S E M I N A R

Mittwoch, 16. Januar 2013
10 Uhr c.t., PHY 2.1.29 (Seminarraum Huber/Bougeard)

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Optical and Electrical Transport Properties of (In,Ga)As-based nanowires on Silicon

III-V semiconductor nanowires (NW) exhibit significant potential to drive new applications in nano-electronic and -photonic devices especially when integrated on low-cost silicon (Si). In particular, (In,Ga)As-based NWs and their heterostructures are of great interest due to their wide functionalities in NW field effect transistors (FET), light absorbers and emitters covering a large spectral region even into the terahertz frequency range. Progress towards these nano-scale devices requires research on many fundamental aspects.

In this talk, I will give an overview of the optical and electronic properties of completely catalyst–free (In,Ga)As NWs on Si (111), grown via both self-assembled and sophisticated selective-area epitaxy (SAE) schemes. In particular, I will discuss their unique structural properties (such as wurtzite phase in the commonly cubic arsenides) and elucidate distinct microstructure-electronic function relationships in the (In,Ga)As NWs and effects on the electronic band gap. In addition, low-T photoluminescence spectroscopy is used to study the influence of NW aspect ratio on radial quantum confinement as well as present routes for light emission enhancements via surface passivated radial core-shell NW heterostructures.

I will further address the prospects of (In,Ga)As-nanowire/Si heterojunctions as major ingredients for novel NW tunneling FETs as well as report electrical transport properties of single (In,Ga)As NW-FETs. In particular, I will show recent results of conductive atomic force microscopy (C-AFM) allowing straightforward probing of the room-temperature I-V characteristics of single Esaki-type n-(In,Ga)As/p-Si heterojunction tunnel diodes. Several dependencies such as NW diameter, doping density, electrical stress, and Ga composition in ternary InGaAs-NW/Si hetero-junctions will be shown and the effects on tunneling characteristics and negative differential resistance (NDR) evaluated.