

Micro- and Nanostructure Research: Cleanroom Linz

G. Bauer, H. Heinrich and G. Brunthaler
Institut für Halbleiter- und Festkörperphysik
Johannes Kepler Universität Linz, A-4040 Linz, Austria

The micro- and nanostructure research in the cleanrooms of the “Institut für Halbleiter- und Festkörperphysik” is supported by the Society for Microelectronics (GMe). In 2003, emphasis was put on the research and development of optoelectronics, nanostructures and devices for spintronics. For optoelectronics, Si/SiGe cascade injectors for voltage tunable two-band detection, lead salt structures with continuous-wave photoluminescence and Erbium doped SOI waveguides for the mid-infrared were developed. Further a CD lab was founded which is dedicated to the simulation and fabrication of photonic crystals for various optical applications. Nanostructures were produced by the top-down approach with electron beam lithography in Si and AlGaAs structures and by the bottom-up approach of self organized growth inside PbSe superlattices. The morphology of the structures was investigated by numerous techniques like transmission electron microscopy, x-ray diffraction of atomic force microscopy. The basic spin relaxation properties of Si-based materials were investigated as a prerequisite for spintronic applications.

The funding of the activities in the cleanrooms at the University of Linz which are jointly used by several groups is of vital importance for our micro- and nanostructure research activities. This basic funding allows for investigations which are made possible through additional funding coming from the FWF, the FFF, the Christian-Doppler society, the European Commission, as well as through cooperation with industrial groups as listed in the report.

The activities of the year 2003 in the cleanrooms in Linz are described in a short overview here. The basic equipment which is available in these clean rooms allows for MBE growth of SiGe, II-VI and IV-VI heterostructures, for the deposition of ferromagnetic layers like Fe on II-VI compounds, as well as GaN deposition by MOCVD with *in-situ* control. For deposition of dielectric layers like SiO₂ and TiO₂ for the visible and MgF and Si for the infrared spectral range a new deposition system from Leybold Optics was installed. Apart from *in-situ* and *ex-situ* structural characterization, lateral patterning is made possible through equipment like optical, holographic and electron beam lithography. In 2003 also a new “LEO Supra 35” electron beam lithography system was installed, which allows the preparation of lateral structures down to about 20 nm. Processing includes also facilities for the deposition on insulating as well as contact layers, in particular a plasma deposition system for silicon nitrides. A transmission electron microscope is intensively used for the characterization of thin SiGeC layers. Research and development of a new Christian-Doppler Laboratory on photonic crystals is also conducted in the same cleanrooms.

The emphasis of the research work in and around the cleanrooms was put mainly on optoelectronics, nanostructures and devices for spintronics as described in the following.

Optoelectronics

Optoelectronic devices are used today for communication, as light sources and for detectors. In the Si/SiGe cascade injectors a resonator enhanced, voltage tunable two-band detector was realized. This device not only allows the detection of mid-infrared radiation, but also the distinction between different wavelengths from (from 5.2 μm to 3.2 μm), in order to identify e.g. different air pollution gasses. The tunability of the photoresponse is a consequence of an electric field induced transfer of holes from the deepest to the shallowest quantum well of the injector sequence. Depending on the bias voltage, dark current limited peak detectivities in excess of $D^* = 1 \times 10^9 \text{ cmHz}^{0.5}\text{W}^{-1}$ were obtained at a temperature of 77 K.

Lead salt structures for continuous-wave photoluminescence are also suited for emission in the mid-infrared. The PbSe/PbEuSe and PbTe/PbEuTe multiquantum well structures as well as the PbSe and PbTe bulklike structures were excited by a semiconductor laser diode. All the samples were grown by molecular-beam epitaxy on BaF₂(111) substrates under the same growth conditions. Both for the Te-based systems and for the Se-based systems, it turns out that bulk-like structures show photoluminescence up to higher temperatures than multi-quantumwell structures. In particular, emission spectra from PbTe/PbEuTe multiquantum wells were obtained up to temperatures of 200 K and from PbSe/PbEuSe multiquantum well structures up to 60 °C whereas for bulklike PbSe photoluminescence at temperatures as high as 190 °C is demonstrated.

Among the various attempts to obtain light emission from Si, optical doping with rare earth elements like Er has been particularly fruitful at first glance as this approach is compatible with standard Si technology. Light emitting diodes emitting at a wavelength of 1.54 μm at room temperature have been fabricated. The low efficiency, however, and the slow response of such diodes limit their use to a few special applications. The main hope, namely application in optical communication systems, appears unrealistic unless laser action can be achieved. In order to come closer to that goal, the recently found increased solubility of Erbium in silicon in the presence of hydrogen was investigated by producing Erbium-doped waveguides in Silicon-on-insulator layers by photolithography. Applying the variable stripe length method a net gain of 32 cm^{-1} at 10 K was estimated.

In 2003 the Christian Doppler Laboratory for Surface Science Methods was established at the University Linz in cooperation with Photeon Technologies located in Bregenz, Austria. The main goal is to bridge the gap between basic research and applied research on the topic of photonic devices. Although it is planned that also prototypes of such devices are fabricated in the cleanroom, in the first year the main emphasis was laid on novel design schemes and on establishing process steps as e-beam or UV lithography, etching, RIE etching, mask preparation and characterization methods like AFM etc.

Nanostructures and Characterization

Nanostructures are the natural consequence of the ongoing miniaturization in microelectronics. As the devices become increasingly smaller, new effects like quantum effects appear. The investigation and understanding of such quantization effects is important in order to continue the functionality of devices but also to use them for completely new types.

Lateral quantum dots have been fabricated on strained Si/SiGe substrates with a mobility of about 200,000 cm^2/Vs using a split gates geometry, where the gates consist of Pd. The gate structures were realized by e-beam lithography. By applying negative voltages to the gates the underlying 2DEG can be depleted. Similar samples showed

fractional quantum Hall effect up to filling factors of $1/3$. The e-beam lithography was performed with a JEOL 6400. In the 4th quarter of 2003, a LEO Supra 35 FESEM (field emission scanning electron microscope) with a Schottky field emitter (SFE) has been purchased and the fabrication of quantum dots will be continued with the new equipment.

Lateral quantum dots were also fabricated from two-dimensional GaAs/AlGaAs heterostructures by electron beam lithography. In a new design, the split gate geometry, which defines the dot electrostatically by metal gates, has been modified. The devices were electrically characterized in a ³He cryostat at 300 mK. Due to improvements in device design and measurement conditions, the number of electrons in the dot can now be controlled over a wider range. Additionally, reproducible conductance fluctuations overlaid on the Coulomb oscillations were observed and will be investigated in more detail.

Anomalous x-ray diffraction is used to investigate self-organized three dimensional PbSe quantum dot lattices formed by multilayer heteroepitaxial growth. Using a short-range dot ordering model in combination with a finite domain size, the ordering parameters are determined from the x-ray spectra. It is shown that the variance of the nearest-neighbor distances is significantly smaller and the laterally ordered domain size larger for the case of three dimensional trigonal PbSe dot lattices with *fcc*-stacking as compared to those with three dimensional hexagonal dot arrangement.

Transmission electron microscopy (TEM) is a powerful tool for detailed analysis of both crystalline and amorphous structures ranging from the micro to the nanometer scale. TEM is capable to display not only the real but also the reciprocal space of a sample; i.e. the diffraction pattern. The analytical capabilities of the JEOL FastEM 2011 with CCD-camera and EDS X-ray detector were used to investigate e.g. the element specific composition of a hetero-bipolar-transistor, to determine the dislocation density at a Si-Ge interface, for the investigation of facets on a prestructured and annealed Si surface, the analysis of size and shape of SiC precipitations, and the alignment of self-arranged Ge dots.

The combination of lithography and self-assembly techniques results in long-range two-dimensionally ordered Ge islands. Island lattices with perpendicular but also with obliquely oriented unit vectors were realized. Quantitative analysis of the island topographies demonstrates that the size dispersion of these islands is much smaller than that found on flat substrates. Furthermore, island formation on the patterned substrates is observed already for a smaller amount of Ge deposition than on unpatterned ones.

Strain relaxation of heteroepitaxial PbTe layers on PbSe (001) by misfit dislocation formation is shown to take place near equilibrium without kinetic barriers. The comparison of the experimental data with different strain relaxation models shows that mutual dislocation interactions are of crucial importance for the strain relaxation process. This results in a faster relaxation than predicted by the Frank and van der Merwe model for non-interacting dislocation arrays.

X-ray diffraction is used for the *in situ* characterization of the growth of cubic GaN by metalorganic chemical vapor deposition. The installed setup permits the simultaneous measurement of a wide angular range and requires neither goniometer nor exact sample positioning. Time-resolved measurements during growth give access to film thickness and growth rate as well as information on the chemical composition of ternary compounds. Additionally, the relaxation of the crystal lattice during heteroepitaxial growth of GaN on AlGaN can be measured directly.

Spintronics

The SiGe material system is a promising candidate for solid-state spintronics application due to its very long relaxation lifetimes and compatibility to standard Si device processing technology. In contrast to predictions of the classical model of D'yakonov-Perel, a strong anisotropy of spin relaxation and a decrease of the spin relaxation rate with increasing electron mobility were found. For high electron mobility, the cyclotron motion causes an additional modulation of spin-orbit coupling leading to an effective suppression of the spin relaxation rate.

The possibilities of g-factor tuning of conduction electrons in SiGe heterostructures as proposed for spin transistors were investigated. The g-factor dependence on the Ge content in SiGe quantum wells was investigated, showing promising results. Devices for demonstrating a high enough shift of the electron g-factor to bring electrons in and out of resonance with an external microwave field — thus allowing spin manipulation — are being developed.

In order to understand the electron-electron interaction in Si-based structures, also the metal-insulator phase transition was investigated. In silicon-on-insulator metal oxide semiconductor structures with a peak mobility of 25,000 cm²/Vs a strong drop of the resistivity towards low temperature has been observed. This metallic effect can be explained by a linear-in-T term, which can be interpreted with both, the ballistic interaction corrections and the temperature dependent screening of impurity scattering.

Project Information for 2003

Project Manager

Gerhard Brunthaler

Institut für Halbleiter-und Festkörperphysik, Johannes Kepler Universität Linz, A-4040 Linz, Austria

Project Group

Last Name	First Name	Status	Remarks
Bauer	Günther	University professor	
Heinrich	Helmuth	University professor	
Jantsch	Wolfgang	University professor	
Schäffler	Friedrich	University professor	
Thim	Hartwig	University professor	
Brunthaler	Gerhard	Associate professor	
Diskus	Christian	Associate professor	
Heiss	Wolfgang	Assistant professor	
Palmethofer	Leopold	Associate professor	
Springholz	Gunther	Associate professor	
Sitter	Helmut	Associate professor	
Bonanni	Alberta	Assistant professor	
Fromherz	Thomas	Assistant professor	
Kolmhofer	Erich	Assistant professor	
Lübke	Kurt	Assistant professor	retired Nov. 2003
Stangl	Julian	Assistant professor	
Andreev	Andrej	Assistant professor	
Kocher	Gudrun	Assistant professor	Partly FWF
Binder	Fritz	Technician	
Bräuer	Stephan	Technician	
Fuchs	Othmar	Technician	
Jägermüller	Josef	Technician	
Katzenmayer	Hans	Technician	
Nusko	Ekkehard	Electronics Engineer	
Vorhauer	Ernst	Electronics engineer	
Andreeva	Svetlana	Lab Technician	FWF-START
Halilovic	Alma	Lab Technician	½ paid by GME
Haslgrübler	Klaus	Lab Technician	½ paid by GME
Kainz	Ursula	Lab Technician	½ position
Firmberger	Johanna	Apprentice	

Last Name	First Name	Status	Remarks
Hingerl	Kurt	Guest researcher	Austrian Academy of Sciences + Company Profactor, until June 30
Stifter	David	Guest researcher	Company Profactor
Meduna	Mojmir	Guest Researcher	EC (SigeNET)
Andreev	Andrej	Post Doc	FWF
Zhong	Zhenyang	Post Doc	Finished 2003
Chen	Gang	Post Doc	FWF
Prinz	Adrian	Post Doc	OeNB/FWF
Roch	Thomas	Post Doc	
Abtin	Laurel	Ph.D. student	FWF
Achleitner	Joachim	Ph.D. student	
Berer	Thomas	Ph.D. student	FWF, Uni Linz
Böberl	Michaela	Ph.D. student	FWF-START
Gruber	Daniel	Ph.D. student	FWF, Uni Start
Hesse	Anke	Ph.D. student	EC, Brussels
Kaufmann	Erich	Ph.D. student	FWF-START
Lechner	Rainer	Ph.D. student	FWF
Lichtenberger	Herbert	Ph.D. student	FWF
Lugovyy	Dmytro	Ph.D. student	FWF
Malissa	Hans	Ph.D. student	FWF, WIMAUS
Montaigne-R.	Alberto	Ph.D. student	Eu-Project ISCE-MOCVD
Mühlberger	Michael	Ph.D. student	Finished Aug 2003
Novak	Jri	Ph.D. student	FWF, finished
Pillwein	Georg	Ph.D. student	FWF
Raab	Anneliese	Ph.D. student	FWF, finished 2003
Rehman-Khan	Aaliya	Ph.D. student	ÖAD
Roither	Jörgen	Ph.D. student	FWF
Schüllli	Tobias	Ph.D. student	EC, Brussels, finished 03
Schmidegg	Klaus	Ph.D. student	EU-Projekt ISCE-MOCVD
Schwarzl	Thomas	Ph.D. student	FWF
Söllinger	Walter	Ph.D. student	FWF
Wiesauer	Karin	Ph.D. student	FWF, finished 2003
Griesser	Stefan	Diploma student	finished 2003
Grydlik	Martyna	Diploma student	stipendat
Janecek	Stefan	Diploma student	
Hörmann	Thomas	Diploma student	
Kirchschlager	Raimund	Diploma student	
Lindner	Benjamin	Diploma student	
Pachinger	Dietmar	Diploma student	finished 2003
Rauter	Patrick	Diploma student	finished 2003
Roither	Jürgen	Diploma student	finished 2003
Söllinger	Walter	Diploma student	finished 2003

Last Name	First Name	Status	Remarks
Schwinger	Wolfgang	Diploma student	finished 2003
Simma	Matthias	Diploma student	
Wintersberger	Eugen	Diploma student	

Publications in Reviewed Journals

published 2003

1. M. Böberl, W. Heiss, T. Schwarzl, K. Wiesauer, G. Springholz, "Mid-infrared continuous-wave photoluminescence of lead salt structures up to temperatures of 190°C", Appl. Phys. Lett. **82**, 4065-4067 (2003).
2. G. Brunthaler, A. Prinz, and G. Bauer, "The role of quantum interference for the metallic state in high-mobility Silicon inversion layers" in "Physics of Semiconductors 2002", Proceedings of the 26th Int. Conf. on the Physics of Semiconductors, Eds. A.R. Long and J.H. Davies, Institut of physics, conference series No. 171, p. 161, Bristol (2003).
3. L. Diehl, S. Mentese, E. Müller, D. Grützmacher, H. Sigg, T. Fromherz, J. Faist, U. Gennser, Y. Campidelli, O. Kermarrec and D. Bensahel, "Strain compensated Si/SiGe quantum well and quantum cascade on Si_{0.5}Ge_{0.5} pseudosubstrates", Physica E **16**, 315-320 (2003).
4. T. Fromherz, G. Bauer, "Light from silicon: SiGe quantum cascade structures", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
5. G. Grabecki, J. Wrobel, T. Dietl, E. Papis, E. Kaminska, A. Piotrowska, A. Ratuszna, G. Sprinholz, G. Bauer, "Ballistic transport in PbTe-based nanostructures", Physica E **20**, 236 - 245 (2004).
6. A. Hesse, J. Stangl, V. Holy, G. Bauer, U. Denker, O.G. Schmidt, "Strained silicon above and below Ge islands", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
7. A. Hesse, J. Stangl, V. Holy, G. Bauer, O. Kirfel, E. Müller, D. Grützmacher, "Influence of capping on strain, composition and shape of SiGe islands", Mat. Sci. Eng. B **101**, 71-76 (2003).
8. S. Janecek, P. Granitzer, H. Krenn, "Influence of dipolar coupling on the magnetic phase diagram of few (111)-monolayer EuTe", Journal of Superconductivity Including Novel Magnetism **16/1**, 87 (2003).
9. H. Kepa, G. Springholz, T.M. Giebultowicz, K.I. Goldman, C.F. Majkrzak, P. Kacman, J. Blinowski, S. Holl, H. Krenn, G. Bauer, "Magnetic interactions in EuTe epitaxial layers and EuTe/PbTe superlattices", Phys. Rev. B **68**, 024419-1/16 (2003).
10. R.T. Lechner, T. Schüllli, V. Holy, G. Springholz, J. Stangl, A. Raab, T.H. Metzger, G. Bauer, "Ordering parameters of self-organized 3D quantum dot lattices determined by anomalous x-ray diffraction", Appl. Phys. Lett. **84**, 885-888 (2004).
11. R.T. Lechner, T. Schüllli, V. Holy, J. Stangl, A. Raab, G. Springholz, G. Bauer, "3D hexagonal versus trigonal ordering in self-organized PbSe quantum dot superlattices", Physica E **21**, 611-614 (2004).

12. H. Lichtenberger, M. Mühlberger, C. Schelling, F. Schäffler, "Transient-enhanced surface diffusion on natural-oxide-covered Si(001) templates during vacuum annealing", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
13. H. Lichtenberger, M. Mühlberger, F. Schäffler, "Transient-enhanced surface diffusion on native-oxide-covered Si(001) nano-structures during vacuum annealing", Appl. Phys. Lett. **82**, 3650-3652 (2003).
14. G.J. Matt, N. S. Sariciftci, T. Fromherz, "Anomalous charge transport behavior of Fullerene based diodes", Appl. Phys. Lett. **84**, 1570-1572 (2004).
15. M. Mühlberger, H. Malissa, N. Sandersfeld, W. Jantsch, F. Schäffler, A. Tyryshkin, S. Lyon, "High-mobility strained Si for spintronics applications", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
16. M. Mühlberger, C. Schelling, G. Springholz, F. Schäffler, "Step-bunching in SiGe layers and superlattices on Si(001)", Surface Science **532-535**, 721-726 (2003).
17. M. Mühlberger, C. Schelling, G. Springholz, F. Schäffler, J. Myslivecek, B. Voigtländer, P. Šmilauer, J. Krug, "Growth instabilities in Si/SiGe homo- and heteroepitaxy", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
18. J. Myslivecek, C. Schelling, F. Schäffler, G. Springholz, P. Šmilauer, J. Krug, B. Voigtländer, "Step bunching during Si(001) homoepitaxy caused by the surface diffusion anisotropy", Mat. Res. Soc. Symp. Proc. Vol. **749**, W1.8.1-W.1.8.6 (2003).
19. G. Pillwein, G. Brunthaler, G. Strasser, "Characterization of lateral quantum dots fabricated by e-beam lithography", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
20. G. Pillwein, A. Prinz, G. Brunthaler, P. E. Lindelof, J. Ahopelto, "Screening behavior of the two-dimensional metallic state in silicon-on-insulator structures", in "Physics of Semiconductors 2002", Proceedings of the 26th Int. Conf. on the Physics of Semiconductors, Eds. A.R. Long and J.H. Davies, Institut of physics, conference series No. 171, CD No. D121, Bristol (2003).
21. V.M. Pudalov, M.E. Gershenson, H. Kojima, G. Brunthaler, A. Prinz, G. Bauer, "Interaction effects in conductivity of Si inversion layers at intermediate temperatures", Phys. Rev. Lett. **91**, 126403/1-4 (2003).
22. A. Raab, G. Springholz, "Intermixing and shape transitions of PbSe quantum dots during overgrowth", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
23. A. Raab, G. Springholz, R.T. Lechner, "Growth temperature and coverage dependence of vertical and lateral ordering in self-assembled PbSe quantum-dot superlattices", Phys. Rev. B **67**, 165321-1/7 (2003).
24. P. Rauter, T. Fromherz, G. Bauer, L. Diehl, G. Dehlinger, H. Sigg, D. Grützmacher, H. Schneider, "Voltage-tunable, two-band mid-infrared detection based on Si/SiGe quantum-cascade injector structures", Appl. Phys. Lett. **83**, 3879 - 3881 (2003)
25. T.U. Schüllli, J. Stangl, Z. Zhong, R.T. Lechner, M. Sztucki, T.H. Metzger, G. Bauer, "Direct determination of strain and composition profiles in SiGe islands by anomalous x-ray diffraction at high momentum transfer", Phys. Rev. Lett. **90**, 066105-1/4 (2003)
26. G. Springholz, A. Raab, R.T. Lechner, V. Holy, "Dot size dependence of vertical and lateral ordering in self-organized PbSe/Pb_{1-x}Eu_xTe quantum dot superlattices", Appl. Phys. Lett. **82**, 799-801 (2003).
27. K. Wiesauer, G. Springholz, "Near-equilibrium strain relaxation and misfit dislocation interactions in PbTe on PbSe(001) heteroepitaxy", Appl. Phys. Lett. **83**, 5160-5162 (2003).

28. Z. Zhong, G. Chen, J. Stangl, Th. Fromherz, F. Schäffler, G. Bauer, "Two-dimensional lateral ordering of self-assembled Ge islands on patterned substrates", *Physica E* **21**, 588-591 (2004).
29. Z. Zhong, A. Halilovic, T. Fromherz, F. Schäffler, G. Bauer, "Two-dimensional periodic positioning of self-assembled Ge islands on prepatterned Si(001) substrates", *Appl. Phys. Lett.* **82**, 4779-4781 (2003).
30. Z. Zhong, A. Halilovic, M. Mühlberger, H. Lichtenberger, F. Schäffler, G. Bauer, "Laterally ordered Ge islands on pre-patterned Si(001) substrates", GMe annual report 2002, ISBN 3-901578-11-0 (2003).
31. Z. Zhong, A. Halilovic, M. Mühlberger, F. Schäffler, G. Bauer, "Ge island formation on stripe-patterned Si (001) substrates", *Appl. Phys. Lett.* **82**, 445-447 (2003).
32. Z. Zhong, A. Halilovic, M. Mühlberger, F. Schäffler, G. Bauer, "Positioning of self-assembled Ge islands on stripe-patterned Si (001) substrates", *J. Appl. Phys.* **93**, 6258-6264 (2003).
33. Z. Zhong, J. Stangl, F. Schäffler, G. Bauer, "Evolution of shape, height, and in-plane lattice constant of Ge-rich islands during capping with Si", *Appl. Phys. Lett.* **83**, 3695-3697 (2003).
34. A. Bonanni, D. Stifter, A. Montaigne-Ramil, K. Schmidegg, K. Hingerl, H. Sitter, "In situ spectroscopic ellipsometry of MOCVD-grown GaN compounds for on-line composition determination and growth control", *J. Cryst. Growth* **249**, 211-215 (2003).
35. A. Bonanni, K. Schmidegg, A. Montaigne-Ramil, H. Sitter, K. Hingerl, D. Stifter, "Virtual interface approximation model applied to spectroscopic ellipsometry for on-line composition determination of metal-organic chemical vapor deposition grown ternary nitrides", *J. Vac. Sci. Technol.* B21(4), 1825 (2003).
36. A. Kozanecki, V. Glukhanyuk, W. Jantsch, "High resolution spectroscopy of Er³⁺ ions in 6H SiC", *Mat. Sci. Eng. B105*, 169-174 (2003)
37. A. Kozanecki, V. Glukhanyuk, W. Jantsch, and B.J. Sealy, (invited), "Implantation Erbium Doping In 6H SiC For Optimum Optical Efficiency at 1.54 μm", *Proc. CAARI 2002 Denton*.
38. D. Kuritsyn, A. Kozanecki, H. Przybylinska, W. Jantsch, "Defect mediated and resonant optical excitation of Er³⁺ ions in silicon-rich silicon oxide", *MRS Symp. Proc.* **770**, 107 (2003).
39. D. Kuritsyn, A. Kozanecki, H. Przybylinska, W. Jantsch, "Defect mediated and resonant optical excitation of Er³⁺ ions in silicon-rich silicon oxide", *Appl. Phys. Lett.* **83**, 4160 (2003)
40. G. Kocher-Oberlehner, W. Jantsch, A. Ulyashin, L. Palmetshofer, "Hydrogen enhanced luminescence of Erbium doped Silicon", *Inst. of Phys. Conference Series Number 171*, A. R. Long and J H Davies (eds.), Publ.: Inst. of Phys. Publ.(Bristol UK and Philadelphia USA), ISBN-7503-0924-5 (2003).
41. G. Kocher-Oberlehner, W. Jantsch, L. Palmetshofer, A. Ulyashin, "On the Influence of Hydrogen on the Erbium-Related Luminescence in Silicon", *Appl. Phys. Lett.* **83**, 623-625 (2003).
42. G. Kocher-Oberlehner, W. Jantsch, L. Palmetshofer, A. Ulyashin, "Luminescence Enhancement by Hydrogenation of Si:Er,O", *Physica E* **16**, 347-350 (2003).
43. H. Sitter, A. Andreev, G. Matt, N.S. Sariciftci, "Hot wall epitaxial growth of highly ordered organic epilayers", *Synthetic Metals*, **138** (2003), 9-13.

44. K. Hingerl, L. Mao, V. Rinnerbauer, J. Schermer, V. Holý, “*Reflection and Transmission of Finite 2D Photonic Crystals*”, European Conference on Optical Communication, Ravenna, 2003.
45. K. Schmidegg, A. Bonanni, A. Montaigne Ramil, H. Sitter, “*In situ growth monitoring and on-line composition determination of MOCVD GaN by spectroscopic ellipsometry*”, GMe annual report 2002, ISBN 3-901578-11-0 (2003).
46. L. D. Sun M. Hohage P. Zeppenfeld, R. E. Balderas-Navarro and K. Hingerl, “*Enhanced Optical Sensitivity to Adsorption due to Depolarization of Anisotropic Surface States*”, Phys. Rev. Lett. 90, (2003), 106104
47. L. D. Sun, M. Hohage, P. Zeppenfeld, R. Balderas- Navarro and K. Hingerl, “*Surface induced d-band anisotropy on Cu (110)*”, Surf. Sci. Lett. 527, L184, (2003)
48. M. Böberl, W. Heiss, T. Schwarzl, K. Wiesauer, G. Springholz, “*Midinfrared continuous-wave photoluminescence of lead-salt structures up to temperatures of 190 °C*”, Appl. Phys. Lett.82, 4065 (2003).
49. W. Heiss, M. Böberl, T. Schwarzl, G. Springholz, J. Fürst, H. Pascher, “*Applications of lead-salt microcavities for mid-infrared devices*”, IEE-Proc.- Optoelectronics 150, 332 (2003).
50. Z. Wilamowski, W. Jantsch, N. Sandersfeld, M. Mühlberger, F. Schäffler, S. Lyon, “*Spin relaxation and g-factor of two-dimensional electrons in Si/SiGe quantum wells*”, Physica E 16, 111-120 (2003).

Submitted 2003 / in print

1. G. Brunthaler, B. Lindner, G. Pillwein, S. Griesser, M. Prunnila, J. Ahopelto, “*Two-Dimensional Metallic State in Silicon-on-Insulator Structures*”, Physica E, in print (2004).
2. W. Heiss, M. Böberl, T. Schwarzl, G. Springholz, J. Fürst, H. Pascher, “*Applications of lead-salt microcavities for mid-infrared devices*”, in Proc. IEEE- Optoelectronics, in print.
3. W. Heiss, R. Kirchschlager, G. Springholz, Z. Chen, M. Debnath, Y. Oka, “*Magnetic polaron induced near-bandgap luminescence in epitaxial EuTe*”, Phys. Rev. B, submitted.
4. R. Kirchschlager, W. Heiss, R.T. Lechner, G. Springholz, “*Energy band gap hysteresis loops in metamagnetic EuSe epilayers with effective g-factors up to 18000*”, Appl. Phys. Lett., submitted.
5. R.T. Lechner, T.U. Schüllli, A. Wildes, R. Cubitt, D. Lott, A. Schreyer, G. Springholz, G. Bauer, “*Magnetic properties of metamagnetic EuSe grown by molecular beam epitaxy*”, ILL Annual Report, in print.
6. M. Meduna, J. Novak, G. Bauer, V. Holy, C.V. Falub, E. Müller, D. Grützmaker, Y. Campidelli, O. Kermarrec, D. Bensahel, “*Annealing studies of high Ge composition Si/SiGe multilayers*”, Z. Kristallogr. **219**, in print.
7. T.U. Schüllli, M. Sztucki, T.H. Metzger, R.T. Lechner, J. Stangl, G. Springholz, G. Bauer, “*Strain determination by complementary anomalous x-ray diffraction*”, Phys. Rev. B, in print.
8. T.U. Schüllli, R.T. Lechner, J. Stangl, G. Springholz, G. Bauer, S. Dhesi, P. Bencok, “*Soft x-ray magnetic scattering from ordered EuSe nanoislands*”, Appl. Phys. Lett., in print.

9. J. Stangl, V. Holý, G. Bauer, "Structural properties of self-organized semiconductor nanostructures", Rev. Mod. Phys., in print.
10. A.M. Tyryshkin, S.A. Lyon, W. Jantsch, F. Schäffler, "Spin Manipulation of Free 2-Dimensional Electrons in Si/SiGe Quantum Wells", Phys. Rev. Lett., submitted.
11. K. Wiesauer, G. Springholz, "Critical thickness and strain relaxation in high misfit heteroepitaxial systems: results for $PbTe_{1-x}Se_x$ on PbSe (001)", Phys. Rev. B, in print.
12. Z. Zhong, A. Halilovic, H. Lichtenberger, F. Schäffler, G. Bauer, "Growth of Ge islands on prepatterned Si(001) substrates", Physica E (Proceedings ESPS-NIS Conference, Stuttgart 2003), submitted.
13. A.M. Tyryshkin, S.A. Lyon, W. Jantsch, F. Schäffler, "Spin Manipulation of free 2-dimensional electrons in Si/SiGe quantum wells", cond-mat/0304284, submitted.
14. F. Quochi, F. Cordella, R. Orru, J. E. Communal, P. Verzeroli, A. Mura, G. Bongiovanni, A. Andreev, H. Sitter, N. S. Sariciftci, "Laser action in self-organized para-sexiphenyl single nanocrystals grown by Hot Wall Epitaxy", Appl. Phys. Lett., submitted.
15. H. Malissa, W. Jantsch, M. Mühlberger, F. Schäffler, Z. Wilamowski, M. Draxler, P. Bauer, "Anisotropy of g-factor and ESR linewidth in modulation doped SiGe quantum wells", Appl. Phys. Lett., submitted.
16. J. Fürst, H. Pascher, T. Schwarzl, M. Böberl, G. Springholz, G. Bauer, W. Heiss, "Continuous wave emission from a mid-infrared IV-VI vertical-cavity surface-emitting laser", Appl. Phys. Lett., in print.
17. J. Fürst, T. Schwarzl, M. Böberl, H. Pascher, G. Springholz, W. Heiss, "Continuous wave and pulsed emission from a vertical-cavity surface-emitting laser in the 8 mm mid-infrared spectral range", IEEE J. of Quantum Electronics, submitted.

Presentations

Invited Talks:

1. G. Bauer, "Nanotomography of Semiconductor Quantum Dots", European Vacuum Congress, Berlin, Germany, 23. - 26. June 2003.
2. J. Stangl, A. Hesse, T. Roch, V. Holy, G. Bauer, T. Schuelli, T.H. Metzger, "Structural investigation of semiconductor nanostructures by x-ray techniques", European Materials Research Society, Strasbourg, France, June 2003.
3. F. Schäffler, "Heteroepitaxial Growth Instabilities on Si(001) and their Modelling by Kinetic Growth Instabilities", 5th Workshop on MBE and VPE, e-MRS Fall Meeting, Warsaw 17. Sept. 2003.
4. G. Springholz, "Ordering and shape transitions in self-organized PbSe quantum dot superlattices", invited talk at the Fall Meeting of the Materials Research Society, Boston, USA, 28. Nov. - 2. Dec. 2003.
5. G. Springholz, "Size effects in self-organized ordering of PbSe/PbEuSe quantum dot superlattices", invited talk at the 5th International Conference on Epitaxial Semiconductors on Patterned Substrates and Novel Indexed Surfaces (ESPS-NIS), Stuttgart, Germany, 13.-16. Sept. 2003.
6. G. Springholz, "Self-Organized Vertical and Lateral Ordering in Quantum Dot Superlattices", invited talk at the Gordon Research Conference on Thin Film and Crystal Growth Mechanisms, Mount Holyoke, USA, 22.-27. June 2003.

7. J. Stangl, “*High resolution x-ray scattering from self-organized nanostructures*”, EMRS Fall Meeting, Warsaw, Poland, 15. Sept. 2003.
8. J. Stangl, “*Structural investigation of semiconductor Nanostructures by X-ray diffraction*”, ÖPG Jahrestagung, Salzburg, Austria, 01. Oct. 2003.
9. W. Heiss, M. Böberl, T. Schwarzl, J. Fürst, H. Pascher, K. Wiesauer, G. Springholz, “*IV-VI compound semiconductor VCSELs*”, The 11th International Conference on Narrow Gap Semiconductors, Buffalo, USA (June 16-20, 2003).

Seminar Talks:

1. F. Schäffler, “Transport and Spin Properties of 2DEGs in Strained Si”, Walter-Schottky-Institut der TU München, 01. July 2003
2. F. Schäffler, “*Kinetic and Strain-Induced Growth Instabilities*”, University of Milano-Bicocca, Milano, 17. July 2003
3. F. Schäffler, “*Transport and Spin Properties of 2DEGs in Strained Si*”, Politecnico di Milano-Como, Como, 18. July 2003
4. F. Schäffler, “*Quanten-Dot Bauelemente*”, Mikroelektronik-Tagung, Wien, 01. Oct. 2003
5. F. Schäffler, “*Silizium-basierende Heterostrukturen: von elementaren Materialeigenschaften zu Hochleistungsbauelementen*”, Universität Erlangen, 18. Nov. 2003
6. W. Heiss, M. Böberl, T. Schwarzl, G. Springholz, J. Fürst, H. Pascher, “*Funktionelle optische Mikroresonatoren*”, Physikerkolloquium an der Gesamthochschule in Paderborn, Germany (February 6th 2003).

Conference presentations (talks and posters):

1. M. Böberl, T. Schwarzl, W. Heiss, G. Springholz, Z. Wang, K. Reimann, M. Woerner, “*Two-color mid-infrared pump-probe studies of IV-VI microcavity lasers*”, poster at the 11th International Conference on Modulated Semiconductor Structures, Nara, Japan, 14. -18. Jul. 2003.
2. G. Brunthaler, B. Lindner, G. Pillwein, S. Griesser, M. Prunnila, J. Ahopelto, “*Two-Dimensional Metallic State in Silicon-on-Insulator Structures*”, poster at the 15th Int. Conf. on Electronic Properties of Two-Dimensional Systems, Nara, Japan, 14. - 18. July 2003.
3. T. Fromherz, G. Bauer, “*Light from Silicon: SiGe Quantum Cascade Structures*”, GME Forum 2003, Vienna, Austria, 10. – 11. April 2003.
4. T. Fromherz, P. Rauter, L. Diehl, G. Dehlinger, H. Sigg, D. Grützmacher, G. Bauer, “*Voltage-tuneable QWIPs Based on Si/SiGe Cascade Injector Structures for Two Colour Detection*”, 7th International Conference on Intersubbandtransitions in Quantum wells (ITQW7), Evolène, Switzerland, 1. – 5. Sept. 2003.
5. T. Fromherz, P. Rauter, L. Diehl, G. Dehlinger, H. Sigg, D. Grützmacher, G. Bauer, “*SiGe cascade injector structures for voltage-tuneable, two-colour detection in the 3-6 μ m spectral range*”, 11th International Conference on Modulated Semiconductor Structures (MSS11), Nara, Japan, 14. – 18. July 2003.
6. G. Grabecki, J. Wróbel, T. Dietl, E. Papis, E. Kamiska, A. Piotrowska, G. Springholz, G. Bauer, “*Transport in PbTe based nanostructures*”, invited talk at the

- 11th International Conference on Narrow Gap Semiconductors and Related Small Energy Phenomena, Physics and Applications, Buffalo, USA, 16. - 20. June 2003.
7. W. Heiss, T. Schwarzl, M. Böberl, M. Kaufmann, G. Springholz, M. Aigle, J. Fürst, H. Pascher, "*IV-VI Mid-Infrared Vertical Cavity Surface Emitting Lasers*", invited talk at the 11th International Conference on Narrow Gap Semiconductors and Related Small Energy Phenomena, Physics and Applications, Buffalo, USA, 16. - 20. June 2003.
 8. S. Janecek, P. Granitzer, H. Krenn, "*Spin Patterns and Phase Diagrams of few (111)-monolayer EuTe including shape anisotropy*", poster at the ICM 2003, Rome, Aug. 2003.
 9. R. Kirchschlager, W. Heiss, J. Achleitner, G. Springholz, Z. Chen, M. Debnath, and Y. Oka "*Large Stokes shift in magnetic EuTe epitaxial layers*", poster at the 2th European Workshop on Molecular Beam Epitaxy, Bad Hofgastein, Austria, 16. - 19. Feb. 2003.
 10. R. Kirchschlager, W. Heiss, R.T. Lechner, G. Springholz, "*Peculiar photoluminescence transitions in Eu based magnetic superlattices*", poster at the 11th International Conference on Modulated Semiconductor Structures, Nara, Japan, 14. -18. Jul. 2003.
 11. R. T. Lechner, A. Hallbauer, T. Schwarzl, and G. Springholz, "*Molecular beam epitaxy of PbSe_{1-x}Te_x for strain engineering in IV-VI semiconductor heterostructures*", poster at the GME Forum 2003, TU-Wien, Austria, 10. - 11. Apr. 2003.
 12. R.T. Lechner, T. Schüllli, S. Dhési, J. Stangl, G. Springholz, G. Bauer, "*Soft x-ray magnetic scattering from a single EuSe quantum dot layer*", International Conference on Narrow Gap Semiconductors, Buffalo, USA, 16. -19. June 2003.
 13. R.T. Lechner, T. Schüllli, V. Holy, J. Stangl, A. Raab, G. Springholz, G. Bauer, "*3D hexagonal versus trigonal ordering in self-organized PbSe quantum dot superlattices*", Int. Conf. Modulated Semiconductor Structures 11, Nara, Japan, 14. - 18. July 2003.
 14. R.T. Lechner, T. Schüllli, V. Holy, J. Stangl, G. Springholz, G. Bauer, "*3D hexagonal versus trigonal ordering in self-organized PbSe quantum dot superlattices*", poster at the 11th International Conference on Modulated Semiconductor Structures, Nara, Japan, 14. -18. Jul. 2003.
 15. R.T. Lechner, T.U. Schüllli, J. Stangl, G. Springholz, S. Dhési, P. Bencok and G. Bauer, "*Magnetic properties of self org,anized EuSe quantum dots*", poster at the 11th International Conference on Modulated Semiconductor Structures, Nara, Japan, 14. -18. Jul. 2003.
 16. R. T. Lechner, G. Springholz, T. Schüllli, H. Krenn, G. Bauer, D. Lott, A. Schreyer, "*Molecular beam epitaxy, structural and magnetic properties of EuSe/PbSeTe and EuSe/EuTe superlattices*", 12th European Workshop on Molecular Beam Epitaxy, Bad Hofgastein, Austria, 16. - 19. Feb. 2003.
 17. H. Lichtenberger, M. Mühlberger, C. Schelling, S. Senz, F. Schäffler "*Transient-enhanced Surface diffusion on Natural-Oxide-Covered Si(001) Templates during Vacuum Annealing*", talk at the ICS13 2003, Santa Fe (NM), Mar. 2003.
 18. H. Lichtenberger, M. Mühlberger, C. Schelling, S. Senz, F. Schäffler "*Transient-enhanced Surface diffusion on Natural-Oxide-Covered Si(001) Templates during Vacuum Annealing*", poster at the Euro-MBE 2003, Bad Hofgastein, Feb. 2003.

19. H. Lichtenberger, M. Mühlberger, C. Schelling, S. Senz, F. Schäffler “*Transient-enhanced Surface diffusion on Natural-Oxide-Covered Si(001) Templates during Vacuum Annealing*”, talk at the ESPS-NIS 2003, Stuttgart, Oct. 2003.
20. H. Lichtenberger, M. Mühlberger, C. Schelling, S. Senz, F. Schäffler “*Transient-enhanced Surface diffusion on Natural-Oxide-Covered Si(001) Templates during Vacuum Annealing*”, poster at the Gme-Forum 2003, Vienna, Apr. 2003.
21. M. Mühlberger, H. Malissa, N. Sandersfeld, W. Jantsch, F. Schäffler, A. Tyryshkin, S. Lyon “*High-Mobility Strained Si for Spintronics Applications*”, poster at the Gme-Forum 2003, Vienna, Apr. 2003.
22. M. Mühlberger, H. Malissa, N. Sandersfeld, W. Jantsch, F. Schäffler, A. Tyryshkin, S. Lyon “*Modulation-doped Si/SiGe quantum well for spintronics*”, talk at the Euro-MBE 2003, Bad Hofgastein, Feb. 2003.
23. M. Mühlberger, H. Malissa, N. Sandersfeld, W. Jantsch, F. Schäffler, A. Tyryshkin, S. Lyon “*Modulation-doped Si/SiGe quantum well for spintronics*”, talk at the ICSI3 2003, Santa Fe (NM), Mar. 2003.
24. M. Mühlberger, C. Schelling, G. Springholz, F. Schäffler, J. Myslivecek, B. Voigtländer, P. Smilauer, J. Krug “*Growth instabilities in Si/SiGe Homo- and Heteroepitaxy*”, poster at the Gme-Forum 2003, Vienna, Apr. 2003.
25. Z. Zhong, A. Halilovic, M. Mühlberger, H. Lichtenberger, F. Schäffler, G. Bauer “*Mask-free two-dimensional periodic positioning of self-assembled Ge islands on pre-patterned Si(001) substrates*”, talk at the ICSI3 2003, Santa Fe (NM), Mar. 2003.
26. A. Raab, G. Springholz “*Intermixing and shape transitions of PbSe quantum dot during overgrowth*”, poster at the 12th European Workshop on Molecular Beam Epitaxy, Bad Hofgastein, Austria, 16. - 19. Feb. 2003.
27. A. Raab, G. Springholz, “*Intermixing and shape transitions of PbSe quantum dot during overgrowth*”, poster at the GME Forum 2003, TU-Wien, Austria, 10. - 11. Apr. 2003.
28. T. Schwarzl, M. Böberl, J. Fürst, W. Heiss, H. Pascher, G. Springholz, “*Comparison of MBE grown IV-VI microcavity lasers for the mid-infrared with active regions of different dimensionality*”, poster at the 12th European Workshop on Molecular Beam Epitaxy, Bad Hofgastein, Austria, 16. - 19. Feb. 2003.
29. T. Schwarzl, M. Böberl, J. Fürst, W. Heiss, H. Pascher, G. Springholz “*Comparison of MBE grown IV-VI microcavity lasers for the mid-infrared with active regions of different dimensionality*”, poster at the GME Forum 2003, TU-Wien, Austria, 10. - 11. Apr. 2003.
30. A. Hallbauer, T. Schwarzl, R. T. Lechner and G. Springholz, “*Molecular beam epitaxy of PbSe_{1-x}Te_x for strain engineering in IV-VI semiconductor heterostructures*”, poster at the 12th European Workshop on Molecular Beam Epitaxy, Bad Hofgastein, Austria, 16. - 19. Feb. 2003.
31. K. Wiesauer and G. Springholz, “*Determination of the critical cluster size and diffusion length in PbTe (111) MBE*” talk at the 12th European Workshop on Molecular Beam Epitaxy, Bad Hofgastein, Austria, 16. - 19. Feb. 2003.
32. Z. Zhong, G. Chen, H. Lichtenberger, F. Schäffler, G. Bauer, “*Growth of Ge islands on prepatterned Si (001) substrates*”, 5th International Conference on Epitaxial Semiconductors on Patterned Substrates and Novel Indexed Surfaces (ESPS-NIS), Stuttgart, Germany, 13. - 16. Sept. 2003.

33. Z. Zhong, G. Chen, J. Stangl, Th. Fromherz, F. Schäffler, G. Bauer, “*Three-dimensional ordering of self-assembled Ge islands*”, Fall Meeting, Materials Research Society Boston, USA, 1. - 5. Dec. 2003.
34. Z. Zhong, G. Chen, J. Stangl, T. Fromherz, F. Schäffler, G. Bauer, “*Two dimensional lateral ordering of self-assembled Ge islands on patterned substrates*”, 11th International Conference on Modulated Semiconductor Structures (MSS11), Nara, Japan, 14. – 18. July 2003.
35. A. Andreev, H. Hoppe, H. Sitter, N.S. Sariciftci, R. Resel, D.-M. Smilgies “*Crystalline nano-wires of para-sexiphenyl grown by Hot Wall Epitaxy*”, poster at the Nanoscience & Technology Conference, Groningen, Netherlands (May 18-21 2003).
36. A. Andreev, H. Sitter, N. S. Sariciftci, A. Kadashchuk, C. Winder, R. Resel, D.-M. Smilgies “*Anisotropic Optoelectronic Properties of Self-Assembled Nano-Wires of Para-sexiphenyl Grown by Hot Wall Epitaxy*”, poster at the GME Forum 2003, Vienna, Austria (April 10-11 2003).
37. A. Andreev, H. Sitter, S. Sariciftci, R. Resel, D.-M. Smilgies “*Growth mechanism of well ordered organic nano-wires*”, talk at the 12th Euro-MBE Workshop, Bad Hofgastein, Austria (February 16-19, 2003).
38. A. Yu. Andreev, H. Sitter, C. Winder, H. Hoppe, S. Sariciftci, R. Resel, D.-M. Smilgies “*Highly ordered thin film structures based on para-sexiphenyl*”, poster at the E-MRS 2003 Spring Meeting, Strasbourg, France (June 10-17 2003).
39. A. Andreev, C. Teichert, G. Hlawacek, H. Hoppe, R. Resel, D.-M. Smilgies, H. Sitter, N. S. Sariciftci “*Anisotropic properties of self-assembled nano-wires of para-sexiphenyl grown by Hot Wall Epitaxy*”, poster at the Informationstagung Mikroelektronik 2003, Vienna, Austria (Oktober 1-2 2003).
40. M. Böberl, T. Schwarzl, W. Heiss, G. Springholz, Z. Wang, K. Reimann, M. Wörner, “*Femtosecond dynamics of lead-salt vertical-cavity surface-emitting mid-infrared lasers*”, Conference on Lasers and Electro-Optics/Europe (CLEO Europe 2003), Munich, Germany (June 22-27, 2003).
41. M. Böberl, T. Schwarzl, W. Heiss, G. Springholz, Z. Wang, K. Reimann, M. Wörner, “*Two-color mid-infrared pump-probe studies of IV-VI microcavity lasers*”, The 11th International Conference on Modulated Semiconductor Structures (MSS 11), Nara, Japan (July 14-18, 2003).
42. A. Hallbauer, T. Schwarzl, R. T. Lechner and G. Springholz, “*Molecular beam epitaxy of PbSe_{1-x}Tex for strain engineering in IV-VI semiconductor heterostructures*”, 12th EURO-MBE Workshop, Bad Hofgastein, Austria (February 16-19, 2003).
43. T. Schwarzl, M. Böberl, J. Fürst, W. Heiss, H. Pascher, G. Springholz, “*Comparison of IV-VI microcavity lasers for the mid-infrared with active regions of different dimensionality*”, Conference on Lasers and Electro-Optics/Europe (CLEO Europe 2003), Munich, Germany (June 22-27, 2003)
44. T. Schwarzl, M. Böberl, J. Fürst, W. Heiss, H. Pascher, G. Springholz, “*Comparison of MBE grown IV-VI microcavity lasers for the mid-infrared with active regions of different dimensionality*”, 12th Euro-MBE Workshop, Bad Hofgastein, Austria (February 16-19, 2003).

Patent

1. J. Zarbakhsh, K. Hingerl, "Anordnung von dielektrischen Strukturen innerhalb eines Mediums", Pat. No. 17243.0-P832-54, filed by PHOTEON Technologies GmbH (2003).

Doctor's Theses

Finished in 2003:

1. Dipl. Phys. Tobias Schüllli
"Anomalous x-ray diffraction from semiconductor nanostructures"
2. Dipl. Ing. Karin Wiesauer
"Dislocation structures in epitaxial IV-VI semiconductor heterostructures"
3. Dipl. Ing. Anna Elisabeth Raab
"Investigation of PbSe quantum dot growth on single layers and in quantum dot superlattices"
4. Dipl. Ing. Michael Mühlberger
"Silicon-based heterostructures: growth, modulation-doping and spin properties"

Current works:

1. M.Sc. Laurel Abtin
"STM investigation on self-assembled IV-VI semiconductor nanostructures"
2. Dipl. Ing. Thomas Berer
"Electronic and spin properties of Si/SiGe heterostructures"
3. Dipl. Ing. Daniel Gruber
"Si/SiGe Heterostructure Devices for Spintronic Applications"
4. Dipl. Phys. Anke Hesse
"Strukturelle Untersuchungen an Halbleiternanostrukturen"
5. Mag. Rainer T. Lechner
"Herstellung und Charakterisierung von EuSe-Nanostrukturen"
6. Dipl. Ing. Herbert Lichtenberger
"Kinetic and strain-induced self-organization of SiGe heterostructures"
7. M.Sc. Dmytro Lugovyy
"Investigation of vertical and lateral ordering in self-organized PbSe quantum dot superlattices"
8. Mag. Jiri Novak
"Untersuchung der strukturellen Eigenschaften von Quantenpunkten"
9. Dipl. Ing. Georg Pillwein
"Elektrische Untersuchungen von Quanteneffekten an Nanostrukturen"
10. M.Sc. Aaliya Rehman Khan
"Growth and structural characterisation of Si/SiGe hetero- and nanostructures"

Diploma Theses

Finished in 2003:

1. Stefan Griesser
"Magnetowiderstandsmessungen des zweidimensionalen metallischen Zustandes in Silizium-Feldeffekttransistoren bei tiefen Temperaturen"
2. Wolfgang Schwinger
"Transmissionselektronenmikroskopie an Halbleiter-Nanostrukturen" (Lehramt Physik)
3. Wolfgang Schwinger
"Epitaxial Overgrowth of Fullerenes on Si (100)"
4. Dietmar Pachinger
"High Mobility Si/SiGe Heterostructures for Spintronic Applications"
5. Patrick Rauter
"Intraband Absorption and Photospectroscopy of SiGe Quantum Cascades"

Current works:

1. Martyna Grydlik
"Si/SiGe resonant cavity enhanced, tunable mid-infrared quantum well detectors."
2. Stefan Janecek
"Simulation of the magnetic order of few-monolayer-(111)-EuTe in oblique magnetic fields"
3. Mathias Simma
"Photoleitungsuntersuchungen an Quantenpunkten"
4. Benjamin Lindner
"Metall-Isolator-Übergang in zweidimensionalen Siliziumstrukturen"
5. Eugen Wintersberger
"Röntgenbeugung und -reflexion an Si/SiGe/GaAs Hetero- und Nanostrukturen"
6. Thomas Hörmann
"Modellrechnungen und Auswertungen zum Metall-Isolator-Übergang in zweidimensionalen Halbleiterstrukturen"

Cooperations

1. Academy of Sciences, Bratislava, Slovakia
2. Aixtron, Aachen, Deutschland
3. Akademie der Wissenschaften, Warschau, Polen
4. AMS Unterpremstätten, Österreich
5. Balzers (Unaxis), Trübach, Schweiz
6. Bosch (Stefan Holl), Linz
7. CENG Grenoble, France
8. CNRS-CRMC2-Marseille, France
9. Daimler Benz Reserach Laboratories, Dr. Presting, Dr. König, Ulm

10. DESY, Hasylab, Hamburg, Deutschland
11. E+E Electronic GmbH, Engerwitzdorf, Österreich
12. ELETTRA, Trieste, Italy
13. ESRF Grenoble, France
14. ETH, Zürich, Swiss
15. FOM Institute Rijnhuizen, Niederlande
16. FORTH, Crete, Greece
17. Politecnico Milano
18. Fraunhofer-Institut (IAF) Freiburg (Chiptechnologie), Deutschland
19. Fraunhofer-Institut für Physikalische Meßtechnik (Freiburg, Deutschland)
20. Heriot Watt University, Edinburgh, Scotland
21. High Magnetic Field Lab., Grenoble, France
22. INFINEON Villach, Österreich
23. INSA, Lyon, France
24. Inst. f. Experimentalphysik I, Universität Bayreuth, Deutschland
25. Institut für Festkörperelektronik, TU Wien
26. Institute for Physics of Microstructures RAS, 603600 Nizhny Novgorod, Russland
27. Institute of Physics, Polish Academy of Sciences, Warschau, POLEN
28. Ioffe Physico-Technical Institute RAS, 194021 St.Petersburg, Russland
29. KEBA, Ing.G.Krippner, Linz, Österreich
30. Lebedev Institut, Russian Academy of Sciences, Moskau, Russland
31. Masaryk University, Brno, Czech Republic
32. Charles University, Prague, Czech Republic
33. Max-Born Institut für Nichtlineare Optik, Berlin, Germany
34. Max-Planck Institut für Festkörperforschung, Stuttgart
35. MIT, Cambridge, MA, USA
36. Nanoelectronics Research Center, University of Glasgow, Scotland
37. NIST, Gaithersburg, MD, USA
38. North Carolina State University, NC, USA
39. Ørsted Institut, Kopenhagen, Dänemark
40. Paul Scherrer Institut, Villigen, Schweiz
41. Philips Analytics, Almelo, Niederlande
42. Physics Department, Cornell University
43. Profactor, Steyr, Upper Austria
44. Purdue University, Lafayette, IN, USA
45. Sektion Physik, Ludwig-Maximilians Universität München
46. Sentech, Berlin

47. Siemens München, Zentrale Technik, Bereich Halbleiter
48. ST Microelectronics, Crolles, Grenoble
49. TASC Triest, Italy
50. Thomson, Paris, France
51. Tohoku University, Sendai, Japan
52. TU Berlin, Institut für Festkörperphysik, Deutschland
53. TU-München (Mikrowellentechnik), Deutschland
54. Unipress, High Pressure Research Center, Polish Academy of Sciences, Warschau
55. Universita Padova, Italia
56. Universität Bayreuth, Experimentalphysik I, Bayreuth, Germany
57. Universität Bremen, Deutschland
58. Universität Graz, Institut für Experimentalphysik
59. Universität Paderborn, Deutschland
60. Universität Potsdam, Deutschland
61. Universität Würzburg, Deutschland
62. Université de Montpellier, France
63. Universiteit Instelling, Antwerpen, Niederlande
64. University of Erlangen-Nürnberg, D-91058 Erlangen, Deutschland
65. University of Lund, Solid State Physics, Lund, Sweden
66. University of Maryland, MD, USA
67. University of Southampton, England
68. University of Warwick, Coventry, England
69. Van der Waals-Zeeman Institute, University of Amsterdam, NL
70. VOEST ALPINE, Dr.Angerer, Linz
71. Walter Schottky Institut, TU München, Deutschland