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ALMA MATER LEOBIENSIS

SEMINAR

aus

Halbleiterphysik und Nanotechnologie

Di, 28.1.2014, 11:15 Uhr

Hörsaal für Physik

“Strain-tunable quantum optoelectronic devices”

Univ. Prof. Dr. Armando Rastelli

Institute of Semiconductor and Solid State Physics, Johannes Kepler University Linz

Optically active semiconductor quantum dots (QDs) confine the motion of charge carriers in three-dimensions and are thus often referred to as "artificial atoms". Research on such systems is partly driven by prospects of using them as building blocks for quantum communication devices. However, unlike real atoms, the structural properties of QDs are affected by unavoidable fluctuations, which make it difficult to obtain QDs with precisely defined electronic and optical properties. To alleviate this problem, we have introduced QD-based devices in which the semiconductor structures are integrated on top of piezoelectric actuators made of PMN-PT material [1]. This combination allows us to reversibly change the strain in the semiconductor (within about ±0.2%) and hence to use (anisotropic) strain fields as a “tuning knob” to modify in a broad range the electronic and optical properties of embedded QDs. In this seminar I will illustrate how strain-induced effects can be used to realize wavelength-tunable, electrically-driven sources of triggered single photons [2,3], to make any QD suitable for the generation of polarization-entangled photon pairs (independent on its structural properties [4]) and to tune the binding energies of different excitonic complexes confined in QDs [5].

[1] A. Rastelli et al. Phys. Stat. Solidi 249, 687 (2012)
[2] R. Trotta et al. Adv. Mater. 24, 2268 (2012)
[3] J.X. Zhang et al. (2013)
[4] R. Trotta et al. Phys. Rev. Lett. 109, 147401 (2012); R. Trotta et al. (2013)
[5] R. Trotta et al. Phys. Rev. B (in press)