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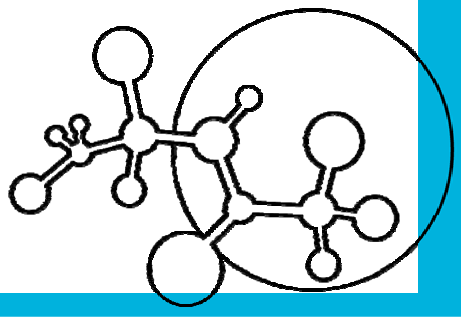

# Quantum Efficiency Seminar and Colloquium


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## FMF, Albert-Ludwigs-Universität Freiburg


## Quantum dots - defect states and solar cell efficiencies


Quantum dots (QDs) are colloidal semiconducting nanocrystals which exhibit unique optical features such as size-tunable fluorescence and absorption spectra. This phenomenon is known as quantum-size effect or quantum confinement and occurs when the crystal size is less than the so-called Bohr Radius, a material specific constant. Because of their quantised energy levels, which arise from the spatial confinement of charge carriers inside the crystal, QDs are often called artificial atoms or superatoms. When QDs absorb light, electrons are promoted from the valence band to the conduction band leaving a bound electron-hole pair (exciton) behind. After the excitation electrons and holes can recombine by e.g. emitting light of lower energy (fluorescence) or non-radiatively by vibrational energy relaxation. The kinetics of the recombination process is strongly influenced by the crystal quality, surface chemistry and the surrounding medium. One promising application of QDs is their use in polymer-hybrid solar cells. There the bound electron-hole pairs, which need to be dissociated into free charge carriers, are generated in the polymer (donor) after light absorption. The electrons are further transferred to the QDs (acceptor) from where they travel to the cathode by hopping events. The corresponding holes stay in the polymer and are transported to the anode. Both, polymer and QDs contribute to the resulting photocurrent. However, the electron-hole recombination mediated by crystal defects in the QDs competes with the charge transfer and thus reduces the solar cell efficiency. In this talk I will highlight the synthesis and surface modification of nearly defect-free CdSe QDs and show the correlation between fluorescence quantum yield and power efficiency leading to improved solar cell performance.


**Date:** **Tuesday, June 28th, 2011 2:15 pm**
**Location:** **FRIAS Seminar Room, Albertstr. 19, Freiburg**


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