Seminarankündigung

Dienstag, 22. November 2016
17:15 Uhr

WSI, Seminarraum S 101

“Type-II II-VI submonolayer quantum dots: Physics and applications”

Semiconductor heterostructures can be classified according to the band alignment between two adjacent materials. Two major classifications are: type-I systems, where the narrower gap material presents a potential well for both electrons and holes, and type-II, where the band alignment has a staggered character, i.e. the material with the lower potential energy for electrons have the higher energy for holes and vice versa, so the charge carriers are separated in the real space.

We have fabricated such type-II systems, based on Zn-Te-Se multilayers. Specifically, we have grown sub-monolayer Zn(Mg,Cd)Te/ZnSe and ZnTe/Zn(Cd)Se stacked quantum dots (QDs) via combination of molecular beam epitaxy (MBE) and migration enhanced epitaxy (MEE). In all the systems, the holes are confined within Zn(Mg,Cd)Te dots, whereas electrons are located in Zn(Cd)Se barriers.

In this talk I will discuss our studies of these systems as well as their potential applications. Specifically, I will show ‘basic’ cw and time-resolved photoluminescence (PL) confirming type-II band alignment. I will present unpolarized and circularly polarized magneto-PL, which exhibit an oscillation in both energy and intensity as a function of the magnetic field (flux), and explain it via the excitonic Aharonov-Bohm (EAB) effect. I further present temperature dependence of the visibility of the EAB peak, and show that it is similar to that observed in transport decoherence experiments, namely, with T-1 term due to electron-electron collisions and with T-3 term due to electron-phonon interactions. However, the magnitude of the latter term is much smaller than that for the transport electrons and similar to the interaction strength of the exciton-phonon coupling. Using results of circularly polarized magneto-PL and results of tight-binding calculations, I will show that g-factor of holes is substantially enhanced in subnomoalyer QDs due to suppression of the orbital motion, even though they are relatively large in plane perpendicular to the growth direction.

Finally, I will discuss potential application of these systems as an active region of intermediate band solar cells.

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