Sonderforschungsbereich 631

Festkörperbasierte Quanteninformationsverarbeitung

TECHNISCHE UNIVERSITÄT MÜNCHEN

SEMINARANKÜNDIGUNG

Dienstag, 20. Januar 2009

17:15 Uhr

WSI, Seminarraum S 101

"Coherent optical control of semiconductor quantum dots"

Self-assembled quantum dots are nanoscale volumes of InGaAs embedded in a GaAs matrix. The dot provides electronic confinement in all three spatial dimensions, resulting in a set of discrete energy levels energetically isolated from their solid-state environment. This results in an atom-like coherent light-matter interaction, where key signatures such as Rabi oscillations, Ramsey interference and Autler-Townes splittings have been reported. In this seminar, I will discuss our recent work on the coherent optical manipulation of the excitonic and spin states of a single semiconductor quantum dot using sequences of picosecond laser pulses and a photocurrent detection technique. The main topics of the talk will be:

(1) A demonstration of a scheme to prepare and detect a single hole spin, and progress towards the optical control of a single hole spin.

(2) The vacuum-exciton-biexciton states form a 3-level ladder. An intense laser is used to couple the exciton and biexciton states, which is observed as a Rabi splitting (Autler-Townes) of the exciton transition. We demonstrate picosecond control of the Rabi splitting, and a scheme to measure the Rabi oscillation between the exciton and biexciton states in the time, rather than power domain.

(3) The excitonic Rabi oscillations of dots, exhibit a loss of coherence with increasing power. The source of the excitation induced dephasing is the subject of intense debate. I will present compelling experimental evidence for the role played by acoustic phonons.

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