene, nanowires and p-type heterostructures offer unexplored parameter regimes in view of spin-orbit interactions, carrier-carrier interactions and hyperfine coupling between electron and nuclear spins, which might be relevant for future spin qubits realized in quantum dots. With more sophisticated nanotechnology it has become possible to fabricate coupled quantum systems where classical and quantum mechanical coupling and back action is experimentally investigated.

In this talk I will present the following experimental examples where the intriguing properties of quantum circuits realized in semiconductor nanostructures are investigated by transport experiments:
- time-resolved charge detection in quantum dots
- on-chip microwave emission and detection on the single photon level
- self- interference of individual electrons traversing a quantum circuit