Dominik Lentrodt

PhD Student

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Educational history

2017– **PhD Student**, *Max-Planck-Institut für Kernphysik*, Heidelberg, Germany.
Thesis topic: Quantum effects in X-ray quantum optics
Supervisor: apl. Prof. Dr. Jörg Evers
Expected date of thesis: March 2021

2016–2017 **4+4 Program of the Heidelberg Graduate School for Fundamental Physics**, *Max-Planck-Institut für Kernphysik and University of Heidelberg*, Heidelberg, Germany.

2012–2016 **MSc & BA Hons Physics**, *Gonville and Caius College, University of Cambridge*, Cambridge, UK.

2009–2012 **German Abitur**, *Maria-Theresia Gymnasium*, Munich, Germany.

2010–2011 **Frühstudium Informatik**, *Technical University of Munich*, Munich, Germany.

Relevant awards and funding

2018 **XXV International Summer School Nicolás Cabrera scholarship**, *Instituto Nicolás Cabrera at the Universidad Autónoma de Madrid*.
Value approx. 400€.

2018 **RACIRI Summer School scholarship**, *Röntgen-Angström-Cluster (RAC), Ioffe-Röntgen-Institute (IRI) & German electron synchrotron (DESY)*.
Value approx. 1500€.

2016 **Summer research project**, *University of Cambridge*, Cambridge, UK.

2013–2016 **Gonville and Caius College Scholar**, *University of Cambridge*, Cambridge, UK.
Yearly prize for continued academic excellence.

2015 **Gonville and Caius College Bell-Wade Bursary**, *University of Cambridge*, Cambridge, UK.
Financial support for students succesfully performing in academia and sports.

2011 **"Projekt Unitag für hochbegabte und besonders leistungsfähige Gymnasiastinnen und Gymnasiasten"**, *Ludwig-Maximilians-University Munich*, Munich, Germany.
"University project day for highly able students".

Leadership roles and outreach

2018– **Student Representative of the International Max-Planck Research School for Quantum Dynamics in Physics, Chemistry and Biology (IMPRS-QD)**.

2018–2019 **Organising Committee of the 12th HGSFP Winterschool**.
A committee of five students elected to organise the yearly winterschool funded by the Heidelberg Graduate School of Fundemental Physics (HGSFP). Financial volume of ∼27000€.

2017– **Outreach at the Max-Planck-Institut für Kernphysik**.
Jointly organised the "Girls day" and two other outreach projects at the Max-Planck-Institut für Kernphysik, which involved teaching students and children about the physics of light in interactive experiments.

2014–2015 **Cambridge University Kickboxing Society Committee: Treasurer**.
Responsible for a financial volume of ∼1000 GBP.

Teaching experience

2017 **Theoretical quantum optics, Head tutor and tutor to class of 8**, *University of Heidelberg*.
Theoretical quantum optics including advanced topics
∼12 hours of lessons + preparation, exercise correction and co-conducting oral examinations.

2017 **Experimental physics I (PEPI), Tutor to class of 22**, *University of Heidelberg*.
Mechanics and Thermodynamics
∼12 hours of lessons + preparation, exercise correction and grading exams.

2017-2019 **Various replacement teaching**, *University of Heidelberg*.
Replacement lectures and tutorials for apl. Prof. Dr. Jörg Evers. ∼4 hours of lecturing on Theoretical Quantum Optics. ∼6 hours of tutoring experimental and theoretical physics courses.

Languages

German Mother tongue

English Fluent; lived in England for 4 years

Programming

Python, MATLAB, C++, Java

Scientific proposals and large-scale facility experiments

2019– **Co-proposer of Proposal No. 2664 submitted to the European XFEL (Hamburg)**.
Proposal submitted Dec 2019.

2019– **Co-proposer of Proposal No. 2628 submitted to the European XFEL (Hamburg)**.
Proposal submitted Dec 2019.

2018–2019 **Co-proposer and Co-investigator of Proposal I-20180786 at PETRA III (Hamburg)**, *Proposal title: "Optimizing resonant photon flux enhancement with yoctosecond phase stability in mechanically controlled nuclear resonance scattering".*.
Experiment conducted May 2019, resulting in publication s1 (submitted).

2017–2018 **Co-investigator of three experiments at PETRA III (Hamburg) and ESRF (Grenoble)**.
Resulting in publication 2 (published in refereed journal) and p2 (in preparation).

Publications

Published in refereed journals

1. D. Lentrodt and J. Evers, "*Ab Initio* Few-Mode Theory for Quantum Potential Scattering Problems", *Phys. Rev. X* **10**, 011008 (2020).
2. K. P. Heeg, A. Kaldun, C. Strohm, P. Reiser, C. Ott, R. Subramanian, D. Lentrodt, J. Haber, H.-C. Wille, S. Goerttler, R. Rüffer, C. H. Keitel, R. Röhlsberger, T. Pfeifer and J. Evers, "Spectral narrowing of x-ray pulses for precision spectroscopy with nuclear resonances", *Science* **357**, 375-378 (2017).

Submitted/Preprints

s1 K. P. Heeg, A. Kaldun, C. Strohm, P. Reiser, C. Ott, R. Subramanian, D. Lentrodt, J. Haber, H.-C. Wille, S. Goerttler, R. Rüffer, C. H. Keitel, R. Röhlsberger, T. Pfeifer and J. Evers, "Coherent x-ray-optical control of nuclear excitons with zeptosecond phase-stability", *arXiv:2003.03755 [quant-ph]*.

s2 D. Lentrodt, K. P. Heeg and J. Evers, "Ab initio quantum models for thin-film X-ray cavity QED with Mössbauer nuclei", *arXiv:2003.13859 [quant-ph]*.

In Preparation

p1 D. Lentrodt, K. P. Heeg, C. Ott, C. Strohm, J. Haber, H.-C. Wille, R. Rüffer, C. H. Keitel, R. Röhlsberger, T. Pfeifer and J. Evers, "Multi-mode mode effects beyond input-output models in nuclear cavity quantum optics", *in preparation*.

p2 D. Lentrodt, K. P. Heeg, C. H. Keitel and J. Evers, "Inducing and detecting population inversions of Mössbauer nuclei", *in preparation*.

Presentations

Invited Conference Talks

Jan. 2020 **41st Extreme Atomic Systems (EAS) conference**, Rietzlern, Kleinwalsertal, Austria,
Ab initio few-mode theory
Invited by: Prof. Dr. Thomas Pfeifer

Sep. 2019 **QSEC 2019**, Heidelberg, Germany,
Ab initio few-mode theory for quantum potential scattering problems
Invited by: Conference committee

July 2019 **LPHYS'19 - 28th annual International Laser Physics Workshop**, Gyeongju, South Korea
Coherent X-Ray-Optical Control of Nuclear Dynamics with Zeptosecond Phase-Stability
Invited by: Prof. Dr. Olga Kocharovskaya

Feb. 2019 **40th Extreme Atomic Systems (EAS) conference**, Rietzlern, Kleinwalsertal, Austria,
X-ray Quantum Optics with Mössbauer Nuclei
Invited by: Prof. Dr. A. Buchleitner, Prof. Dr. T. Pfeifer, Prof. Dr. J. M. Rost

Invited Seminar Talks/Colloquia

Okt. 2019 **Seminarium Fizyki Materii Skondensowanej**, University of Warsaw, Warsaw, Poland
Ab initio few-mode theories for quantum potential scattering problems
Hosts: Dr. habil. Magdalena Stobińska, Dr. Thomas Sturges

May 2019 **MPSD Theory Seminar**, Max-Planck-Institut für Struktur und Dynamik der Materie, Center for Free-Electron Laser Science, Hamburg, Germany
Ab initio few-mode theories for quantum potential scattering problems
Hosts: Prof. Dr. Angel Rubio, Dr. Michael Ruggenthaler

Feb. 2019 **Quantum Optics and Statistics Colloquium**, Albert-Ludwigs-Universität Freiburg, Freiburg, Germany,
Ab initio few-mode theories for quantum potential scattering problems
Hosts: Prof. Dr. Andreas Buchleitner, Dr. Stefan Buhmann

Nov. 2018 **ITP Seminar**, Institute for Theoretical Physics, Vienna University of Technology, Vienna, Austria
Effective few-mode theories for ab initio cavity QED
Hosts: Prof. Dr. Stefan Rotter, Dr. Himadri Shekhar Dhar

Contributed Talks/Other Talks

July 2019 **LPHYS'19 - 28th annual International Laser Physics Workshop**, Gyeongju, South Korea
Ab Initio Few-Mode Theories for Quantum Potential Scattering Problems
Invited by: Prof. Dr. Olga Kocharovskaya

Mar. 2019 **DPG Spring Meeting for Atomic, Molecular, Quantum Optical and Plasma Physics**, Rostock, Germany
Ab initio few-mode Hamiltonians for cavity QED

Nov. 2018 **CQD Colloquium - IMPRS-QD Pretalk**, Center for Quantum Dynamics, Heidelberg University, Heidelberg, Germany
Effective few-mode theories for resonant quantum scattering problems

May 2018 **Evaluation of the International Max Planck Research School for Quantum Dynamics in Physics, Chemistry and Biology - Student Talk**, MPI für Kernphysik, Heidelberg, Germany
X-ray quantum optics with Mössbauer nuclei

Mar. 2018 **DPG Spring Meeting for Atomic, Molecular, Quantum Optical and Plasma Physics**, Erlangen, Germany
Linking ab initio theory and phenomenological models in cavity QED

Jan. 2018 **Seminar Theoretical Quantum Dynamics**, MPI für Kernphysik, Heidelberg, Germany
Effective few-mode theories for quantum scattering problems in X-ray cavity QED

Posters

Sep. 2019 **QSEC 2019**, Heidelberg, Germany
Ab initio few-mode theory for quantum potential scattering problems, K. P. Heeg, C. H. Keitel and J. Evers

Mar. 2019 **DPG Spring Meeting for Atomic, Molecular, Quantum Optical and Plasma Physics**, Rostock, Germany
Beyond input-output models in X-ray cavity QED with overlapping modes, K. P. Heeg, C. H. Keitel and J. Evers

Sep. 2018 **XXV International Summer School Nicolás Cabrera**, Miraflores de la Sierra, Madrid, Spain
X-ray cavity QED in the overlapping modes regime
D. Lentrodt, K. P. Heeg, C. H. Keitel and J. Evers

Aug. 2018 **RACIRI Summer School**, Sellin, Rügen, Germany
X-ray cavity QED with Mössbauer nuclei in the overlapping modes regime
D. Lentrodt, K. P. Heeg, C. H. Keitel and J. Evers

May 2018 **SFB 1225 ISOQUANT Workshop**, Heidelberg, Germany
Effective few-mode theories for quantum potential scattering in X-ray cavity QED, K. P. Heeg, C. H. Keitel and J. Evers

Mar. 2018 **DPG Spring Meeting for Atomic, Molecular, Quantum Optical and Plasma Physics**, Erlangen, Germany
X-ray cavity QED beyond the input-output formalism, K. P. Heeg, C. H. Keitel and J. Evers

Jan. 2018 **11th Winterschool of the Heidelberg Graduate School of Fundamental Physics**, Obergurgl, Austria
Effective few-mode theories for quantum scattering problems in X-ray cavity QED, K. P. Heeg, C. H. Keitel and J. Evers

Dez. 2017 **Center for Quantum Dynamics Colloquium**, Ruprecht-Karls University, Heidelberg, Germany
Cavity QED beyond the input-output formalism, K. P. Heeg, C. H. Keitel and J. Evers

Mar. 2017 **DPG Spring Meeting for Atomic, Molecular, Quantum Optical and Plasma Physics**, Mainz, Germany
Collective sensing at x-ray energies
P. Longo, D. Lentrodt, C. H. Keitel and J. Evers

Feb. 2017 **SFB 1225 ISOQUANT Kick-Off Workshop**, Obergurgl, Austria
Many-body dynamics of large ensembles of nuclei
P. Longo, D. Lentrodt, C. H. Keitel and J. Evers