

# CURRICULUM VITAE



## 1. Personal data

- Name: Katrin Dulitz
- Born: 15.11.1985 in Wilhelm-Pieck-Stadt Guben, Germany
- Languages: German (native), English (fluent), French (good)
- Work address:  
University of Freiburg, Institute of Physics,  
Hermann-Herder Str. 3, 79104 Freiburg i. Br., Germany  
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## 2. Research interests

- Precision measurements of molecular systems using reactive scattering
- Cold and controlled atoms, molecules and collisions
- Spectroscopy of molecular cations
- Femtosecond dynamics in doped superfluid helium nanodroplets

## 3. Selection of key achievements

- First direct experimental observation of electron spin and  $\Lambda$  conservation (where  $\Lambda$  is the projection of the total molecular orbital angular momentum along the internuclear axis) in autoionizing collisions
- First demonstration of an improved transverse phase-space acceptance in a Zeeman decelerator
- Development of a model to predict the six-dimensional phase-space acceptance in a Zeeman decelerator

## 4. Professional experience

- Since 03.2018: Junior research group leader (Liebig Fellow), Institute of Physics, University of Freiburg, Germany
- 10.2016 – 02.2018: Non-tenured research staff (Akademischer Rat, A13), Institute of Physics, University of Freiburg, Germany (with Prof. F. Stienkemeier)
- 12.2014 – 09.2016: Postdoc, Laboratory of Physical Chemistry, ETH Zurich, Switzerland (with Prof. F. Merkt)
- 04.2007 – 07.2009: Student research assistant, Institute of Chemistry, University of Potsdam, Germany (with apl. Prof. M. U. Kumke)

## 5. Education and academic degrees

- 10.2010 – 01.2015: Doctor of Philosophy (DPhil) in Physical and Theoretical Chemistry, University of Oxford, United Kingdom (with Prof. T. P. Softley)

- Thesis “Towards the study of cold chemical reactions using Zeeman decelerated supersonic beams“
- Passed with minor corrections
- 10.2005 – 04.2010: Diploma in Chemistry (Dipl. Chem.), University of Potsdam, Germany
  - Thesis “Laser-kinetic studies of reactions impacting on the atmospheric HNO<sub>3</sub> budget“
  - Grade: 1.1 (with distinction)
- 08.1998 – 06.2005: A-levels, Pestalozzi-Gymnasium, Guben, Germany
  - Grade: 1.0

## **6. Academic visits**

- 09.2010: Extracurricular internship at ETH Zurich, Switzerland (with Prof. F. Merkt on Zeeman deceleration)
- 07.2010: Extracurricular internship at the Fritz Haber Institute of the Max Planck society in Berlin, Germany (with Prof. S.Y.T. van de Meerakker on Stark deceleration)
- 08.2009 – 04.2010: Work on diploma thesis at the Max Planck Institute for Chemistry in Mainz, Germany (with Dr. J. N. Crowley, in atmospheric chemistry)
- 10.2007: Extracurricular internship at the Max Planck Institute for Chemistry in Mainz, Germany (with Dr. J. N. Crowley, in atmospheric chemistry)
- 03.2007: Extracurricular internship at Forschungszentrum Jülich, Germany (with Dr. R. Wegener, in atmospheric chemistry)

## **7. Professional development courses**

- 01.2021: Academic career development, workshop, Freiburg Research Services, Freiburg (online), Germany
- 11.2019: Academic career development, workshop, Freiburg Research Services, Freiburg, Germany
- 04.2019: Personnel management in a junior research group, seminar, Rainer Röpnack, Frankfurt, Germany
- 03.2019: Research funding by the European Research Council, workshop, Freiburg Research Services, Freiburg, Germany
- 11.2018: Voice and speech training, workshop, Zentrum für Hochschuldidaktik, Freiburg, Germany
- 11.2016: Planning and development of scientific projects, workshop, Freiburg Research Services, Freiburg, Germany
- 12.2015: Science communication, workshop, Klaus Tschira Foundation, Heidelberg, Germany
- 12.2010: Creative thinking, workshop, facilitate this! company, Cricklade, United Kingdom

## **8. Scholarships and awards**

- Since 03/2018: Liebig Fellowship, Fonds der Chemischen Industrie

- 03/2014: Simms Bursary (doctoral completion fund), Merton College, Oxford, United Kingdom
- 03/2014: Invitation to present a poster at the SET for Britain poster competition at the Houses of Parliament, London, United Kingdom
- 06/2012: Poster prize, OxTALENT competition, Oxford, United Kingdom
- 10/2010 – 09/2013: Kekulé Mobility Fellowship (doctoral fellowship), Fonds der Chemischen Industrie

## **9. Funding**

- 03/2018-02/2023: Liebig Fellowship, Fonds der Chemischen Industrie, €299,000
- 01/2018 – 06/2018: Grant by the Research Innovation Fund, University of Freiburg, €23,000
- 12/2017-12/2021: Research grant (Sachbeihilfe), German Research Foundation, €337,000
- 2017 – 2019: Principal investigator in the International Research Training Group “Cold Controlled Ensembles in Physics and Chemistry” (IRTG 2079), German Research Foundation, €380,000 (pro rata)

## **10. Publication statistics**

- 18 peer-reviewed scientific publications
- ORCID: 0000-0003-0489-6038

## **11. Management and administration**

- Since 2019: Participation in junior faculty meetings, Institute of Physics, University of Freiburg, Germany
- 12.2017: Member of the committee responsible for the Habilitation (i.e. the qualification procedure for full professorships in Germany) of K. Köneke, Institute of Physics, University of Freiburg, Germany
- 2015 – 2016: Member of the institute council, Laboratory of Physical Chemistry, ETH Zurich, Switzerland

## **12. Other academic activities**

- Since 01.2020: Guest editor for New J. Phys., focus issue on the “Cold and Ultracold Chemistry of Atoms, Molecules and Ions”
- Since 03.2019: Safety representative for a chemistry laboratory (safety briefings for approx. 40 members of staff, preparation of operating procedures for hazardous materials), Institute of Physics, University of Freiburg, Germany
- Since 2017: Referee for international journals (Eur. Phys. J. D, J. Mod. Opt., J. Phys. B: At. Mol. Opt., Mol. Phys., PCCP, Phys. Rev. A, Phys. Rev. Lett., Phys. Scripta)
- Since 2017: Session chair at scientific conferences
  - DPG Fall Meeting, Freiburg, Germany, 2019
  - International Conference on Quantum Fluid Clusters (QFC), Bad Honnef, Germany, 2019

- International Symposium on Molecular Beams, Nijmegen, The Netherlands, 2017
- International Conference on Quantum Fluid Clusters (QFC), Obergurgl, Austria, 2017
- DPG Spring Meeting, Mainz, Germany, 2017
- 2017: Planning and set-up of a new laboratory experiment (“Solid State Laser”) for the MSc Applied Physics program of study
- 2013 – 2014: Member of the Green Impact team (raising environmental awareness at the workplace), Department of Chemistry, University of Oxford, United Kingdom; awarded with three prizes

### 13. Conference organization

- 02.2022: Initiator and organizer of the scientific workshop “Cold and ultracold chemistry“, Freiburg Institute for Advanced Studies (FRIAS), Freiburg, Germany
- 03.2020: Initiator and organizer of the scientific symposium “Hot topics in cold molecules“, DPG Spring Meeting, Hannover, Germany (canceled due to Corona pandemic)

### 14. Collaborations

- Current collaborations:
  - Principal investigator in the **International Research Training Group “Cold Controlled Ensembles in Physics and Chemistry”** in collaboration with UBC (IRTG 2079), German Research Foundation; two joint publications
  - **Dr. B. Heazlewood** (University of Oxford, United Kingdom): quantum-state preparation of He; one joint publication; one joint publication in preparation
  - **Prof. Dr. M. Mudrich** (Aarhus University, Denmark): studies at free-electron lasers, imaging detectors, laser cooling; two joint publications
  - **Dr. J. Pérez Ríos** (Fritz Haber Institute of the Max Planck society in Berlin, Germany): *ab-initio* calculations of potential energy surfaces
  - **Prof. Dr. S. Willitsch** (University of Basel, Switzerland): production of high-intensity beams of fluorine atoms (research at the University of Basel); one joint publication in preparation
  - **Dr. habil. P. Żuchowski** (Nicolaus Copernicus University in Toruń, Poland): *ab-initio* calculations of potential energy surfaces
- Doctoral project:
  - **Prof. Dr. F. Merkt** (ETH Zurich, Switzerland): Zeeman deceleration

### 15. Memberships in professional bodies

- German Physical Society (member)
- Royal Society of Chemistry (associate member)

## **16. Support of women in the natural sciences**

- Since 03/2018: Member of the Female Research Equality (FREQ) network (promotion of female researchers in Chemistry and related disciplines; co-organization of a two-day long workshop for female doctoral researchers in October 2020)
- 2016: Committee member in the Society for Women in Natural Sciences (WiNS; organization of events for female doctoral and postdoctoral researchers), ETH Zurich, Switzerland

## **17. Outreach activities**

- 2018: Initiation of a school-based programme to motivate high-school children to study physics at university level (Schulbotschafterin), University of Freiburg, Germany
- 2017: Lab courses for high-school children (Schnupperstudium), University of Freiburg, Germany
- Since 2016: Supervision of internships by high-school children (Berufsorientierung an Gymnasien, BoGy), University of Freiburg, Germany
- 03.2014: Workshop in an elementary school as part of the Oxfordshire Science Festival Science Roadshow, Oxfordshire, United Kingdom
- 03.2013: Participation in a podcast about the research on cold collisions, University of Oxford, United Kingdom
- 2013, 2014, 2018: Guided lab tours (two school classes, member of parliament) University of Freiburg and University of Oxford, United Kingdom

## **18. Supervision and co-supervision of students and researchers**

- Since 01.2020: L. Bienkowski, MSc student and student assistant (co-supervisor)
- Since 10.2019: A. Tsoukala, doctoral researcher (main supervisor)
- Since 01.2019: T. Sixt, doctoral researcher (main supervisor)
- 01.2019 – 08.2019: Dr. M. Debatin, postdoc (main supervisor)
  - Now: postdoc at the University of Kassel, Germany
- 03.2018 – 09.2019: M. van den Beld-Serrano, student assistant (main supervisor)
  - Now: MSc student at the University of Tübingen, Germany
- 09.2018 – 05.2020: Dr. J. Guan, postdoc (main supervisor)
- 04.2018 – 02.2019: T. Muthu-Arachchige, doctoral researcher (main supervisor)
  - Now: doctoral researcher at the University of Southern Denmark, Denmark
- Since 10.2017: A. Scognamiglio, doctoral researcher (co-supervisor)
- 10.2017 – 12.2018: V. Behrendt, MSc student and student assistant (co-supervisor)
  - Now: doctoral researcher at Fraunhofer IPM, Freiburg, Germany
- 01.2017 – 06.2018: S. Hofsäss, MSc student and student assistant (co-supervisor)
  - Now: doctoral researcher at the Fritz Haber Institute of the Max Planck Society, Berlin, Germany
- 10.2016 – 12.2018: J. Grzesiak, doctoral researcher (co-supervisor)
  - Now: member of staff at the German Aerospace Center, Germany

- 10.2015 – 08.2016: P. Klohofer, MSc student (co-supervisor)

## **19. Teaching experience**

- **Lecturing**
  - WS 2018/19: “Advanced Atomic and Molecular Physics”, University of Freiburg (full course)
  - WS 2016/17: “Advanced Atomic and Molecular Physics”, University of Freiburg (one lecture)
  - WS 2016/17: “Experimental Physics III”, University of Freiburg (one lecture)
- **Organization of classes (Oberassistentz)**
  - WS 2020/21: “Experimental Physics III”, University of Freiburg
  - SS 2020: “Experimental Physics IV”, University of Freiburg
  - WS 2019/20: “Advanced Atomic and Molecular Physics”, University of Freiburg
  - SS 2018: “Advanced Optics and Lasers”, University of Freiburg
  - WS 2017/18: “Low Temperature Physics”, University of Freiburg
- **Tutoring**
  - WS 2019/20: “Advanced Atomic and Molecular Physics”, University of Freiburg
  - SS 2018: “Advanced Optics and Lasers”, University of Freiburg
  - WS 2017/18: “Low Temperature Physics”, University of Freiburg
  - WS 2016/17: “Experimental Physics III”, University of Freiburg
  - SS 2016: “Physical Chemistry V”: Spectroscopy, ETH Zurich
  - WS 2015/16: “Physical Chemistry IV: Magnetic Resonance”, ETH Zurich
  - SS 2015: “Physical Chemistry V: Spectroscopy”, ETH Zurich
  - 2011: “Mathematics for Chemistry Students”, University of Oxford
- **Laboratory demonstrating**
  - SS 2020: Applied Physics Master Laboratory, University of Freiburg
  - WS 2019/20: Applied Physics Master Laboratory, University of Freiburg
  - SS 2017: Applied Physics Master Laboratory, University of Freiburg
  - 2013: Physical Chemistry Laboratory, University of Oxford
- **Supervision of seminars**
  - SS 2019: Student seminar (Term Paper) “Quantum-State Control of Atoms and Molecules: Alignment and Orientation”, University of Freiburg
  - WS 2017/18: Student seminar “Seminal Discoveries in Atomic and Particle Physics”, University of Freiburg
  - Since WS 2017/18: Group seminar (Oberseminar) “Molecular Spectroscopy”, University of Freiburg

- SS 2017: Student seminar (Term Paper) “Coherent Spectroscopy”, University of Freiburg
- WS 2016/17: Student seminar (Term Paper) “Cold Molecules”, University of Freiburg

- **Examinations**

- WS 2020/21: written exam for students of the course “Experimental Physics III”, University of Freiburg
- SS 2020: two written exams for a total of 77 students of the course “Experimental Physics IV”, University of Freiburg
- WS 2018/19: oral exams for 16 students of the course “Advanced Atomic and Molecular Physics” (with special permission), University of Freiburg
- Since 2016: Assessor in numerous oral exams for BSc and MSc students at the Institute of Physics, University of Freiburg

## 20. Publications

- (1) J. Guan, T. Sixt, K. Dulitz\*, F. Stienkemeier, *Sensitive detection of metastable NO and N<sub>2</sub> by reactive collisions with laser-excited Li*, J. Phys. B: At. Mol. Opt., **53**, 245201 (2020).
- (2) K. Dulitz\*, T. Sixt, J. Guan, J. Grzesiak, M. Debatin, F. Stienkemeier, *Suppression of Penning ionization by orbital angular momentum conservation*, Phys. Rev. A **102**, 022818 (2020).
- (3) K. Dulitz\*, M. van den Beld Serrano, F. Stienkemeier, *Single-source, collinear merged-beam experiment for the study of reactive neutral-neutral collisions*, J. Phys. Chem. A **124**, 3484 (2020).
- (4) J. Guan, V. Behrendt, P. Shen, S. Hofsäss, T. Muthu-Arachchige, J. Grzesiak, F. Stienkemeier, K. Dulitz\*, *Optical quenching of metastable helium atoms using excitation to the 4P state*, Phys. Rev. Appl. **11**, 054073 (2019).
- (5) U. Hollenstein, K. Dulitz, F. Merkt, *The adiabatic ionisation energy of CO<sub>2</sub>*, Mol. Phys. **117**(21), 2956 (2019).
- (6) J. Grzesiak, T. Momose, F. Stienkemeier, M. Mudrich, K. Dulitz\*, *Penning collisions between supersonically expanded metastable helium atoms and laser-cooled lithium atoms*, J. Chem. Phys. **150**, 034201 (2019).
- (7) J. Grzesiak, M. Vashishta, Pavle Djuricanin, F. Stienkemeier, M. Mudrich, K. Dulitz, T. Momose, *Production of rotationally cold methyl radicals in pulsed supersonic beams*, Rev. Sci. Instrum., **89**, 113103 (2018).
- (8) K. Dulitz, D. Amedro, T. J. Dillon, A. Pozzer, J. N. Crowley, *Temperature (208 – 318 K) and pressure (18 - 696 Torr) dependent rate coefficients for the reaction between OH and HNO<sub>3</sub>*, Atmos. Chem. Phys., **18**, 2381 (2018).
- (9) T. J. Dillon, K. Dulitz, C. M. B. Gross and J. N. Crowley, *Temperature dependent rate coefficients for the reactions of the hydroxyl radical with the atmospheric biogenics isoprene,  $\alpha$ -pinene and  $\Delta$ -3-carene*, Atmos. Chem. Phys., **17**, 15137 (2017).
- (10) J. Toscano, A. Tauschinsky, K. Dulitz, C. J. Rennick, B. R. Heazlewood and T. P. Softley, *Zeeman deceleration beyond periodic phase space stability*, New J. Phys. **19**, 083016 (2017).
- (11) K. Dulitz, E. Bommeli, G. Grassi, D. Zindel and F. Merkt, *Spin-orbit coupling and*

*rovibrational structure in the iododiacetylene radical cation by PFI-ZEKE photoelectron spectroscopy*, Mol. Phys. **114**(19), 2848 (2016).

- (12) K. Dulitz, J. Toscano, A. Tauschinsky and T. P. Softley, *Zeeman deceleration of metastable nitrogen atoms*, J. Phys. B: At. Mol. Opt., **49**, 075203 (2016).
- (13) K. Dulitz and T. P. Softley, *Velocity-selected magnetic guiding of Zeeman-decelerated hydrogen atoms*, Eur. Phys. J. D, **70**, 19 (2016).
- (14) A. P. P. van der Poel, K. Dulitz, T. P. Softley and H. L. Bethlem, *A compact design for a magnetic synchrotron to store beams of hydrogen atoms*, New J. Phys., **17**, 055012 (2015).
- (15) K. Dulitz, A. Tauschinsky and T. P. Softley, *Zeeman deceleration of electron-impact-excited metastable helium atoms*, New J. Phys., **17**, 035005 (2015).
- (16) K. Dulitz, N. Vanhaecke and T. P. Softley, *Model for the overall phase-space acceptance in a Zeeman decelerator*, Phys. Rev. A, **91**, 013409 (2015).
- (17) K. Dulitz, M. Motsch, N. Vanhaecke and T. P. Softley, *Getting a grip on the transverse motion in a Zeeman decelerator*, J. Chem. Phys., **140**, 104201 (2014).
- (18) T. J. Dillon, M. E. Tucceri, K. Dulitz, A. Horowitz, L. Vereecken and J. N. Crowley, *Reaction of hydroxyl radicals with C<sub>4</sub>H<sub>5</sub>N (pyrrole): Temperature and pressure dependent rate coefficients*, J. Phys. Chem. A, **116**(24), 6051 (2012).

\*corresponding author

## **21. Invited talks**

- (19) *New avenues in studying and controlling chemical reactions at the quantum limit*, Physics Colloquium, Institute of Physics, Freiburg, Germany, 2020.
- (20) *Quantum-state-controlled reactive atom-atom scattering*, Department of Chemistry, University of Basel (seminar), Basel, Switzerland, 2019.
- (21) *Quantum-state-controlled reactive atom-atom scattering*, Department of Physics, University of Rennes 1 (seminar), Rennes, France, 2019.
- (22) *Quantum-state-controlled Penning collisions between metastable He atoms and ultracold Li atoms*, New Horizons in Chemical Physics (symposium), Oxford, United Kingdom, 2019.
- (23) *Towards the study of quantum-state-selected Penning reactions*, Canadian Chemistry Conference and Exhibition (CSC, conference), Edmonton, Canada, 2018.
- (24) *Towards the study of quantum-state-selected Penning reactions*, Conference on Cold and Controlled Molecules and Ions (CCMI, conference), Athens, USA, 2018.
- (25) *Towards the study of quantum-state-selected Penning reactions*, DPG Spring Meeting (conference), Erlangen, Germany, 2018.
- (26) *Reactive scattering between metastable helium and state-selected, magneto-optically trapped lithium*, International Meeting on Atomic and Molecular Physics and Chemistry (IMAMPC, conference), Toruń, Poland, 2017.
- (27) *Reactive scattering between metastable helium and state-selected, magneto-optically trapped lithium*, IRTG Seminar (seminar), Freiburg, Germany, 2017.
- (28) *Transverse focusing effects in the Zeeman deceleration of hydrogen atoms*, Department of Molecular and Laser Physics, Radboud University Nijmegen (seminar), Nijmegen, The Netherlands, 2014.
- (29) *Towards cold chemistry with magnetically decelerated atoms*, International Workshop on Zeeman Deceleration (workshop), Zurich, Switzerland, 2012.



## **22. Contributed talks**

- (30) *Sensitive detection of metastable NO and N<sub>2</sub> by reactive collisions with laser-excited Li*, Women Physicists' Conference, Hamburg (online), Germany, 2020.
- (31) *Zeeman deceleration of metastable helium and nitrogen atoms*, DPG Spring Meeting, Heidelberg, Germany, 2015.
- (32) *Zeeman deceleration of light metastable atoms*, Conference on Cold and Controlled Molecules and Ions (CCMI), Monte Verità, Switzerland, 2014.
- (33) *Transverse focusing effects in the Zeeman deceleration of hydrogen atoms*, 46th Conference of the European Group on Atomic Systems (EGAS 46), Lille, France, 2014.
- (34) *Transverse focusing effects in the Zeeman deceleration of hydrogen atoms*, DPG Spring Meeting, Berlin, Germany, 2014.
- (35) *Towards cold chemistry with magnetically decelerated hydrogen atoms*, Bunsentagung, Karlsruhe, Germany, 2013.
- (36) *Towards cold chemistry with magnetically decelerated hydrogen atoms*, DPG Spring Meeting, Hannover, Germany, 2013.
- (37) *Towards cold chemistry with magnetically decelerated hydrogen atoms*, Spectroscopy and Dynamics Group Meeting, SDGM, Durham, United Kingdom, 2013.

In addition to that, I have 18 poster contributions as presenting author and > 20 contributions to presentations and posters as co-author.

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