# Seminarankündigung

## Dienstag, 5. Februar 2019
## 17:15 Uhr

## WSI, Seminarraum S 101

# “Advances in optoelectronic properties of self-assembled InAs quantum dots”

Due to their atomic level structure and good integration practicability, semiconductor quantum dots are promising candidates for future quantum technology applications. The natural confinement for electrons and holes and excellent coupling to photons makes self-assembled III-V-semiconductors quantum dots (SAQD) accountable for a large variety of fundamental research findings and interesting candidates for optical quantum communication. To this end, the extracted photons should possess natural linewidth and the quantum states recorded in e.g. spin states should be long lived. Long coherence times for electrons and holes have been achieved, while even in these excellent solid state quantum systems noise is still an issue and spoils the theoretically achievable coherence properties. In the presentation, a subset of these noise sources, their origins and applied countermeasures will be discussed.

While nuclear spin noise is of great importance for electrons, a heavy hole may be largely decoupled. Charge noise from fluctuating charges shakes up the electrostatic environment. This disturbs the transition energies by the Stark effect as well as the coherence of the spins due to an electric field dependent hole g-factor. By high quality material growth and special designed heterostructures, charge noise is largely reduced and thus becomes less detrimental. Auger processes, mostly neglected in SAQDs, give rise to luminescence quenching and broad linewidths due to weak coupling to a charge reservoir. Also a too strong tunnel coupling is not desirable as indirect transitions may occur between the charge reservoir and the quantum state. At a carefully adjusted tunnel coupling, natural linewidth photon emission can be achieved. Beside these single SAQD measurements, capacitance-voltage-spectroscopy is used among others to characterize the MBE material quality and to deeper investigate the tunnel coupling to the reservoir.

The aforementioned advances in material and device design allow for an expansion of STED microscopy without the need for metastable states and the investigation of clean cavity-quantum-electrodynamics in a tuneable cavity system.


**Dr. Arne Ludwig**
**Lehrstuhl für Angewandte Festkörperphysik**
**Ruhr-Universität Bochum**
**Germany**