Prof. Dr. Kathy Lüdge

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Scientific Career after Dissertation

since 04/2016	**W2 Professor** (without tenure track) at the Technische Universität Berlin Institute of Theoretical Physics, Specialist field: *Nonlinear laser dynamics*
10/2016 – 09/2017	**Alexander von Humboldt** Fellow, University of Auckland, New Zealand Feodor Lynen Scholarship for Experienced Researchers
10/2014 – 03/2016	**Guest Professor** at the Freie Universität Berlin, Germany Institute of Theoretical Physics
12/2011 – 09/2014	**Research Assistant, Privatdozentin** Institute of Theoretical Physics, Technische Universität Berlin, Germany
23.11.2011	**Habilitation(venia legendi)** for *theoretical physics* at the TU Berlin Title of the thesis: *Modeling quantum-dot based laser devices*
11/2003 – 11/2011	**Research Associate**(C1) within research group of Prof. Dr. E. Schöll, Institute of Theoretical Physics, Technische Universität Berlin, Germany
2006	Birth of daughter, subsequently 1 year parental leave
2003	Birth of son, subsequently 1 year parental leave
29.10.2003	**Dr. rer. nat. (physics)**, Institute of Solid State Physics, TU Berlin Supervisor: Prof. W. Richter,*Interface formation during epitaxial growth of Co layers on III-V semiconductor (001) surfaces*

Scientific Facts

- **Hirsch-index:** 21 (web of science); 26 (google scholar)
- **Publications:** 77 peer reviewed publications (2 Nat. Com., 3 Phys. Rev. Appl., 1 PRL, 1 Sci.Rep.)
  6 book chapters, 1 edited book
- **Supervision of students:** 9 PhD students (5 past, 4 ongoing)
  37 bachelor/master students (31 past, 6 ongoing)
- **Lectures**: 16 lecture courses – both on master (14) and bachelor (2) level
- **Funding record**: 1.4 million Euro

CV and Scientific Career before Dissertation

10/2000 – 10/2003	**Research Associate** within the group of Prof. Dr. W. Richter Institute of Solid State Physics, TU Berlin, Germany
04/2001 – 02/2002	**Visiting Scientist** within the group of Prof. C. Palmstrøm Department of Chemical Engineering and Material Science, University of Minnesota, Minneapolis, USA
06/2000 – 07/2000	**Visiting Scientist** within the group of Prof. Dr.F. Bechstedt, Institute of Solid State Theory, Friedrich-Schiller-Univ. Jena, Germany
11/1997 – 05/1998	**Student assistant** within the group of Dr. Helge Riemann Growth of bulk crystals, Institute of Crystal Growth (IKZ),Berlin, Germany
10/1995 – 09/2000	**Studies** of Physics at TU Berlin, Diploma at Institute of Solid State Physics, Prof. W. Richter *Atomare Struktur phosphorhaltiger III-V Halbleiter im System In, Ga, P*,
08/1992 – 07/1995	**Abitur certificate**, Albert-Einstein-Gymnasium Berlin, Germany
08/1990 – 07/1992	Heinrich-Hertz Spezialschule for Math and Physics, Berlin, Germany
08/1982 – 07/1990	Herman Fink Oberschule, Schulzendorf, Germany
17.01.1976	Born in Berlin, Germany

Research Experiences

- Stochastic equations with spontaneous emission noise and its impact on the laser linewidth, the timing jitter in mode-locked lasers, and mode-switching statistics in multi-mode lasers
- Machine learning with optical networks and reservoir computing schemes
- Many-body charge-carrier interaction in nano-structured optical devices, e.g., quantum-dot devices, optically pumped nanowire laser, and micro-resonator laser
- Nonlinear dynamics within the emitted light of different laser systems, for example integrated multi-section devices, mode-locked lasers and laser networks
- Controlling the output of complex optical devices with optical injection, optical self-feedback and electro-optical feedback loops
- Bifurcation analysis of delay differential equations
- Asymptotic perturbation methods for system reduction
- Experimental surface science in ultra high vacuum, e.g. Scanning tunneling microscopy, photoemission spectroscopy, electron diffraction

Awards and Scholarships

10/2016 - 9/2017	**Feodor-Lynen Research Fellowship**, Alexander von Humboldt foundation Project*: Understanding the bifurcation structure of coupled mode-locked lasers for improving the regularity of fast optical pulse trains*
06/2012	**Karl-Scheel-Preis** der Physikalischen Gesellschaft zu Berlin (PGzB) for excellent scientific research after the PhD
04/2001	**DAAD grant** for studies abroad (10 month), Department of Chemical Engineering and Material Science, University of Minnesota, USA
02/2001	**Erwin-Stephan-Preis**, Award for excellent and fast studies at TU Berlin
07/2000	Heraeus-Studienförderpreis for physics, Phys. Gesellschaft zu Berlin

Funded Projects

- **Principal investigator** (2019-2022) of project B9 *Stochastic and structural properties of complex laser networks for optical computing* of the Collaborative Research Center **SFB 910** of the DFG on *Control of self-organizing nonlinear systems*
- **Principal investigator** (2012-2019) of project B2 *Dynamics of quantum dot based multi-section laser and amplifier structures* of the Collaborative Research Center **SFB 787** of the DFG on *Semiconductor Nanophotonics*
- **DAAD Project** (2018-2019)*Narrow linewidth semiconductor lasers for coherent communication systems*, Förderprogramm Projektbezogener Personenaustausch (PPP France)
- **Principal investigator** (2015-2018) of project B9 *Collective phenomena in laser networks with nonidentical units* of the Collaborative Research Center **SFB 910** of the DFG
- **Associate Project Leader** (2013-2018) of project A1 *Semiconductor laser dynamics far above threshold - nonequilibrium kinetics and dissipation* of the Graduate-School **GRK 1558** *Nonequilibrium Collective Dynamics in Condensed Matter and Biological Systems*
- **DAAD Project** (2014-2015)*Nonlinear Photonics in Nanostructured Semiconductor Lasers* im Förderprogramm Projektbezogener Personenaustausch (PPP) with France

Selected Invited Talks

- 07/2019 *Complex laser networks for reservoir computing: How can we optimize the learning curve*, Nonlinear Optics Topical Meeting, Hawaii, US
- 01/2018 *Coherent pulse shaping in passively mode-locked semiconductor lasers*, SPIE Photonics West, San Francisco, US
- 04/2016 *Pulse train patterns in passively mode-locked lasers*, SPIE Photonics Europe, Brüssel

Organised Workshops

- **Tandem Workshop Grant** on *Pattern Dynamics in Nonlinear Optical Cavities* funded by the MPIPKS (Max Planck Institute for the Physics of Complex Systems)
  Organisation of the Workshop in Dresden, Germany, August 2016 and in Auckland, Neuseeland, August 2017 together with Prof. B. Krauskopf und Prof. N. Broderick
- **Symposium** *Nonlinear dynamics in lasers: fundamental issues and novel applications*, Dynamics Days Europe, Madrid, Spain, 06/2013,
- **Workshop** *Nonlinear Dynamics in Semiconductor Lasers*,
  Weierstrass Institute für Angewandte Analysis und Stochastic (WIAS), Berlin, 09/2012

Services to the Community

- Associate Editor for the Journal *IEEE Journal of Quantum Electronics*
- Associate Editor for the *Eurpean Physics Journal B* Special Issue *Non-Linear and Complex Dynamics in Semiconductors and Related Materials*
- Member of IUPAP(The International Union of Pure and Applied Physics), Commission on Laser Physics and Photonics
- Referee of several journals from Physical Review, AIP, IEEE, OSA

Miscellaneous

- **Languages**: fluent in English; basic knowledge in French
- **Software**: Programming knowledge in C++ and Python;
  Experience with: Simulation Tools (Matlab and Mathematica); Plotting Tools (Origin, Excel, Matlab) and Text processing and Presentations (Latex , Microsoft Office)
- **Hobbies**: playing the piano; managing the family

Selected publications in peer reviewed journals

[1] J. Hausen, S. Meinecke, B. Lingnau, and K. Lüdge, *Pulse Cluster Dynamics in Passively Mode-Locked Semiconductor Vertical-External-Cavity Surface-Emitting Lasers,* Phys. Rev. Appl. **11**, 044055 (2019).

[2] S. Kreinberg, X. Porte, D. Schicke, B. Lingnau, C. Schneider, S. Höfling, I. Kanter, K. Lüdge, and S. Reitzenstein, *Mutual coupling and synchronization of optically coupled quantum-dot micropillar lasers at ultra-low light levels*, Nat. Commun. **10**, 1539 (2019).

[3] S. Meinecke, L. Drzewietzki, C. Weber, B. Lingnau, S. Breuer, and K. Lüdge, *Ultra-Short Pulse Generation in a Three Section Tapered Passively Mode-Locked Quantum-Dot Semiconductor Laser*, Sci. Rep. **9**,1783 (2019).

[4] A. Röhm, K. Lüdge, *Multiplexed networks: reservoir computing with virtual and real nodes*, J. Phys. Commun. **2**, 085007 (2018).

[5] C. Redlich, B. Lingnau, H. Huang, R. Raghunathan, K. Schires, P. J. Poole, F. Grillot, K. Lüdge, *Linewidth rebroadening in quantum dot semiconductor lasers*, IEEE J. Sel. Top. Quantum Electron. **23**, 6, 1901110 (2017).

[6] L. C. Jaurigue, E. Schöll and K. Lüdge, *Suppression of Noise-Induced Modulations in Multidelay Systems*, Phys. Rev. Lett. **117**, 154101 (2016).

[7] A. Röhm, B. Lingnau, and K. Lüdge, *Ground-state modulation-enhancement by two-state lasing in quantum-dot laser devices*, Appl. Phys. Lett. **106**, 191102 (2015).

[8] C. Otto, L. Jaurigue, E. Schöll, and K. Lüdge, *Optimization of timing jitter reduction by optical feedback for a passively mode-locked laser*, IEEE Photonics Journal **6**, 1501814 (2014).

[9] S. Wilkinson, B. Lingnau, J. Korn, E. Schöll, and K. Lüdge, *Influence of Noise on Quantum-Dot Semiconductor Optical Amplifiers*, IEEE J. Sel. Top. Quantum Electron. **19**, 1900106 (2013).

[10] K. Lüdge and E. Schöll, *Quantum-dot lasers – desynchronized nonlinear dynamics of electrons and holes,* IEEE J. Quantum Electron. **45**(11), 1396 (2009).