
HL 6: Invited Talk Fromherz

Time: Monday 11:00–11:45

Location: HSZ 01

Invited Talk

HL 6.1 Mon 11:00 HSZ 01

Three dimensional SiGe quantum dot crystals — •THOMAS
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The formation of SiGe quantum dots (QDs) on a regular, two dimensional lattice has been demonstrated to result in an extremely narrow QD size distribution and correspondingly narrow QD photoluminescence spectra. Overgrowing this first QD layer with a thin Si cap followed by a few monolayers Ge results in the formation of vertically aligned QDs. In our samples, 10 QD layers vertically perfectly aligned to the first layer without deterioration of the narrow size distribution were grown. Crystallographically, the resulting three dimensionally ordered QDs represent an artificial crystal as evidenced by x-ray diffrac-

tion. Using interference lithography based on UV radiation at 13.5 nm wavelength, lattices with periods small enough to couple neighboring QDs also electronically can be defined. Three dimensional envelope function approach band structure calculations based on the nextnano³ simulation tool show that by a proper choice of the distances between neighboring QDs, delocalized electron ground states built up by a superposition of QD states can be realized. Thus, also from an electronic point of view, these three dimensionally ordered QDs represent an artificial crystal with electronic and optic properties adjustable by the period and the structure of the QDs.

The work was performed in collaboration with C. Dais, J. Stangl, E. Müller, Y. Ekinci, D. Grützmacher, H. H. Solak, R. T. Lechner, E. Wintersberger, S. Birner, and Václav Holý.