

# Philipp Preiss

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## EDUCATION

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**Harvard University**, Cambridge, MA, USA

PhD in Physics

**Mar 2016**

**University of Cambridge**, Cambridge, United Kingdom

Master of Natural Sciences in Experimental and Theoretical Physics

**Jun 2010**

First Class mark

Bachelor of Arts in Experimental and Theoretical Physics

**Jun 2010**

First Class mark

**Bischof-Neumann-Schule**, Königstein, Germany

Abitur with majors in mathematics and physics

**Jun 2005**

Average grade 1.0 (highest)

## RESEARCH

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**Heidelberg University**, Heidelberg, Germany

Postdoctoral fellow in the group of Prof S. Jochim

**Apr 2016–present**

Quantum simulation of mesoscopic Fermi systems

Strongly interacting Fermi gases in two dimensions

**Harvard University**, Cambridge, MA, USA

PhD student with Prof M. Greiner

**Aug 2010–Mar 2016**

Thesis *Atomic Bose-Hubbard Systems with Single-Particle Control*

Microscopic studies of ultracold atomic gases in optical lattices

**University of Cambridge**, Cambridge, UK

Masters student with Dr M. Atatüre

**Oct 2009–May 2010**

Thesis *Transmission Spectroscopy of Self-Assembled InAs Quantum Dots*

Optical properties of semiconductor quantum dots

## PUBLICATIONS

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- M. Holten, L. Bayha, K. Subramanian, C. Heintze, **Philipp Preiss**, and S. Jochim: Observation of Pauli Crystals, arXiv:2005.03929 (2020)
- L. Palm, F. Grusdt, and **Philipp Preiss**: Skyrmion Ground States of Rapidly Rotating Few-Fermion Systems, *New J. Phys.* **22**, 083037 (2020)
- L. Bayha, M. Holten, R. Klemt, K. Subramanian, J. Bjerlin, S. M. Reimann, G. M. Bruun, **Philipp Preiss**, and S. Jochim: Observing the emergence of a quantum phase transition – shell by shell, arXiv:2004.14761(2020)
- P. A. Murthy, N. Defenu, L. Bayha, M. Holten, **Philipp Preiss**, T. Enss, and S. Jochim: Quantum scale anomaly and spatial coherence in a 2D Fermi superfluid, *Science* **365**, 268 (2019)
- J. Cotler, S. Choi, A. Lukin, H. Gharibyan, T. Grover, M. E. Tai, M. Rispoli, R. Schittko, **Philipp Preiss**, A. M. Kaufman, M. Greiner, H. Pichler, and P. Hayden: Quantum Virtual Cooling, *Phys. Rev. X* **9**, 031013 (2019)
- Q. Guan, V. M. Klinkhamer, R. Klemt, J. H. Becher, A. Bergschneider, **Philipp Preiss**, S. Jochim, and D. Blume: Density Oscillations Induced by Individual Ultracold Two-Body Collisions, *Phys. Rev. Lett.* **122**, 083401 (2019)
- Philipp Preiss**, J. H. Becher, R. Klemt, V. M. Klinkhamer, A. Bergschneider, and S. Jochim: High-Contrast Interference of Ultracold Fermions, *Phys. Rev. Lett.* **122**, 143602 (2019)
- A. Bergschneider, V. M. Klinkhamer, J. H. Becher, R. Klemt, L. Palm, G. Zürn, S. Jochim, and **Philipp Preiss**: Experimental characterization of two-particle entanglement through position and momentum correlations, *Nature Physics* **15**, 640 (2019)
- A. Bergschneider, V. M. Klinkhamer, J. H. Becher, R. Klemt, G. Zürn, **Philipp Preiss**, and S. Jochim: Spin-resolved single-atom imaging of  $^6\text{Li}$  in free space, *Phys. Rev. A* **97**, 063613 (2018)
- M. Holten, L. Bayha, A. C. Klein, P. A. Murthy, **Philipp Preiss**, and S. Jochim: Anomalous breaking of scale invariance in a two-dimensional Fermi gas, *Phys. Rev. Lett.* **121**, 120401 (2018)
- P. A. Murthy, M. Neidig, R. Klemt, L. Bayha, I. Boettcher, T. Enss, M. Holten, G. Zürn, **Philipp Preiss**, and S. Jochim: High-temperature pairing in a strongly interacting two-dimensional Fermi gas, *Science*, **359**, 452 (2018)
- J. Unmuth-Yockey, J. Zhang, **Philipp Preiss**, L.-P. Yang, S.-W. Tsai, and Y. Meurice: Probing the conformal Calabrese-Cardy scaling with cold atoms, *Phys. Rev. A*, **96**, 023603 (2017)
- M. E. Tai, A. Lukin, M. Rispoli, R. Schittko, T. Menke, D. Borgnia, **Philipp Preiss**, F. Grusdt, A. M. Kaufman, and M. Greiner: Microscopy of the interacting Harper-Hofstadter model in the two-body limit, *Nature*, **528**, 77 (2017)
- A. M. Kaufman, M. E. Tai, A. Lukin, M. Rispoli, R. Schittko, **Philipp Preiss**, and M. Greiner: Quantum thermalization through entanglement in an isolated many-body system, *Science*, **353**, 794 (2016)
- P. Zupancic, **Philipp Preiss**, R. Ma, A. Lukin, M. E. Tai, M. Rispoli, R. Islam, and M. Greiner: Ultra-precise holographic beam shaping for microscopic quantum control, *Opt. Express*, **24**, 13881 (2016)
- R. Islam, R. Ma, **Philipp Preiss**, M.E. Tai, A. Lukin, M. Rispoli, and M. Greiner: Measuring entanglement entropy in a quantum many-body system, *Nature*, **528**, 77 (2015)

**Philipp Preiss**, R. Ma, M.E. Tai, A. Lukin, M. Rispoli, P. Zupancic, Y. Lahini, R. Islam, and M. Greiner: Strongly correlated quantum walks in optical lattices, *Science*, **347**, 1229 (2015)

**Philipp Preiss**, R. Ma, M.E. Tai, J. Simon, and M. Greiner: Quantum gas microscopy with spin, atom-number and multi-layer readout, *Phys. Rev. A*, **91**, 041602(R) (2015)

W. Bakr, **Philipp Preiss**, M.E. Tai, R. Ma, J. Simon, and M. Greiner: Orbital excitation blockade and algorithmic cooling in quantum gases, *Nature*, **480**, 500 (2011)

R. Ma, M.E. Tai, **Philipp Preiss**, W. Bakr, J. Simon, and M. Greiner: Photon-assisted tunneling in a biased strongly correlated Bose gas, *Phys. Rev. Lett*, **107**, 095301 (2011)

J. Simon, W. Bakr, R. Ma, M.E. Tai, **Philipp Preiss**, and M. Greiner: Quantum simulation of antiferromagnetic spin chains in an optical lattice, *Nature*, **472**, 307 (2011)

## PRIZES AND AWARDS

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**Daimler and Benz Foundation fellowship** **2018-2020**  
Young investigator fellowship

**Marie Skłodowska-Curie individual postdoctoral fellowship** **2016-2018**  
Heidelberg University

**ICQT Conference Moscow, Russia** **2015**  
Best poster award

**Harvard University** **2010**  
Purcell Fellowship

**University of Cambridge**  
Senior Scholar of Trinity College **2008**  
Robert Wright Prize for Geology **2007**

## RECENT TALKS

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**Spring meeting of the German Physical Society** **Mar 2020**  
Hannover, Germany (invited talk - cancelled)

**Research Seminar** **Mar 2020**  
Yale University, CT, USA

**Research Seminar** **Jan 2020**  
Columbia University, NY, USA

**Research Seminar** **Jan 2020**  
Hamburg University, Germany

**APS DAMOP** **Jun 2019**  
Milwaukee, Wisconsin (invited talk)

**Atomintitut Vienna Seminar Series** **Jan 2019**  
TU Vienna, Austria (invited talk)

<b>Heraeus Workshop: Research Frontiers in Ultracold Quantum Gases</b> Bad Honnef, Germany	<b>Dec 2018</b>
<b>Anyon Physics of Ultracold Atomic Gases</b> International School and Workshop, Kaiserslautern (invited talk)	<b>Dec 2018</b>
<b>Heidelberg CQD Colloquium</b> Center for Quantum Dynamics, Heidelberg (invited talk)	<b>Oct 2018</b>
<b>Research Seminar</b> Centre for Cold Matter, Imperial College, London	<b>Jan 2018</b>
<b>Research Seminar</b> Cavendish Laboratory, University of Cambridge	<b>Jan 2018</b>
<b>International Conference on Quantum Simulation</b> ENS, Paris, France	<b>Nov 2017</b>
<b>Topological Effects in Ultracold Atoms</b> International Institute of Physics, Natal, Brazil (invited talk)	<b>Nov 2016</b>
<b>BEC 2016 Conference</b> University of Salerno, Salerno, Italy (invited talk)	<b>Sep 2016</b>
<b>Quantum Gases 2016 Conference</b> Institute for Advanced Studies, Tsinghua University, Beijing, China (invited talk)	<b>Aug 2016</b>
<b>Research Seminar</b> USTC, Hefei, China	<b>Aug 2016</b>
<b>Gordon Research Seminar Quantum Science</b> Stonehill College, Easton, MA, USA (invited talk)	<b>Jul 2016</b>
<b>Heraeus Workshop: Discrete and Analogue Quantum Simulation</b> Bad Honnef, Germany (invited talk)	<b>Feb 2014</b>

## PROFESSIONAL ACTIVITIES

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### Project supervision

Bachelor	Casey McKenna, Ram-Janik Petzold, Felix Jaeschke, Sebastian Blänsdorf
Master	Michael Dehabe, Lukas Plam, Laurin Fischer, Carl Heintze
PhD	Ralf Klemt, Jan Hendrik Becher

### Conference co-organizer

<i>Multi-Point Correlations in Quantum Many-Body Systems</i> International Academic Forum, Heidelberg	<b>Apr 2019</b>
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<i>Beyond Digital Computing: The Power of Quantum and Neural Networks</i> International Academic Forum, Heidelberg	<b>Mar 2018</b>
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<b>Organizer of the CQD colloquium series</b> Center for Quantum Dynamics, Heidelberg	<b>Jan 2017 – Feb 2018</b>
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## Journal referee

*Nature Physics, Physical Review Letters, Physical Review A, and New Journal of Physics*

## TEACHING EXPERIENCE

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- Instructor *Quantum Technologies*** **Apr 2020 – Jul 2020**  
Master seminar, Heidelberg University, co-instructor PD Martin Gärttner
- Lecturer *Microscopy of Quantum Gases*** **Aug 2018**  
Summer school: Cold Controlled Ensembles in Physics and Chemistry, Freiburg University
- Instructor *Running a Quantum Computer*** **Mar 2018 – Jul 2018**  
Master seminar, Heidelberg University, co-instructor Prof F. Jendrzejewski
- Lecturer *Quantum Simulation with Ultracold Atoms*** **Jan 2018**  
Heidelberg Graduate School for Fundamental Physics winter school
- Mentor at the *Quantum Ideas Factory*** **Sep 2017**  
Interdisciplinary innovation workshp, Heidelberg University
- Instructor *Experimental Frontiers of Quantum Dynamics Research*** **Oct 2016 – Jan 2017**  
Master seminar, Heidelberg University, co-instructor Prof T. Pfeifer
- Teaching Assistant for *Mechanics and Special Relativity*** **Sep–Dec 2013**  
Undergraduate course, Harvard University, instructor Prof H. Georgi
- Teaching Assistant for *Wave Mechanics*** **Sep–Dec 2011**  
Undergraduate course, Harvard University, instructor Prof M. Greiner