



Masterarbeit



Modeling of SiGeSn Ternary Alloys

Project Description

One of the concepts for further increasing the performance of integrated circuits is to equip them with optical communication channels. While Si is notoriously bad at emitting light, alloys of SiGeSn are CMOS-compatible and have recently been shown to exhibit a direct bandgap for certain compositional ranges. This suggests to develop optoelectronic devices based SiGeSn-based heterostructures, such as quantum wells and quantum dots.

One central aspect for the modeling of SiGeSn-based optoelectronic devices is the compositional dependence of the direct and the indirect band gaps of the material. Current experimental and theoretical investigations are contradicting each other. For this reason, the aim of this master thesis is to refine and extend the presently available theoretical approaches. Specifically, the Empirical Pseudopotential Method (EPM) represents an ideal numerical technique for computing the band structure of the elemental semiconductors Si, Ge, and Sn as well as their alloys.

Within this master thesis, you have the opportunity to learn more about:

- Modeling of optoelectronic devices
- Numerical band structure techniques (with focus on EPM)
- Implementing your own version of EPM
- How to have fun doing atomistic material modeling.

Furthermore, the results of your work will be directly used by our experimental collaborators at University of Stuttgart for their experimental designs.

Prerequisites

Good knowledge in solid state physics/semiconductor physics and optics. Enjoying working with computers and interest in computational physics; Willingness to learn the programming of numerical methods.

Contact

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