

LUKAS BRUDER

General Information

Dr. Lukas Bruder
Born: 05.09.1985 in Wolfach, Germany
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Research Focus

- Ultrafast coherent nonlinear and multidimensional spectroscopy with core areas:
 - extending multidimensional spectroscopy to new fields:
 - (i) to the gas phase and cluster beams
 - (ii) to the extreme ultraviolet and X-ray wavelength regime
 - Many-body interactions in highly dilute samples probed by nonlinear spectroscopy
- Nonlinear optics
- Molecular and cluster beams

Employment

Since 03/2020	Akademischer Rat (tenured), Institute of Physics, University of Freiburg (group of Prof. F. Stienkemeier)
09/2019 – 03/2020	Postdoc, Institute of Physics, University of Freiburg (group of Prof. F. Stienkemeier)
11/2018 – 09/2019	Postdoc, Division of Chemical Physics, Lund University (group of Prof. D. Zigmantas)
06/2017 – 11/2018	Postdoc, Institute of Physics, University of Freiburg (group of Prof. F. Stienkemeier)
06/2013 – 10/2013	Internship at TRUMPF Laser GmbH + Co. KG, Schramberg
06/2005 – 10/2006	Farmer in the family-owned business

Education

11/2013 – 06/2017	PhD in experimental Physics, University of Freiburg Grade: summa cum laude
10/2006 – 06/2013	Diploma in Physics, University of Freiburg Grade: 1.1
04/2010 – 02/2011	Research internship (6 months), Physics department, University of Auckland (group of Prof. M. D. Hoogerland)
07/2010 – 11/2010	Studies abroad, University of Auckland, New Zealand

Scholarships and Awards

2020	Invitation for an <i>emerging leaders</i> contribution in the Journal of Physics B
2020	Member of the Elite Postdoc Program, Baden-Württemberg Stiftung
2019	NanoLund Junior Scientist Ideas Award, Lund University, Sweden

- 2016 Poster prize, IRTG 2079 CoCo summer school, Mittelwhir, France
- 2015 Poster prize, PcifiChem conference, Honolulu, USA
- 2014 PhD scholarship, Evangelisches Studienwerk e.V.
- 2010 Research scholarship, University of Auckland, New Zealand
- 2005 School award from the German Physical Society

Networks

- 01/2021 Member of the network "WavemiX" (leading network for the development of nonlinear XUV and X-ray spectroscopy)

Academic Memberships

German Physical Society

Outreach

- 2014 Supervision of student internship (BOGY)
- 2013, 2017 Guided lab tours for schoolchildren and students
- 2010 Presentation of physical principles to children at Science Day

Organization of Scientific Meetings

- 2017 Initiation and organization of conference: *Beyond molecular movies: Imaging meets time-domain spectroscopy*, FRIAS, Freiburg

Management and Administration

- Since 2021 Principle investigator in the research training group DynCAM
- 2020 Member of habilitation commission, Institute of Physics, University of Freiburg
- Since 2020 Laser safety officer in the Institute of Physics, University of Freiburg
- Since 2019 Organization of user beamtimes at the free-electron laser FERMI, Italy
- Since 2018 Reviewer for Journals: New Journal of Physics (IOPscience), Optics Express (OSA)
- Since 2017 Coordinator of ERC advanced grant, Prof F. Stienkemeier
- Since 2015 Invitation of seminar speakers

Funding Record

- 2020 Research grant from the Elite Postdoc Program, Baden-Württemberg Stiftung (137000 €)
- 2019 Research grant NanoLund Junior Scientist Ideas Award, Lund University (10000 SEK)

2017 Fund for organizing and hosting a conference, Freiburg Institute for Advanced Studies (8000 €)

Teaching Experience

Legend:

Lecturer: Lecturing the full course
Substitute Lecturer: Giving one lecture of the course
Head of Exercises: Organization of homework, exam questions and tutorials
Head of Lab Course: Organization of the lab course (shared duty with two other supervisors)
Tutor: Supervising tutorials, marking problem sheets / supervising lab course

Lectures, practical courses

SS 2021 Head of Lab Course, Physics laboratory (BSc course)
WS 2020/21 Head of Lab Course, Physics laboratory (BSc course)
SS 2020 Head of Lab Course, Physics laboratory (BSc course)
SS 2020 Lecturer, Advanced Optics and Lasers (MSc course)
WS 2019/20 Head of Exercises, Introduction to Physics with Experiments for Students of Natural and Environmental Sciences (BSc course)
WS 2019/20 Substitute Lecturer, Introduction to Physics with Experiments for Students of Natural and Environmental Sciences (BSc course), 440 students
SS 2018 Substitute Lecturer, Advanced Optics and Lasers (MSc course)
WS 2017/18 Tutor, Master Laboratory course (MSc physics)
WS 2017/18 Head of Exercises, Advanced Atomic and Molecular Physics (MSc course)
SS 2016 Tutor, Master Laboratory course (MSc physics)
WS 2015/16 Tutor, Master Laboratory course (MSc physics)
WS 2014/15 Tutor, Master Laboratory course (MSc physics)
WS 2014/15 Head of Exercises, Advanced Atomic and Molecular Physics (MSc course)
SS 2014 Tutor, Advanced Optics and Lasers (MSc course)
WS 2012/13 Tutor, Physics Laboratory (BSc course)
SS 2012 Tutor, Physics Laboratory (BSc course)
SS 2019 Tutor, Theoretical Physics I (BSc course)

Co-supervised students

S. D. Ganeshamandiram, PhD in Physics, University of Freiburg (ongoing)
F. Richter, PhD in Physics, University of Freiburg (ongoing)
F. Landmesser, PhD in Physics, University of Freiburg (ongoing)
A. Scognamiglio, PhD in Physics, University of Freiburg (ongoing)

D. Uhl, PhD in Physics, University of Freiburg (ongoing)
U. Bangert, PhD in Physics, University of Freiburg (ongoing)
M. Binz, PhD in Physics, University of Freiburg (ongoing)
A. Wituschek, PhD in Physics, University of Freiburg (2021)
L. S. Klein, MSc Appl. Physics, University of Freiburg (2021)
E. Leißler, MSc Appl. Physics, University of Freiburg (2020)
R. van der Neut, BSc Physics, University of Freiburg (2020)
N. A. Gölz, BSc Physics, University of Freiburg (2020)
M. Jakob, MSc Physics, University of Freiburg (2018)
R. Illinseer, MSc engineering intern, University of Freiburg (2018)
K. Schneider, MSc Physics, University of Freiburg (2017)
D. Uhl, MSc Physics, University of Freiburg (2017)
U. Bangert, MSc Physics, University of Freiburg (2016)
M. Binz, MSc Physics, University of Freiburg (2015)
D. Uhl, BSc Physics, University of Freiburg (2015)
S. Leutheusser, intern from DAAD RISE scholarship program (2014)

Publications

Legend

* corresponding author

** shared first authorship

Book Chapters

- [1] **L. Bruder**, M. Koch, M. Mudrich, F. Stienkemeier, *Ultrafast Dynamics in Helium Droplets*, in: *Molecules in Helium Nanodroplets - Spectroscopy, Structure and Dynamics*, edited by A. Slenczka, J. P. Toennies, Top. Appl. Phys. (Springer) (under review)

Invited Reviews

- [1] **L. Bruder***, U. Bangert, M. Binz, D. Uhl, and F. Stienkemeier, *Coherent multidimensional spectroscopy in the gas phase*, J. Phys. B: At. Mol. Opt. Phys. **52**, 183501 (2019)

Journal Articles

- [1] D. Uhl, U. Bangert, **L. Bruder***, and F. Stienkemeier, *Coherent two-dimensional photoelectronspectroscopy* (under review)
- [2] D. Uhl, **L. Bruder***, and F. Stienkemeier, *A Flexible and Scalable, Fully Software-Based Lock-in Amplifier for Nonlinear Spectroscopy*, Rev. Sci. Instrum. **92**, 083101 (2021).
- [3] **L. Bruder**, L. Wittenbecher, P. V. Kolesnichenko and D. Zigmantas, *Generation and compression of 10-fs deep ultraviolet pulses at high repetition rate using standard optics*, Opt. Express, **29**, 25593 (2021)

- [4] R. Michiels, M. Abu-samha, L. B. Madsen, M. Binz, U. Bangert, **L. Bruder**, R. Duim, A. Wituschek, A. C. LaForge, R. J. Squibb, R. Feifel, C. Callegari, M. Di Fraia, M. Danailov, M. Manfreda, O. Plekan, K. C. Prince, P. Rebernik, M. Zangrando, F. Stienkemeier, M. Mudrich, *Collective enhancement of above threshold ionization by resonantly excited helium nanodroplets*, arXiv:2105.01918 (2021)
- [5] J. D. Asmussen, R. Michiels, K. Dulitz, A. Ngai, U. Bangert, M. Barranco, M. Binz, **L. Bruder**, M. Danailov, M. Di Fraia, J. Eloranta, R. Feifel, L. Giannessi, M. Pi, O. Plekan, K. C. Prince, R. J. Squibb, D. Uhl, A. Wituschek, M. Zangrando, C. Callegari, F. Stienkemeier, M. Mudrich, *Unravelling the Full Relaxation Dynamics of Superexcited Helium Nanodroplets*, arXiv:2103.05948 (2021)
- [6] A. Wituschek, O. Kornilov*, T. Witting, L. Maikowski, F. Stienkemeier, M. J. J. Vrakking, and **L. Bruder***, *Phase Cycling of Extreme Ultraviolet Pulse Sequences Generated in Rare Gases*, New J. Phys. **22**, 092001 (2020) - Fast Track Communication –
- [7] M. Binz, **L. Bruder***, L. Chen, M. F. Gelin, W. Domcke, and F. Stienkemeier, *Effects of High Pulse Intensity and Chirp in Two-Dimensional Electronic Spectroscopy of an Atomic Vapor*, Opt. Express **28**, 25806 (2020)
- [8] A. Wituschek, **L. Bruder***, E. Allaria, U. Bangert, M. Binz, C. Callegari, P. Cinquegrana, M. Danailov, A. Demidovich, M. D. Fraia, R. Feifel, T. Laarmann, T. Laarmann, R. Michiels, M. Mudrich, I. Nikolov, P. Piseri, O. Plekan, K. C. Prince, A. Przystawik, P. R. Ribič, P. R. Ribič, P. Sigalotti, S. Stranges, S. Stranges, D. Uhl, L. Giannessi, L. Giannessi, and F. Stienkemeier, *High-Gain Harmonic Generation with Temporally Overlapping Seed Pulses and Application to Ultrafast Spectroscopy*, Opt. Express **28**, 29976 (2020)
- [9] A. Wituschek***, **L. Bruder*****, E. Allaria, U. Bangert, M. Binz, R. Borghes, C. Callegari, G. Cerullo, P. Cinquegrana, L. Giannessi, M. Danailov, A. Demidovich, M. D. Fraia, M. Drabbels, R. Feifel, T. Laarmann, R. Michiels, N. S. Mirian, M. Mudrich, I. Nikolov, F. H. O’Shea, G. Penco, P. Piseri, O. Plekan, K. C. Prince, A. Przystawik, P. R. Ribič, G. Sansone, P. Sigalotti, S. Spampinati, C. Spezzani, R. J. Squibb, S. Stranges, D. Uhl, and F. Stienkemeier, *Tracking Attosecond Electronic Coherences Using Phase-Manipulated Extreme Ultraviolet Pulses*, Nat Commun **11**, 1 (2020)
- [10] A. Wituschek*, **L. Bruder**, L.-S. Klein, J. Strucka, A. Demidovich, M.B. Danailov, and F. Stienkemeier, *Stable interferometric platform for phase modulation of seeded free-electron lasers*. Opt. Lett. **44**, 943-946 (2019)
- [11] **L. Bruder***, A. Eisfeld, U. Bangert, M. Binz, M. Jakob, D. Uhl, M. Schulz-Weiling, E.R. Grant, and F. Stienkemeier, *Delocalized excitons and interaction effects in extremely dilute thermal ensembles*. Phys. Chem. Chem. Phys. **21**, 2276–2282 (2019).
- Selected for journal cover, rated 2018 PCCP HOT articles -
- [12] **L. Bruder***, U. Bangert, M. Binz, D. Uhl, R. Vexiau, N. Bouloufa-Maafa, O. Dulieu, and F. Stienkemeier, *Coherent multidimensional spectroscopy of dilute gas-phase nanosystems*. Nat Commun **9**, 4823 (2018)
- [13] **L. Bruder***, M. Binz, and F. Stienkemeier, *Phase-synchronous undersampling in nonlinear spectroscopy*. Opt. Lett. **43**, 875–878 (2018)
- Editor’s pick -

- [14] Z.-Z. Li, **L. Bruder**, F. Stienkemeier, and A. Eisfeld*, *Probing weak dipole-dipole interaction using phase-modulated nonlinear spectroscopy*. Phys. Rev. A **95**, 052509 (2017)
- [15] **L. Bruder***, U. Bangert, and F. Stienkemeier, *Phase-modulated harmonic light spectroscopy*. Opt. Express **25**, 5302–5315 (2017)
- [16] **L. Bruder***, M. Binz, and F. Stienkemeier, *Efficient isolation of multiphoton processes and detection of collective resonances in dilute samples*. Phys. Rev. A **92**, 053412 (2015).
- [17] **L. Bruder***, M. Mudrich, and F. Stienkemeier, *Phase-modulated electronic wave packet interferometry reveals high resolution spectra of free Rb atoms and Rb*He molecules*. Phys. Chem. Chem. Phys. **17**, 23877–23885 (2015)
- [18] V. Lyamayev, Y. Ovcharenko, R. Katzy, M. Devetta, **L. Bruder**, A. LaForge, Marcel Mudrich, U. Person, F. Stienkemeier, M. Krikunova, T. Möller, P. Piseri, Lorenzo Avaldi, M. Coreno, P. O’Keeffe, P. Bolognesi, M. Alagia, A. Kivimäki, M. D. Fraia, N. B. Brauer, M. Drabbels, T. Mazza, S. Stranges, P. Finetti, Cesare Grazioli, O. Plekan, R. Richter, K. C. Prince, and C. Callegari, *A Modular End-Station for Atomic, Molecular, and Cluster Science at the Low Density Matter Beamline of FERMI@Elettra*, J. Phys. B: At. Mol. Opt. Phys. **46**, 164007 (2013)

Scientific Presentations

Invited and Hot Topic Talks

- [1] *Coherent multidimensional spectroscopy of cluster beams*, International Symposium of Molecular Beams, virtual conference (2021)
- [2] *Tracking electronic coherences in the XUV spectral range*, 11th Ringberg Workshop: Hard X-ray XFELs, Tegernsee, Germany (2020)
- [3] *Tracking attosecond electronic coherences with phase-modulated XUV pulses*, Max-Born-Institut, Berlin, Germany (2019)
- [4] *Coherent nonlinear spectroscopy in the gas phase*, Conference on Frontiers in Size-Selected Cluster Research: Bridging the Gap, Bad Honnef, Germany (2019)
- [5] *Coherent nonlinear spectroscopy in the gas phase*, Workshop about two-dimensional spectroscopy, Raitenhaslach, Germany (2019)
- [6] *Two-dimensional electronic spectroscopy of cold, controlled systems*, Conference on Coherent multidimensional spectroscopy, Seoul, South Korea (2018)
- [7] *Towards coherent multidimensional spectroscopy with XUV photons*, Max-Born-Institute, Berlin, Germany (2018)
- [8] *Coherent two-dimensional electronic spectroscopy of helium droplet beams*, International Symposium of Molecular Beams, Nijmegen, Netherlands (2017)
- [9] *Phase-modulated harmonic light spectroscopy*, DPG Spring Meeting, Mainz, Germany (2017)
- [10] *Coherent femtosecond spectroscopy of doped helium nanodroplets*, University of Oregon, Eugene, USA (2016)
- [11] *Phase-modulated femtosecond spectroscopy*, Max-Planck Institute for Complex Systems, Dresden (2015)

Contributed talks and poster presentations

- [1] *Two-Dimensional Electronic Spectroscopy of Phthalocyanine on Rare Gas Clusters*, DPG Frühjahrstagung, online (2021)
- [2] *Two-Dimensional Coherent Spectroscopy of Doped Helium Nanodroplets*, International Conference on Quantum Fluid Clusters QFC (2019)
- [3] *Many-body resonances in dilute gas-phase systems*, DPG Frühjahrstagung Erlangen (2018)
- [4] *Nonlinear spectroscopy of gas phase samples: high resolution spectra and collective effects*, Femto13 conference, Frontiers of ultrafast phenomena in Chemistry, Biology, and Physics, Cancun, Mexico (2017)
- [5] *Collective resonances in dilute vapors*, DPG Frühjahrstagung, Mainz (2017)
- [6] *Collective effects in atomic and helium droplet systems revealed by phase-modulated pump-probe spectroscopy*, Conference on Quantum Fluid Clusters (2017)
- [7] *Detection of multiple-quantum coherences in dilute samples*, DPG Frühjahrstagung, Hannover (2016)
- [8] *Phase-modulated coherent spectroscopy applied to ultracold doped helium droplets*, Pacificchem 2015, Honolulu, Hawaii (2015)
- [9] *Phase-modulated fs pump-probe experiments of doped helium droplet beams*, Clustertreffen, Lindow (2015)
- [10] *Phase-modulated fs pump-probe spectroscopy of RbHe exciplexes*, DPG Frühjahrstagung, Heidelberg (2015)
- [11] *Coherent time-resolved spectroscopy of dilute gas phase samples and detection of multiple-quantum coherences*, Atom Workshop, Max-Planck-Institut KS, Dresden (2015)
- [12] *Phase-modulated Pump-Probe Experiments with Alkali Atoms*, DPG Frühjahrstagung, Berlin (2014)
- [13] *Wave Packet Interferometry at Potassium Atoms Applying a Band-pass Filtering Technique*, DPG Frühjahrstagung, Hannover (2013)

Last updated: 05.08.2021