Bachelor/Master thesis

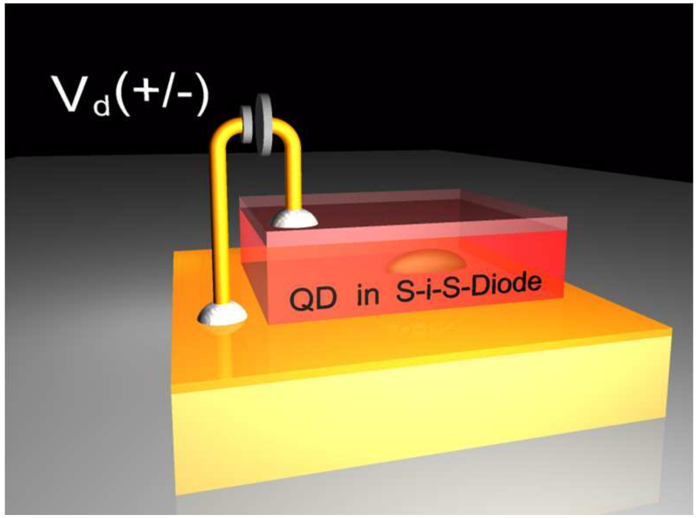
Controlling the Optical Properties of Artificial Atoms via Bidirectional Stark Effect

Semiconductor quantum dots are nanostructures which confine the motion of electrons in 3-dimensions. For this reason they are called “artificial atoms” as they show discrete energy states similar to natural atoms. The energy of such states can be controlled by application of external perturbations such as electric fields and elastic strain.

Within this thesis you will **fabricate and characterize a new device** which allows controlling the **optical spectrum** of single artificial atoms by **applying electric fields with direction parallel or antiparallel to the dot axis**. This is different from all devices reported so far in the literature, where electric fields can be applied only in one direction.

The work will be carried out in part in a cleanroom and in part in a state-of-the-art lab for optical spectroscopy of single nanostructures. For more information, please contact or visit us in the semiconductor physics building!

Duration: 6 weeks
Contact: Armando Rastelli
E-Mail: armando.rastelli@jku.at



Bachelor thesis

Dual-Wavelength Narrow-Bandpass Filters for Two-Color Resonant Excitation of Artificial Atoms

Semiconductor quantum dots are nanostructures which confine the motion of electrons in 3-dimensions. For this reason they are called “artificial atoms”, as they show discrete energy states similar to natural atoms. Resonant optical excitation is the best way for initializing the state of a quantum dot, but it requires several technological challenges to be faced. The main one is the rejection of the laser light used for excitation.

Within this thesis you will **design, fabricate and characterize an optical filter** which allows a quantum dot to be excited with two photons of different wavelengths. The filter is based on a coupled-cavity Fabry-Perot design and will be fabricated by deposition of multilayers of oxide materials.

The work will be carried out in part in a cleanroom and in part in a state-of-the-art lab for optical spectroscopy. For more information, please contact or visit us in the semiconductor physics building!

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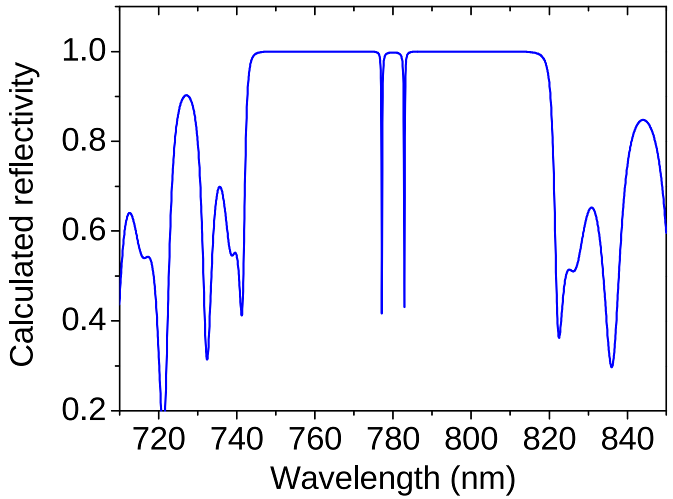

Bachelor thesis

Setup for Optical Micro-Reflectivity Measurements

Within this thesis you will **build-up and use a system to characterize the reflectivity of dielectric and semiconductor layers in the visible and near-infrared spectral range**. The setup will be used to characterize, with micrometric spatial resolution, the reflectivity of optical microcavities, antireflection coatings etc.

The work will be carried out in a state-of-the-art lab for optical spectroscopy. For more information, please contact or visit us in the semiconductor physics building!

Duration: 6 weeks
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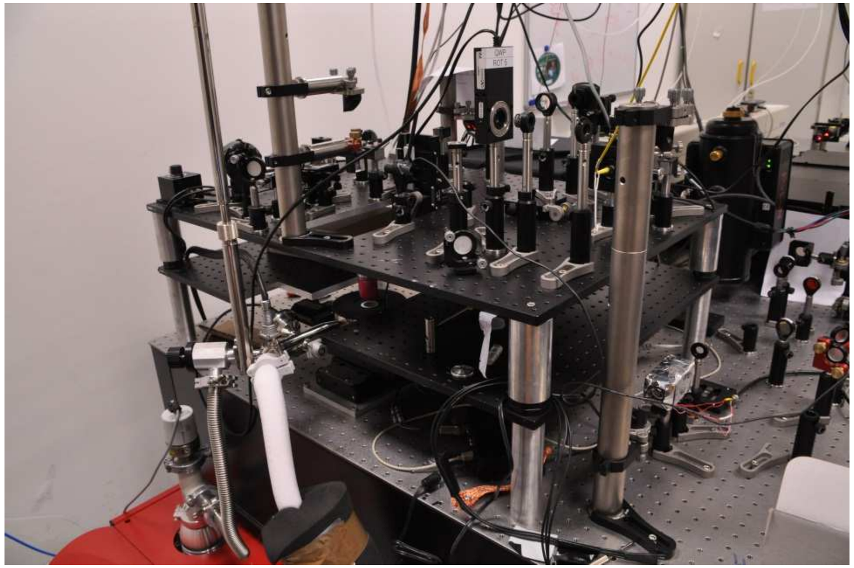


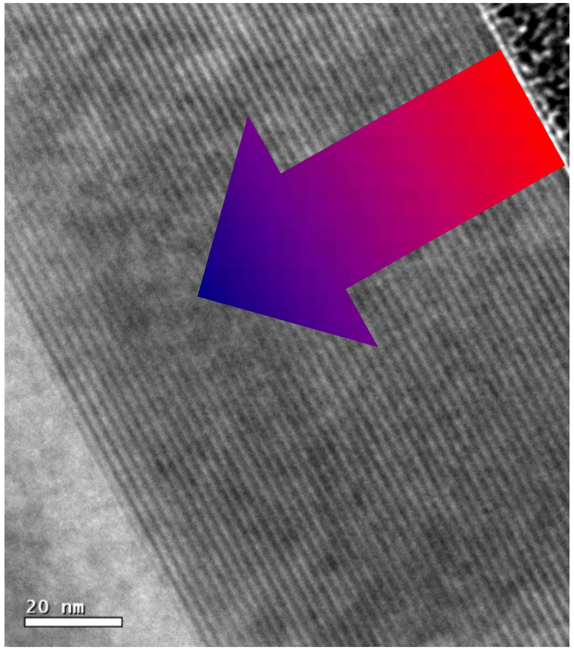
Setup for Optical Micro-Reflectivity Measurements

Bachelor thesis

Measurement of Thermal Conductivity of Nanoscale Semiconductors

Understanding thermal transport in nanostructured semiconductors is important for heat management in devices and for the realization of efficient thermoelectric elements.

Within this thesis you will **measure the thermal conductivity of thin films produced in the institute in a broad temperature range**. To do so you will employ the so-called 3-Omega method, in which a thin metal strip is used both to heat the sample surface and to measure the temperature rise. Sample preparation will be performed in the cleanroom of the institute. There you will get acquainted with material deposition, optical lithography and atomic force microscopy.



The work will be carried out in part in the cleanroom of the cleanroom and in part in a lab for therma transport. For more information, please contact or visit us in the semiconductor physics building!

Duration: 6 weeks
Contact: Armando Rastelli
E-Mail: armando.rastelli@jku.at

HFP | Institute of Semiconductor and Solid State Physics
HFP | Institute of Semiconductor and Solid State Physics

Bachelor/Master thesis

Controlling the Optical Properties of Artificial Atoms via uniaxial stress

Semiconductor quantum dots are nanostructures which confine the motion of electrons in 3-dimensions. For this reason they are called “artificial atoms” as they show discrete energy states similar to natural atoms. The energy of such states can be controlled by application of external perturbations such as electric fields and elastic strain.

Within this thesis you will **fabricate and characterize a new device** which allows controlling the **optical spectrum** of single artificial atoms by **applying uniaxial stress** (along different directions) on membranes containing QDs. Stress is obtained by a novel piezoelectric actuator shown in the figure.

The work will be carried out in part in a cleanroom and in part in a state-of-the-art lab for optical spectroscopy of single nanostructures. For more information, please contact or visit us in the semiconductor physics building!

Duration: 6 weeks
Contact: Armando Rastelli
E-Mail: armando.rastelli@jku.at