

ANNUAL REPORT *JAHRES- BERICHT*

20
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FACTS & FIGURES: PDI PUBLICATIONS 2024

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Takagaki, Y.,

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M. Albrecht,

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PHD THESES

- Nicolai, Lars
Interface Tomography of III-V Semiconductor Heterostructures
Humboldt-Universität zu Berlin
- Oliva, Miriam
Photoluminescence Intensity and Internal Quantum Efficiency of Ordered Arrays of Arsenide and Nitride Nanowire Heterostructures
Technische Universität Berlin

MASTER THESES

- Jose, Rose Mary
Control improvement in large-area top-down GaN nanowire fabrication
Technische Universität Ilmenau
- Kassa, Atekelte Abebe
Structural and Magneto-Transport Properties of Two-Dimensional Fe₅GeTe₂ and Fe-3GaTe₂ Ferromagnetic Films
Technische Universität Darmstadt

STUDENTS WORKING ON MASTER THESIS

- Karadag, Murat
Monte Carlo simulations
- Notarangelo, Adriano
Molecular beam epitaxy of (Al,Sc)N/GaN core-shell nanowires

VISITOR SEMINARS

Date	Speaker	Title
27 th January 2025	Dr. Alexander Tselev, CICECO-Aveiro Institute of Materials, Department of Physics, University of Aveiro, Portugal	Scanning Probe Microscopy of Functional Materials
7 th January 2025	Dr. Jit Sarkar, Fritz Haber Institute of Max-Planck Society	Coherent Light Control of the Metastable Hidden Phase in TaS ₂ : Controlling phase-transition at ultrashort timescale
6 th December 2024	Dr. Renato Juliano Martins, CEO and founder of Flatlight	Exploring Metasurfaces for applications in Industry
5 th December 2024	Prof. Roman Gröger, Institute of Physics of Materials, Czech Academy of Sciences	Nucleation of threading dislocations in atomistic simulations of strained layer epitaxy of III-nitride layers
27 th November 2024	Dr. Avishek Chowdhury and Dr. Dominik Berndt, Zurich Instruments	Squeeze out more of your noisy measurements
25 th November 2024	Huaiyu Chen, Synchrotron Radiation Research Division, Lund University	Strain analysis using Bragg coherent diffraction imaging
12 th November 2024	Dr. Tetsuomi Sogawa, NTT Science and Core Technology Laboratory Group, Atsugi, Japan	NTT's recent activities related to IOWN (Innovative Optical and Wireless Network) and quantum technology
20 th September 2024	Dr. Raffaella Calarco, Research Director at CNR-IMM unit Rome, Italy	Phase Change Materials for Reliable Flexible Memory
30 th July 2024	Prof. Gonzalo Usaj, CONICET Instituto Balseiro and Centro Atómico Bariloche, CNEA	A synchronized dance between exciton-polaritons and cavity phonons
29 th July 2024	Prof. Karen M. Gambaryan, Department of Physics of Semiconductors and Microelectronics, Yerevan State University	Graded Composition Double Quantum Dots: Nucleation Features, Characterization and Application for New Generation Nano-Optoelectronic Devices
8 th July 2024	Prof. LiuWen Chang, National Sun Yat-sen University, Taiwan	Electro-epitaxy of metals and oxide semiconductors using a combinatorial substrate approach
1 st July 2024	Dr. Sebastian Heeg, Junior Research Group leader at Humboldt University	Strain fingerprinting excitons in 2D materials and how to get a Raman spectrum of surfaces and thin films

29 th May 2024	Prof. Oscar Dubon, Materials Science and Engineering and Faculty Scientist of Berkeley Lab	Unusual properties of G-monochalcogenide van der Waals semiconductors
22 nd April	Dr. Alejandro Fainstein, Professor at Centro Atómico Bariloche and Instituto Balseiro in Bariloche	Exciton-polariton Continuous Time Crystal with an Optomechanical Clock
5 th February 2024	Dr. Wouter Jolie, Junior Research group leader at University Cologne	Confining correlated states in single-layer MoS ₂
29 th January 2024	Prof. Mathias Kläui, University Mainz	Topological Spin Structures & Spin-Orbitronics in 2D: from van der Waals systems to multilayers
22 nd January 2024	Dr. Lucia Aballe, ALBA-Spain	Synchrotron magnetic microscopies for 2D materials: much more than images
16 th January 2024	Prof. Jaroslav Fabian, University Regensburg	Spintronics with 2D materials
15 th December 2024	Prof. Sergio Valenzuela, ICN2 Barcelona	Designer van der Waals Heterostructures for Spintronic Applications
11 th December 2023	Prof. Danielle Hickey, Assistant Professor at Pennsylvania State University	Understanding Atomic Structures and Properties Using Aberration-Corrected Transmission Electron Microscopy
7 th December 2023	Dr. Gaia Tomasello, Editor in Chief for Advanced Electronics Materials	The use of Generative Artificial Intelligence tools in scientific writing and publishing with Wiley
4 th December 2023	Dr. Clemens von Korff Schmising, Max Born Institute Berlin	Ultrafast magnetization dynamics probed by transient spectroscopy in the extreme ultraviolet spectral range: recent results and prospects for 2D materials
24 th November 2023	Dr. Arnaud Gloppe, CNRS & University of Strasbourg	Optomechanics of a suspended magnetic van der Waals membrane
23 rd October 2023	Prof. Nadire Nayir, Assistant Professor at Istanbul Technical University and Pennsylvania State University	Low-Dimensional Advanced Materials by Computational Modeling, Simulation and Theory: From Atomic Properties to Emergent Functionalities
19 th October 2023	Dr. Simone Zanotto, Researcher at Nanoscience Institute Pisa	Membrane metasurfaces: from high speed modulation to chiral coherent absorption

BUDGET SUMMARY

Fiscal year	2024 (actual amount)	2025 (budgeted amount 31.01.2025)
	k€	k€
Revenues		
Allocations	12,408.5	11,278.6
Earnings	13.0	60.0
Sum	12,421.5	11,338.6
Expenditures		
Staff	7,154.6	7,446.5
Administrative expenses	2,649.0	1,773.1
Equipment investment funds	1,691.3	2,119.0
Sum	11,494.9	13,338.6
External funding through projects		
Granted funds	2,714.6*	3,825.8*
Spent funds	1,309.7	2,937.4

* including residual funds from the previous year

SUMMARY OF EXTERNAL FUNDING

Agency	Period	Title	Project leader	FST
EFRE	01.01.2023 – 31.12.2025	ZALKAL – Applikationslabor für Zeitaufgelöste Kathodolumineszenzspektroskopie	Dr. Jonas Lähnemann	9225
DAAD	01.01.2023 – 31.12.2024	Large-area top-down processing of (In,Ga)N and (Al,Ga)N nanowires	Dr. Jonas Lähnemann	9227
DAAD	01.01.2025 – 31.12.2026	Complementary Electron Microscopy Techniques for Efficient AlGaN Optoelectronics	Dr. Jonas Lähnemann	9244
DFG	01.11.2018 – 31.08.2024	Controlling Electron-Phonon Interaction in Nanocircuits – Strong Coupling Regime	Dr. Stefan Ludwig	9195
DFG	01.04.2021 – 28.02.2025	Nanoscale optomechanical interactions in semiconductor microcavities	Dr. Paulo V. Santos	9208
DFG	01.01.2021 – 31.12.2024	Charge carrier dynamics under the influence of extreme strain gradients realized in bent semiconductor nanowires	Dr. Lutz Geelhaar	9210
DFG	01.02.2021 – 31.12.2024	Photoelectrochemical CO ₂ conversion with tunable semiconductor nanostructures	Dr. Lutz Geelhaar	9213
DFG	01.03.2021 – 31.05.2025	Point defects control in Ga ₂ O ₃ thin films grown via molecular beam epitaxy	Dr. Oliver Bierwagen	9217
DFG	01.09.2021 – 31.01.2025	New strategies for dislocation density reduction in monolithic III/V epitaxy on Si	Dr. Achim Trampert	9218
DFG	01.02.2022 – 31.01.2025	Lead-free piezoelectric nanowire-nanocellulose hybrids for flexible energy harveste	Dr. Lutz Geelhaar	9219
DFG	01.05.2022 – 30.04.2025	Coherent GHz electro-optomechanics with polarmechanical crystals	Dr. Alexander Kuznetsov	9223
DFG	01.05.2022 – 30.04.2025	Coherent GHz electro-optomechanics with polarmechanical crystals	Dr. Paulo V. Santos	9224
DFG	01.02.2024 – 31.01.2027	Artificial quantum states on semiconductor surfaces created and probed by cryogenic scanning tunneling microscopy	Dr. Stefan Fölsch	9231
DFG	01.03.2024 – 28.02.2027	"Magic Tune" - Enabling large tunnel magnetoresistance at room temperature in scalable epitaxial van der Waals magnet heterostructures	Dr. J. Marcelo J. Lopes	9232
DFG	Bewilligung vom 09.10.2024	"2d CHARM" - MBE growth and advanced characterization of large-scale van der Waals heterostructures	Dr. J. Marcelo J. Lopes	9239

DFG	Bewilligung vom 09.10.2024	"NOBLESSE" - New oxide-based two-dimensional electron and hole gases for spin-orbitronics	Prof. Dr. Roman Engel-Herbert	9240
DFG	Bewilligung vom 23.10.2024	Pushing the FF of Non-Fullerene Acceptors Based Solar Cells Above 80 %: Relating Order to Reduced Recombination to Device Performance II (Fabulous II)	Prof. Dr. Safa Shoaee	9242
DFG	Bewilligung vom 18.11.2024	Heterogeneous Integration of novel ultra-wide band gap oxides on silicon	Prof. Dr. Roman Engel-Herbert	9243
DFG (SPP)	01.03.2023 – 28.02.2026	Priority Programme "INtegrated TERahertz sySTems Enabling Novel Functionality (INTEREST)" (SPP 2314) Micro-integrated terahertz quantum-cascade laser for high-resolution spectroscopy (Micro-QCL)	Dr. Klaus Biermann	9222
DFG (SPP)	Bewilligung vom 29.08.2024	Integrated terahertz quantum-cascade transceiver for high-resolution spectroscopy and space applications (iQCT)	Dr. Klaus Biermann	9237
DFG (SPP)	Bewilligung vom 29.08.2024	Terahertz Injection Locking of Quantum Cascade Lasers using Modified Uni-Travelling Carrier Photodiodes (UTC4QCL)	Dr. Xiang Lü	9238
DFG (OAK)	01.01.2023 – 31.12.2025	Open-Access-Publikationskosten	Anne Timm	9226
EU	01.09.2023 – 31.08.2027	Understanding, Predicting and Enhancing the Stability of Organic Photovoltaics (OPVStability)	Prof. Dr. Safa Shoaee	9234
EU	01.11.2024 – 31.10.2028	HINA - Hybrid INtegration of Alkaline niobate -tantalate films for advanced photonic and piezoelectric devices	Dr. Alberto Hernandez-Minguez	9241
WGL (SAW)	01.07.2021 – 30.06.2025	Defect-engineering in graphene via focused ion beam for tailored van der Waals epitaxy of h-BN (ENGRAVE)	Dr. J. Marcelo J. Lopes	9216
WGL (SAW)	01.02.2022 – 31.12.2025	(Si,Ge,Sn)O ₂ -based ultra-wide bandgap semiconductors for power electronics (SiGOPE)	Dr. Oliver Bierwagen	9220
WGL (SAS)	01.07.2020 – 31.12.2024	Growth and fundamentals of oxides for electronic applications (GraFOx II)	Dr. Oliver Bierwagen	9211
WGL	01.01.2024 – 31.12.2028	Next generation Sustainable semicoNductors For Optoelectronic aNd spintronic Applications (SINFONIA)	Prof. Dr. Safa Shoaee	9228

VISITING SCIENTISTS

Name	Institute	Period	Topic	Country
Stefano Cecci	Università degli Studi di Milano-Bicocca	01.01.2023 – 31.12.2024	Conclusion of studies related to Ge-Sb-Te alloys	Italy
Alessandro Pitanti	Consiglio Nazionale delle Ricerche (CNR)	06.03.2023 – 30.04.2024	Acoustic chirality and polarization in solid-state systems	Italy
Madeleine Msall	Bowdoin College	24.07.2023 – 14.07.2024	Optimization of the design of interdigital transducers for the excitation of high frequency surface-acoustic-waves	USA
Aidan Campbell	University of Strathclyde	15.09.2023 – 30.04.2024	Cathodoluminescence of InGaN in thick planar layers and top-down nanowire arrays	United Kingdom
Faezeh Ashtari Mahini	Universität Potsdam	01.01.2024-31.03.2024	Probing spin in disordered semiconductors	Germany
Farshad Doustipour	Freie Universität Berlin	01.01.2024-30.04.2024	Production and characterisation of 2D materials	Germany
Sedef Aksoy	Beuth Hochschule Berlin	24.01.2024-30.06.2024	Morphological characterization of ferromagnetic Fe ₅ GeTe ₂ films grown by molecular beam epitaxy	Germany
John Freeland	Argonne National Laboratory	05.03.2024-24.03.2024	Measurements of spectroscopic and structural characteristics during film growth	USA
Audrey Gilbert	Université de Montpellier	12.03.2024-28.03.2024	Transmission electron microscopy study of dislocation filtering layers and strain in epitaxial III-Vs on silicon	France
Lou-Anne Droy	Institut polytechnique de Grenoble	15.03.2024-15.08.2024	Experiments investigating the resolution in electron tomography of semiconductor interfaces	France
Aysha Asif Riaz	University College London	25.03.2024-19.04.2024	Investigating and engineering surface band bending of MBE-grown semiconducting oxide layers as a tool to tailor electronic contact properties	United Kingdom
Alejandro Fainstein	Centro Atomico Bariloche	14.04.2024-21.04.2024	Analysis and clarification of unresolved issues regarding measurements and theory of coherent GHz electro-optomechanics with polaromechanical crystals	Argentina
Ignacio Carraro Haddad	Centro Atomico Bariloche	01.05.2024-31.08.2024	Optomechanical microwave control in arrays of exciton-polariton Josephson junctions	Argentina
Danielle Reifsnnyder Hickey	Penn State University	06.05.2024-18.07.2024	Investigation of the atomic structures of semiconductors and their interfaces	USA
Benjamin Esteban Pinto Arroyo	Bowdoin College	27.05.2024-26.07.2024	Research on High Frequency IDTs and Sezawa Waves	USA
Oscar Dubon	University of California, Berkeley	28.05.2024-31.05.2024	Microscopy of layered semiconductores	USA

Karen Gambaryan	Yerevan State University	04.07.2024-04.08.2024	Fabrication and investigation of structural and optoelectronic properties of InAsSbP composition quantum dots and semiconducting devices based on them	Armenia
Johanna Nordlander	Universität Zürich	01.10.2024-30.09.2025	Design of novel epitaxial quantum oxide materials by PLD	Switzerland
Marc Rovirola Metcalfe	Universitat de Barcelona	14.10.2024-14.12.2024	Coupling of surface acoustic waves with epitaxial ferromagnetic films	Spain
Jona Grümbel	Otto-von-Guericke-Universität	04.12.2024-03.12.2025	Raman Messungen an ScN und verwandten Materialien	Germany
Gwenole Jean Jacopin	CNRS; Institut Neel	10.12.2024-23.12.2024	Time-resolved cathodoluminescence spectroscopy of wide-gap semiconductors	France

STAFF

Scientific staff including PhD students (D) and externally funded personnel (P)

Aggarwal, Neha (P)	Defect-engineering in graphene for tailored van der Waals epitaxy of hexagonal BN
Adeli, Narges (D)	Electron tomography of epitaxially strained heterostructure
Ardenghi, Andrea (D, P)	Point defects control in Ga ₂ O ₃ thin films grown via molecular beam epitaxy
Ashtari Mahini, Faezeh (D, P)	stability, understanding, predicting and enhancing stability of organic solar cells
Ashurbekov, Nazim (D, P)	Radio-frequency phonon resonators for coherent electron-phonon coupling
Biermann, Klaus	Molecular beam epitaxy of GaAs-based advanced heterostructures
Bierwagen, Oliver	Molecular beam epitaxy of oxides
Brandt, Oliver	Group-III nitrides and semiconductor nanowires
Campbell, Aidan (D)	characterization of an ultra-fast time-resolved cathodoluminescence spectroscopy setup and application to semiconductor nanowires
Cao, Yonglin (D)	Probing spin in disordered semiconductors
Chen, Wenshan (D, P)	Growth and doping of (Si,Ge,Sn)O ₂ -based materials
Cho, YongJin	Molecular beam epitaxy of nitrides
de Pedro Embid, Ismael (D, P)	Optical spectroscopy on microcavity polaritons modulated by acoustic phonons
Dinh, Duc Van (P)	Growth of (Sc,Al)N thin films
Engel-Herbert, Roman	Director
Flissikowski, Timur	Ultrafast dynamics of semiconductor structures
Fölsch, Stefan	Low-temperature scanning tunneling microscopy and spectroscopy
Geelhaar, Lutz	Molecular beam epitaxy and semiconductor nanowires
Ghayeb Zamharir, Sara	Micro-integrated terahertz quantum-cascade lasers for high-resolution spectroscopy
Gómez Ruiz, Mikel (D)	Cathodoluminescence spectroscopy and correlated chemical and structural analysis of core/shell nanowires
Graser, Karl (D, P)	Transmission electron microscopy on dislocation reduction in III-V on Si heterostructures
Gutmann, Nicola (D)	2D hole gas at the interface LaInO ₃ /BaSnO ₃
Hanke, Michael	Synchrotron x-ray diffraction
Hansemann, Moritz (D)	Synthesis of FeGe ₂ layers
Herfort, Jens	Ferromagnet-semiconductor heterostructures <i>Chairman Works Council</i>
Hernández Mínguez, Alberto	Manipulation of optical and electronic properties of low-dimensional structures using surface acoustic waves
Hoffmann, Georg	2D electron gas at the interface LaInO ₃ /BaSnO ₃
Hucho, Carsten	Technology and transfer
John, Philipp (P)	Epitaxy and materials science of (Al,Sc)N nanowires
Jordão Lopes, João Marcelo	Epitaxy of two-dimensional materials

Kaganer, Vladimir	Theories of molecular-beam-epitaxial growth and x-ray scattering
Kang, Jingxuan (D, P)	Top-down synthesis and optical properties of ordered (In,Ga)N nanowire arrays
Karadag, Murat	Masterstudent: Monte Carlo simulations
Khan, Kacho Imtiyaz Ali	Molecular beam epitaxy of layered magnetic materials
Kumar, Hitesh (D, P)	Cryogenic scanning tunneling microscopy and atom manipulation on III-V semiconductor surfaces
Kuznetsov, Alexander (P)	Coherent electro-optomechanics at GHz frequencies with confined microcavity exciton-polaritons
Lähnemann, Jonas	Spatially resolved optical spectroscopy and structural as well as compositional analysis of nanostructures
Langentepe-Kong, Jonathan (D)	triplets, solar cells and beyond
Leite Gomes, João Pedro (D)	Acoustically-driven magnonics
Loeto, Kagiso	time-resolved cathodoluminescence spectroscopy on various semiconductor materials
Lü, Xiang	Terahertz quantum-cascade lasers
Ludwig, Stefan	Quantum transport in nanoelectronic systems
Luna Garcia de la Infanta, Esperanza	Transmission electron microscopy of heterointerfaces
Lv, Hua	Spin-transport phenomena in layered and two-dimensional magnetic materials
Marín Largo, Francisca (D, P)	Growth and luminescence analysis of bent GaAs nanowires
Meißner, Moritz	Student assistant: Quantum efficiencies of micro LEDs
Nayir, Nadire	Junior Research Group Leader Computation of Thin Film Growth Processes
Notarangelo, Adriano	Masterstudent: Molecular beam epitaxy of (Al,Sc)N/GaN core-shell nanowires
Paysen, Ekaterina (D)	Multi-scale electron tomography of interfaces
Pham, Van Dong	Scanning tunneling microscopy on 2D metal intercalation and magnetic layered materials
Pistore, Valentino (P)	Micro- integrated terahertz quantum cascade laser for ultrahigh-resolution spectroscopic
Saeedi, Meysam (D)	Optomechanical exciton-polariton metamaterials
Santos, Paulo	Acoustic, optic, and magnetic properties of nanostructures
Shinwari, Tauqir (P)	Epitaxial growth of 2D ferromagnetic materials
Shoae, Safa	Group Leader Researchgroup
Sirt, Serkan (D, P)	Interplay between the quantum Hall and Aharonov-Bohm effects in mesoscopic circuits
Spallek, Domenik (D)	Cathodoluminescence of ultrawide bandgap semiconductors
Sun, Doyoung (D)	role of energetic disorder for industrial fabrication of organic solar cells
Tahraoui, Abbas	Comprehensive semiconductor technology
Takagaki, Yukihiko	Electric properties of nanometer-scale materials
Tokmoldin, Nurlan	reducing recombination loss process in relation to organic solar cells
Tornatzky, Hans	Raman spectroscopy of binary and complex oxides

Trampert, Achim	Microstructure and electron microscopy
Wagner, Markus	Semiconductor Spectroscopy
Yazmaciyan, Aren (P)	Understanding, controlling and optimising organic solar cell performance as a function of preparation conditions
Yuan, Mingyun	GHz acoustic control in semiconductor nanostructures
Zhang, Huaide (D)	(In,Ga)N nano-epitaxy for amber LEDs

NON-SCIENTIFIC STAFF

Anders, Walid	Technology
Arnhold, Kerstin	Finances/Purchasing
Baumann, René	Head of Workshop
Behnke, Steffen	Technician
Bluhm, Anne-Kathrin	Technician
Bruen, Eimear	Communications / EOO
Ehrensack, Kerstin	Technician / Deputy EOO
Ferber, Thomas	Workshop
Garcia Gomez, Sokrates	IT
Heinitz, Sebastian	Electrician
Herrmann, Claudia	Technician
Kosikowski, Philipp	Technician
Krauß, Sabine	Passive phase of semi-retirement
Litschauer, Maximilian	Technician
Matzeck, Christopher	Technician
Morgenroth, Katrin	Technician
Pfeiffer, Astrid	Passive phase of semi-retirement
Pfeiffer, Jörg	Passive phase of semi-retirement
Prüfer, Evan	HR / Diversity Officer
Rauwerdink, Sander	Technology
Schönherr, Hans-Peter	Technician
Sieg, Michael	Workshop
Steffen, Doreen	Technician
Stemmler, Carsten	Technician
Suchilina, Ekaterina	Office Assistant and Travel Management
Szegedy, Erika (P)	Administrative Coordinator (Project)
Timm, Anne Susanne	Library / Deputy Work Council
Venohr, Thomas	Workshop
Volkmer, Nicole	Technology
Wendt, Christian	Head of IT
Wirsig, Arno	Technology
Wirt-Brunnckow, Andreas	IT
Yildirim, Altug Haydar	Technology