

# CURRICULUM VITAE

PETER SCHAUSS

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## CONTACT INFORMATION

Department of Physics  
Jesse Beams Laboratory 134  
University of Virginia  
Charlottesville, VA 22903-3461, USA

Phone: +1 434-243-3472  
Fax: +1 434-924-4576  
Email: ps@virginia.edu  
Web: ultracold.phys.virginia.edu  
ORCID: <http://orcid.org/0000-0002-8505-5195>

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## EMPLOYMENT

Since 08/2018 Assistant Professor of Physics, University of Virginia

10/2015–08/2018 Associate Research Scholar at the Department of Physics, Princeton University on a Dicke fellowship with Waseem Bakr

03/2015–09/2015 Postdoctoral Researcher at the Max-Planck Institute of Quantum Optics

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## EDUCATION

2010–2015 Ph.D. in Physics, summa cum laude (highest grade), Max-Planck Institute of Quantum Optics and Ludwig-Maximilians-Universität München, Germany (Prof. I. Bloch)

2007–2009 M.S. Physics, with distinction, Technical University of Darmstadt, Germany

2005–2010 B.S. Computer Science, Technical University of Darmstadt, Germany

2004–2007 B.S. Physics, Technical University of Darmstadt, Germany

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## HONORS AND AWARDS

2018 Blavatnik Family Foundation 2018 Regional Award Finalist

2015 – 2018 Dicke Fellowship at Princeton University

2010 – 2012 Max-Planck Society Fellowship

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## PROFESSIONAL SERVICE

Referee for Science, Physical Review Letters, Nat. Comm., J. Phys. B, Quantum Sci. Technol., J. Phys.: Condens. Matter, Appl. Phys B, Opt. Express

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## MAIN SCIENTIFIC ACHIEVEMENTS

- First single-site imaging of Rydberg atoms in a quantum gas microscope
- First in-situ imaging of Rydberg crystals
- Realization of transverse Ising models with Rydberg atoms in optical lattices
- Adiabatic preparation of Rydberg crystals in one and two dimensions
- First implementation of autofocussing for a quantum gas microscope
- Optimization of the image deconvolution code by Stefan Kuhr code to obtain real-time evaluation
- Direct measurement of the spatial Rydberg-Rydberg correlation function
- Spatially resolved imaging of entangled Rydberg superatoms
- First excitation of lithium Rydberg atoms in an optical lattice using 230nm light
- Experimental implementation of Raman sideband cooling for  $^6\text{Li}$  in a novel optical lattice
- Observation of canted antiferromagnetism of fermions in optical lattices
- Observation of charge density waves of attractive fermions in optical lattices
- Preparation of Ising Rydberg-antiferromagnets in optical lattices
- Observation of bad metallic transport in Hubbard systems

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## INVITED TALKS

28. Seminar, Virginia Tech, Blacksburg, April 22, 2019, "Quantum gas microscopy of many-body dynamics in Fermi-Hubbard and Ising systems"
27. Condensed Matter Seminar, University of Virginia, Charlottesville, March 28, 2019, "Quantum gas microscopy of many-body dynamics in Fermi-Hubbard and Ising systems"
26. Aspen Winter Conference 2019: New Approaches to Strongly Correlated Quantum Systems, Aspen, USA, February 5, 2019, "Quantum gas microscopy of many-body dynamics in Fermi-Hubbard and Ising systems"
25. Advances in Quantum Simulation with Ultracold Atoms, Natal, Brazil, November 9, 2018, "Quantum gas microscopy of many-body dynamics in Fermi-Hubbard and Ising systems"
24. Bounding Transport and Chaos in Condensed Matter and Holography, Nordita, Stockholm, Sweden, September 9, 2018, "Bad Metallic Transport in a Cold Atom Fermi-Hubbard System"
23. Thomas F. Gallagher Retirement Symposium, University of Virginia, Charlottesville, VA, August 24, 2018, "Quantum simulation of transverse Ising models with Rydberg atoms in optical lattices"
22. Quantum transport with cold atoms conference, Congressi Stefano Franscini, Monte Verità, TI, Switzerland, July 21-25, 2018, "Bad Metallic Transport in a Cold Atom Fermi-Hubbard System"

21. Seminar, ZOQ, Hamburg, Germany, July 11, 2018, "Bad Metallic Transport in a Cold Atom Fermi-Hubbard System"
20. Seminar, ICFO, Barcelona, Spain, July 4, 2018, "Probing the quench dynamics of antiferromagnetic correlations in a 2D quantum Ising spin system"
19. IAP Colloquium, TU Darmstadt, Germany, April 10, 2018, "Quantum gas microscopy of many-body dynamics in Fermi-Hubbard and Ising systems"
18. JFI Special seminar, University of Chicago, IL, March 12, 2018, "Quantum gas microscopy of many-body dynamics in Fermi-Hubbard and Ising systems"
17. Colloquium, University of Virginia, March 2, 2018, "Quantum gas microscopy of many-body dynamics in Fermi-Hubbard and Ising systems"
16. Croucher Conference in Frontiers of Cold Atom Physics, Hong Kong, December 5-8, 2017, "Microscopy of Fermi-Hubbard and transverse Ising systems"
15. Brazilian Physical Society Meeting 2017 XL ENFMC, Armação dos Búzios, RJ, Brazil, August 28, 2017, "Microscopy of atomic Fermi-Hubbard systems in new regimes"
14. JILA Public Seminar, Boulder, CO, August 22, 2017, "Microscopy of atomic Fermi-Hubbard systems in new regimes"
13. Group seminar Pfau, Stuttgart, Germany, July 13, 2017, "Microscopy of atomic Fermi-Hubbard systems in new regimes"
12. Condensed Matter Physics seminar, Caltech, Pasadena, CA, June 19, 2017, "Microscopy of atomic Fermi-Hubbard systems in new regimes"
11. Focus Workshop on Long-range interactions with ultracold atoms, Natal, RN, Brazil, November 21, 2016, "Long-range Ising quantum magnets with Rydberg atoms"
10. Workshop on Topological Effects In Ultra-Cold Atoms, Natal, RN, Brazil, November 15, 2016, "Spin-imbalanced Fermi gases with and without lattice in two dimensions"
9. DAMOP 2016, Providence, RI, May 23-27, 2016, "Crystallization in Ising quantum magnets and Rydberg superatoms"
8. Group seminar Bloch, Garching, Germany, April 12, 2016, "Phase separation and pair condensation in a spin-imbalanced 2D Fermi gas"
7. Group seminar Kuhr, Glasgow, UK, July 7, 2015, "Transport in Heisenberg spin chains"
6. Group seminar Rempe, Garching, Germany, June 11, 2015, "High-resolution imaging of Rydberg many-body systems"
5. Workshop - Networks of Ultra-Cold Rydberg atoms - Keble College, Oxford, UK, January 9-10, 2014, "Spatially ordered structures and coherent control in a two-dimensional Rydberg gas"
4. Theory Seminar, MPI of Quantum Optics, Garching, Germany, December 18, 2013, "Spatially ordered structures and coherent control in a two-dimensional Rydberg gas"
3. MPQ-Colloquium, MPI of Quantum Optics, Garching, Germany, December 3, 2013, "Spatially ordered structures and coherent control in a two-dimensional Rydberg gas"
2. Long-range interactions in the ultracold, Satellite workshop of Sant-Feliu BEC 2013, Stuttgart, Germany, September 3-5, 2013, "Spatially ordered structures in a two-dimensional Rydberg gas"

1. RQI – Winter School on Rydberg Physics and Quantum Information 2013, Obergurgl, Austria, February 10-15, 2013, "Observation of mesoscopic crystalline structures in a two-dimensional Rydberg gas"

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## SELECTED CONTRIBUTED TALKS

- Conference on Frontiers in Two-Dimensional Quantum Systems, Trieste, Italy, November 14, 2017, "Microscopy of two-dimensional atomic Fermi-Hubbard systems in new regimes"
- EGAS49, Durham, UK, July 18, 2017, "Quantum gas microscopy of spatial correlations in attractive and repulsive Fermi-Hubbard systems"
- International Workshop on Many-body physics in synthetic quantum systems, Stellenbosch, South Africa, April 7, 2016, "Demonstration of Rydberg dressing in a many body system"
- 2013 Joint Meeting of the APS Division of Atomic, Molecular & Optical Physics and the CAP Division of Atomic, Molecular & Optical Physics, Québec City, Canada, June 5, 2013, "Observation of spatially ordered structures in a two-dimensional Rydberg gas"

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## PROJECTS AND THEORY COLLABORATIONS

- Transport in the 2D Fermi-Hubbard model  
In the group of Waseem Bakr in collaboration with David Huse.
- Dynamics in a 2D Ising model with Rydberg atoms in an optical lattice  
In the group of Waseem Bakr in collaboration with Trithep Devakul and David Huse.
- Spin correlations in the Fermi-Hubbard model  
In the group of Waseem Bakr in collaboration with Ehsan Khatami, Thereza Paiva, Nandini Trivedi and David Huse.
- Many-body localization in the 2D Bose-Hubbard model  
In the group of Immanuel Bloch and Christian Gross. In collaboration with Vedika Khemani and David Huse.
- Rydberg atoms in optical lattices  
In the group of Immanuel Bloch, Stefan Kuhr, Christian Gross. In collaboration with Thomas Pohl, Tommaso Macrì and Rick van Bijnen.
- Dynamics, excitations and correlations in the Bose-Hubbard model  
In the group of Immanuel Bloch, Stefan Kuhr, Christian Gross. In collaboration with Mari Carmen Bañuls, Peter Barmettler, Eugene Demler, Thierry Giamarchi, Michael Knap, Corinna Kollath, Leonardo Mazza, David Pekker, Dario Poletti, Lode Pollet, Ulrich Schollwöck.
- Atoms in optical microtraps  
In the group of Gerhard Birkel.

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## PUBLICATIONS

Google scholar: h-index 19, # of citations > 4,000  
ISI WoS: h-index 16, # of citations >2,600  
Preprints of all publications are available on arxiv.org.

### Peer-reviewed publications

21. P. T. Brown, D. Mitra, E. Guardado-Sanchez, R. Nourafkan, A. Reymbaut, C.-D. Hébert, S. Bergeron, A.-M. S. Tremblay, J. Kokalj, D. A. Huse, **P. Schauß**, W. S. Bakr  
*Bad metallic transport in a cold atom Fermi-Hubbard system*  
Science **363**, 379–382 (2019)
20. E. Guardado-Sanchez, P. T. Brown, D. Mitra, T. Devakul, D. A. Huse, **P. Schauß**, W. S. Bakr  
*Probing the quench dynamics of antiferromagnetic correlations in a 2D quantum Ising spin system*  
Phys. Rev. X **8**, 021069 (2018)
19. **P. Schauss**  
*Quantum simulation of transverse Ising models with Rydberg atoms*  
Quantum Sci. Technol. **3**, 023001 (2018)
18. D. Mitra, P. T. Brown, E. Guardado-Sanchez, S. S. Kondov, T. Devakul, D. A. Huse, **P. Schauß**, W. S. Bakr  
*Quantum gas microscopy of an attractive Fermi-Hubbard system*  
Nat. Phys., **14**, 173–177 (2018)
17. P. T. Brown, D. Mitra, E. Guardado-Sanchez, **P. Schauß**, S. S. Kondov, E. Khatami, T. Paiva, N. Trivedi, D. A. Huse, W. S. Bakr  
**•Spin-imbalance in a 2D Fermi-Hubbard system**  
Science **357**, 1385–1388 (2017)
16. D. Mitra, P. Brown, **P. Schauß**, S. S. Kondov, W. S. Bakr  
*Phase Separation and Pair Condensation in a Spin-Imbalanced 2D Fermi Gas*  
Phys. Rev. Lett. **117**, 093601 (2016)
15. J. Zeiher, R. van Bijnen, **P. Schauß**, S. Hild, J.-y. Choi, T. Pohl, I. Bloch, C. Gross  
*Many-body interferometry of a Rydberg-dressed spin lattice*  
Nat. Phys. **12**, 1095–1099 (2016)
14. J.-y. Choi, S. Hild, J. Zeiher, **P. Schauß**, A. Rubio-Abadal, T. Yefsah, V. Khemani, D. A. Huse, I. Bloch, C. Gross  
*Exploring the many-body localization transition in two dimensions*  
Science **352**, 1547–1552 (2016)
13. J. Zeiher, **P. Schauß**, S. Hild, T. Macrì, I. Bloch, C. Gross  
[OA] *Microscopic Characterization of Scalable Coherent Rydberg Superatoms*  
Phys. Rev. X **5**, 031015 (2015)
12. T. Fukuhara, S. Hild, J. Zeiher, **P. Schauß**, I. Bloch, M. Endres, C. Gross  
*Spatially Resolved Detection of a Spin-Entanglement Wave in a Bose-Hubbard Chain*  
Phys. Rev. Lett. **115**, 035302 (2015)

11. **P. Schauß**, J. Zeiher, T. Fukuhara, S. Hild, M. Cheneau, T. Macrì, T. Pohl, I. Bloch, C. Gross  
 •*Crystallization in Ising quantum magnets*  
 Science **347**, 1455–1458 (2015)
10. S. Hild, T. Fukuhara, **P. Schauß**, J. Zeiher, M. Knap, E. Demler, I. Bloch, C. Gross  
*Far-from-Equilibrium Spin Transport in Heisenberg Quantum Magnets*  
 Phys. Rev. Lett. **113**, 147205 (2014)
9. T. Fukuhara, **P. Schauß**, M. Endres, S. Hild, M. Cheneau, I. Bloch, C. Gross  
*Microscopic observation of magnon bound states and their dynamics*  
 Nature **502**, 76–79 (2013)
8. T. Fukuhara, A. Kantian, M. Endres, M. Cheneau, **P. Schauß**, S. Hild, D. Bellem, U. Schollwöck, T. Giamarchi, C. Gross, I. Bloch, S. Kuhr  
*Quantum dynamics of a mobile spin impurity*  
 Nat. Phys. **9**, 235–241 (2013)
7. M. Endres, M. Cheneau, T. Fukuhara, C. Weitenberg, **P. Schauß**, C. Gross, L. Mazza, M. C. Bañuls, L. and Pollet, I. Bloch, S. Kuhr  
*Single-site- and single-atom-resolved measurement of correlation functions*  
 Appl. Phys. B **113**, 27–39 (2013)
6. **P. Schauß**, M. Cheneau, M. Endres, T. Fukuhara, S. Hild, A. Omran, T. Pohl, C. Gross, S. Kuhr, I. Bloch  
 •*Observation of spatially ordered structures in a two-dimensional Rydberg gas*  
 Nature **491**, 87–91 (2012)
5. M. Endres, T. Fukuhara, D. Pekker, M. Cheneau, **P. Schauß**, C. Gross, E. Demler, S. Kuhr, I. Bloch  
*The 'Higgs' amplitude mode at the two-dimensional superfluid/Mott insulator transition*  
 Nature **487**, 454–458 (2012)
4. M. Cheneau, P. Barmettler, D. Poletti, M. Endres, **P. Schauß**, T. Fukuhara, C. Gross, I. Bloch, C. Kollath, S. Kuhr  
*Light-cone-like spreading of correlations in a quantum many-body system*  
 Nature **481**, 484–487 (2012)
3. M. Endres, M. Cheneau, T. Fukuhara, C. Weitenberg, **P. Schauß**, C. Gross, L. Mazza, M. C. Bañuls, L. Pollet, I. Bloch, S. Kuhr  
*Observation of correlated particle-hole pairs and string order in low-dimensional Mott insulators*  
 Science **334**, 200–203 (2011)
2. C. Weitenberg, **P. Schauß**, T. Fukuhara, M. Cheneau, M. Endres, I. Bloch, S. Kuhr  
*Coherent Light Scattering from a Two-Dimensional Mott Insulator*  
 Phys. Rev. Lett. **106**, 215301 (2011) [Selected for a PRL 'Viewpoint']
1. C. Weitenberg, M. Endres, J. F. Sherson, M. Cheneau, **P. Schauß**, T. Fukuhara, I. Bloch, S. Kuhr  
*Single-spin addressing in an atomic Mott insulator*  
 Nature **471**, 319–324 (2011)