

PHYSIKALISCHES KOLLOQUIUM

Sommersemester 2024

Das Kolloquium findet (soweit nicht anders angegeben) **jeweils montags um 16:15 Uhr in Präsenz im Röntgen-Hörsaal** des Physikalischen Instituts, Hubland Campus Süd, Universität Würzburg **und online via Zoom statt**. (Der jeweilige Link wird noch zur Verfügung gestellt.)

06.05.2024

Vorstellungsvortrag im Rahmen des Habilitationsverfahrens

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Optics and electronics in antimonide-based type-II heterostructures

Abstract

We discuss our recent activities on opto-electronic devices composed of semiconducting materials of the so-called 6.1 Å family, i.e. InAs, GaSb, and AlSb. Via epitaxial design routines, heterostructures composed of their binary, ternary or quaternary alloys allow unique features such as optically active type-II superlattices enabling light emitters and detectors suitable for the mid-infrared wavelength region. We will discuss recent results on interband cascade infrared detectors employing Ga free Type II superlattices [1] as well as resonant tunneling diode (RTD) photodetectors operating in the mid-infrared spectral region [2]. In addition, topological insulators (TI) based on the InAs/GaSb material system are especially appealing because of the spatial separation and localization of electron and hole states in the InAs and GaSb layers, respectively. The spatial separation of charges provides the necessary ingredient to exploit a rich phase diagram [3] that is accessible and controllable by a bottom- and top-gate electrode. We discuss our recent activities on InAs/GaInSb/InAs trilayer quantum wells with its TI band gap up to 45 meV [4], the quantum spin hall effect at elevated temperature up to around 60 K, and show the tuning between trivial- and topological phases by intrinsic and extrinsic control parameters [3,5].

References

[1] A. Bader, F. Rothmayr, N. Khan, F. Jabeen, J. Koeth, S. Höfling, and F. Hartmann
Appl. Phys. Lett. 121, 41104 (2022), DOI: 10.1063/5.0094166



- [2] F. Rothmayr, E. D. Guarín Castro, F. Hartmann, G. Knebl, A. Schade, S. Höfling, J. Koeth, A. Pfenning, L. Worschech, and V. Lopez-Richard, *Nanomaterials* (Basel) 12 (2022), DOI: 10.3390/nano12061024
- [3] S. Schmid, M. Meyer, F. Jabeen, G. Bastard, F. Hartmann, and S. Höfling, *Phys. Rev. B* 105, 155304 (2022), DOI: 10.1103/PhysRevB.105.155304
- [4] C Avogadri et al, *PHYSICAL REVIEW RESEARCH* 4, L042042 (2022).
- [5] M. Meyer et al., arXiv:2401.11965v1 (2024)

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Hinkov, Prof. Dr. Hinrichsen, Prof. Dr. Porod, Dr. Ünzelmann und Hr. Kuhr