

ADDRESS

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RESEARCH INTERESTS

Strongly correlated quantum many-body systems, ultracold atoms in optical lattices, topological quantum states, quantum gas microscopy, long-range interactions, degenerate Bose- and Fermi gases, transport in strongly correlated systems, Rydberg atoms, extended Hubbard models, few-particle systems, single-atom imaging, quantum magnetism

PROFESSIONAL EXPERIENCE

Since 08/2018 Assistant Professor, Department 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

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

HONORS AND AWARDS

2018 Blavatnik Family Foundation 2018 Regional Award Finalist

2015 – 2018 Dicke Fellowship at Princeton University

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

Reviewer for 2020 Huskey Graduate Research Exhibition at the University of Virginia

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
- Molecular Bose-Einstein condensate of ${}^6\text{Li}$ achieved within 1.5 years of start of the lab at the University of Virginia

INVITED TALKS

33. SESAPS 2019, Wrightsville Beach, NC, November 7, "Probing dynamical properties of Fermi-Hubbard systems with a quantum gas microscope"
32. SESAPS 2019, Wrightsville Beach, NC, November 7, "Probing the quench dynamics of antiferromagnetic correlations in a 2D quantum Ising system of 200 spins"
31. Paris Edge 2019, Paris, September 26, 2019, "Probing dynamical properties of Fermi-Hubbard systems with a quantum gas microscope"
30. Seminar, Institute d'optique, Palaiseau, France, September 23, 2019, "Probing dynamical properties of Fermi-Hubbard systems with a quantum gas microscope"
29. 2019 Blavatnik Science Symposium, NYAS, New York, July 15, 2019, "Quantum gas microscopy of ultracold fermionic atoms"
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"

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"

PROJECTS AND THEORY COLLABORATIONS

- Exotic Hubbard models with fermions in optical lattices (Ongoing)
Experiment in the laboratory at the University of Virginia.
- Rydberg dressing of fermions in optical lattices (Ongoing)
In collaboration with Waseem Bakr.
- 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.

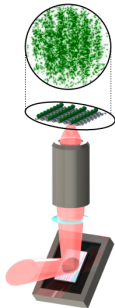
PUBLICATIONS

Google scholar: h-index 20, # of citations > 4,800
 ISI WoS: h-index 19, # of citations > 3,000
 Preprints of all publications are available on arxiv.org.
 22 publications, 10 in Nature/Science, 9 in Phys. Rev. Lett./Nature Physics/PRX

22. P. Schauss

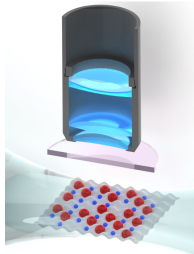
Polarons leave a trace (Perspective)
 Science **365**, 218 (2019)

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)
 → Observation of bad metallic transport in Hubbard systems
 → First precision diffusion measurement with ultracold fermions
 Citations (ISI Web of Science): 28, (Google scholar): 58

20.



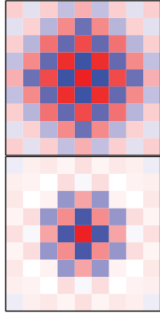
E. Guardado-Sanchez, P. T. Brown, D. Mitra, T. Devakul, D. A. Huse, **P. Schauß**, W. S. Bakr
Probing the quench dynamics of antiferromagnetic correlations in a 2D quantum Ising spin system
 Phys. Rev. X **8**, 021069 (2018)
 → Preparation of 2D Ising Rydberg-antiferromagnets
 → First excitation of lithium Rydberg atoms in an optical lattice
 Citations (ISI Web of Science): 31, (Google scholar): 55

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)

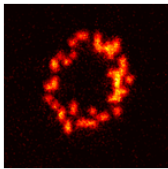
17.



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)
 → First observation anisotropic correlations in cold-atom Hubbard system
 → Raman sideband cooling for ^6Li in a novel optical lattice
 Citations (ISI Web of Science): 48, (Google scholar): 72

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)
 → First coherent Rydberg dressing in a many-body system
 Citations (ISI Web of Science): 108, (Google scholar): 158

14.

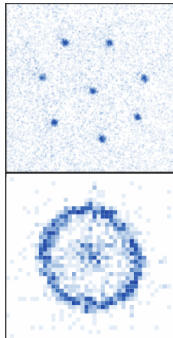


J.-y. Choi, S. Hild, J. Zeiher, **P. Schauß**, A. Rubio-Abadal, T. Yefsah, V. Khemani, D. A. Huse, I. Bloch, C. Gross
Exploring the many-body localization transition in two dimensions
Science **352**, 1547–1552 (2016)
 → Observation of many-body localization with interacting bosons in 2D
 Citations (ISI Web of Science): 302, (Google scholar): 511

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)
 → First in-situ imaging of Rydberg crystals in 1D and 2D
 → First adiabatic preparation in Rydberg Ising system
 → Onset of shell formation
 Citations (ISI Web of Science): 140, (Google scholar): 216

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)
 → First imaging of Rydberg atoms in a quantum gas microscope
 → First in-situ observation of Rydberg ordering
 Citations (ISI Web of Science): 309, (Google scholar): 473
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)