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Aktuelle Probleme dimensionsreduzierter Festkörper

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Spectroscopy on single self-assembled quantum dots with broadband rapid adiabatic passage

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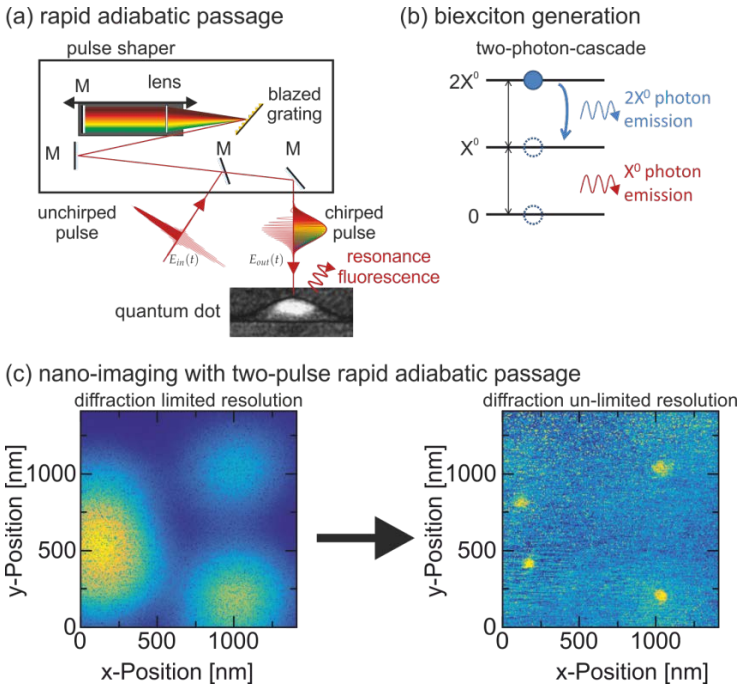
Self-assembled semiconductor quantum dots are referred to as artificial atoms. They are bright single photon sources implemented in easily scalable systems. These properties promote quantum dots as promising candidates for quantum information technology. A high fidelity state preparation reduces the error rate in quantum information protocols and is hence an essential requirement.

Here, we present a new spectroscopy tool which can be used for high fidelity state preparation as well as to gain deeper insights into processes in a quantum dot and its environment.

We combine advantages of resonance fluorescence spectroscopy with a coherent control technique called rapid adiabatic passage, Figure (a). We work with ultra-fast laser pulses which is an unusual choice for QD spectroscopy. This allows us to enter a new regime of electron-phonon interaction in the QD's environment. Furthermore, we use knowledge about the phonons to prepare a pure source of single photon pairs, a biexciton, Figure (b). Following the fruitful path of our new spectroscopy tool, we use a two-pulse-sequence to bypass Abe's diffraction limit and demonstrate with the coherent control technique the optical nano-imaging of two-level systems with a resolution down to 30 nm (λ/31), Figure (c).



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