CURRICULUM VITAE

Dr. Christof Weitenberg
Address: Institut für Laserphysik, Luruper Chaussee 149, Gebäude 69, 22761 Hamburg, Germany
Email: cweitenb@physnet.uni-hamburg.de
ORCID: 0000-0001-9301-2067
https://scholar.google.com/citations?user=hEV2onkAAAAJ&hl=de
Internet: https://www.physik.uni-hamburg.de/en/ilp/ag-weitenberg/team/weitenberg.html

Research Focus

Ultracold atoms, Optical lattices, Quantum many-body systems, Floquet engineering, Topological quantum matter, Anyons, Quantum computing, Machine learning in quantum physics

Academic Appointments

Since 2013 Senior Scientist (permanent position), Group leader of two experimental teams, University of Hamburg (Group of Klaus Sengstock)

2011 - 2013 Postdoc, Laboratoire Kastler Brossel, Ecole Normale Supérieure, Paris, France (Group of Jean Dalibard)

Education

2011 PhD in Physics, Ludwig Maximilian University of Munich, *Single-atom-resolved imaging and single-spin addressing in an atomic Mott insulator* (summa cum laude)

2007 - 2011 PhD student at Johannes Gutenberg University Mainz, since 2009 at Max Planck Institute of Quantum Optics, Garching. Advisor: Immanuel Bloch

2001 - 2007 Diploma in Physics at Saarland University, Saarbrücken (with distinction, grade: 1.1)

2001 - 2005 Diploma in Musical Composition at University of Music Saar, Saarbrücken

1992 - 2001 Gymnasium Remigianum, Borken, Abitur (grade: 1.1)

1998 - 1999 Exchange year at King High School, Corpus Christi, Texas

Awards and Scholarships

2018 ERC Starting Grant ANYON

2012-2013 IEF Scholarship, Marie Curie Actions of the European Commission

2011-2012 Fellow of the Alexander von Humboldt-Stiftung (Feodor Lynen-Programm)

2011 Otto-Hahn-Medal of the Max Planck Society for the PhD thesis

2002-2007 Scholarship holder of the Studienstiftung des deutschen Volkes

External Funding and Collaborative Research

2019-2024	ERC Starting Grant *Engineering and probing anyonic quantum gases (ANYON)*
2019-2025	Young Investigator in the Cluster of Excellence *Advanced Imaging of Matter*
2016-2022	Principal Investigator in the DFG research unit (Forschergruppe) 2414, *Artificial gauge fields and interacting topological phases in ultracold atoms* (together with Klaus Sengstock)
2015-2023	Principal Investigator in the collaborative research center SFB 925, *Light induced dynamics and control of correlated quantum systems*
2012	Marie Curie Scholarship of the European Commission
2011	Feodor-Lynen Scholarship of the Alexander von Humboldt Foundation

Languages

German (native speaker), English (fluent), French (fluent), Latin (Latinum)

Publication Output

I am coauthor of 33 articles in peer-reviewed journals, 4x as first author, 10x as last author. Among these articles 2 appeared in Science, 3 in Nature, 5 in Nature Physics, 2 in Physical Review X, 4 in Physical Review Letters and 17 in other journals. In total, these articles have 3319 citations, the most-cited article has 941 citations. My h-index ist 19 (according to Web of Science, August 2022).

Publications in Peer-Reviewed Journals

1. H. P. Zahn, V. P. Singh, M. N. Kosch, L. Asteria, L. Freystatzky, K. Sengstock, L. Mathey, C. Weitenberg, *Formation of spontaneous density-wave patterns in DC driven lattices*, Phys. Rev. X 12, 021014 (2022).
2. L. Asteria, H. P. Zahn, M. N. Kosch, K. Sengstock, C. Weitenberg, *Quantum gas magnifier for sub-lattice-resolved imaging of three-dimensional quantum systems*, Nature 599, 571 (2021).
3. C. Weitenberg and J. Simonet, *Tailoring quantum gases by Floquet engineering*, Nature Phys. 17, 1342 (2021).
4. N. Käming, A. David, K. Kottmann, M. Lewenstein, K. Sengstock, A. Dauphin, C. Weitenberg, *Unsupervised machine learning of topological phase transitions from experimental data*, Machine Learning: Science and Technology 2, 035037 (2021).
5. B. Andrade, V. Kasper, M. Lewenstein, C. Weitenberg, T. Graß, *Preparation of the Laughlin state with atoms in a rotating trap*, Phys. Rev. A 103, 063325 (2021).
6. J.-H. Zheng, B. Irsigler, L. Jiang, C. Weitenberg, W. Hofstetter, *Measuring the topological phase transition via the single-particle density matrix*, Phys. Rev. A 101, 013631 (2020).
7. B. S. Rem, N. Käming, M. Tarnowski, L. Asteria, N. Fläschner, C. Becker, K. Sengstock, C. Weitenberg, *Identifying quantum phase transitions using artificial neural networks on experimental data*, Nature Phys. 15, 917 (2019).
8. L. Asteria, D. T. Tran, T. Ozawa, M. Tarnowski, B. S. Rem, N. Fläschner, K. Sengstock, N. Goldman, and C. Weitenberg, *Measuring quantized circular dichroism in ultracold topological matter*, Nature Phys**.** 15, 449 (2019).

9. P. Cheng, P. W. Klein, K. Plekhanov, K. Sengstock, M. Aidelsburger, C. Weitenberg, K. Le Hur, *Topological proximity effects in a Haldane graphene bilayer system*, Phys. Rev. B 100, 081107 (2019).
10. M. Pyzh, S. Krönke, C. Weitenberg, P. Schmelcher, *Quantum point spread function for imaging trapped few-body systems with a quantum gas microscope*, New J. Phys**.** 21, 053013 (2019).
11. M. Tarnowski, F. N. Ünal, N. Fläschner, B. S. Rem, A. Eckardt, K. Sengstock, and C. Weitenberg, *Measuring topology from dynamics by obtaining the Chern number from a linking number*, Nature Commun. 10, 1728 (2019).
12. T. Qin, A. Schnell, K. Sengstock, C. Weitenberg, A. Eckardt, and W. Hofstetter, *Charge density wave and charge pump of interacting fermions in circularly shaken hexagonal optical lattices*, Phys. Rev. A 98, 033601 (2018).
13. N. Fläschner, D. Vogel, M. Tarnowski, B. S. Rem, D.-S. Lühmann, M. Heyl, J. C. Budich, L. Mathey, K. Sengstock, and C. Weitenberg, *Observation of dynamical vortices after quenches in a system with topology*, Nature Phys. 14, 265 (2018).
14. N. Fläschner, M. Tarnowski, B. S. Rem, D. Vogel, K. Sengstock, and C. Weitenberg, *High-precision multiband spectroscopy of ultracold fermions in a nonseparable optical lattice*, Phys. Rev. A 97, 051601(R) (2018).
15. M. Pyzh, S. Krönke, C. Weitenberg, and P. Schmelcher, *Spectral properties and breathing dynamics of a few-body Bose-Bose mixture in a 1D harmonic trap*, New J. Phys. 20, 015006 (2018).
16. A. Quelle, C. Weitenberg, K. Sengstock, and C. Morais Smith, *Driving protocol for a Floquet topological phase without static counterpart*, New J. Phys. 19, 113010 (2017).
17. M. Lahrz, C. Weitenberg, and L. Mathey, *Implementing supersymmetric dynamics in ultracold atomic systems*, Phys. Rev. A 96, 043624 (2017).
18. M. Tarnowski, M. Nuske, N. Fläschner, B. S. Rem, D. Vogel, L. Freystatzky, K. Sengstock, L. Mathey, and C. Weitenberg, *Observation of topological Bloch-state defects and their merging transition*, Phys. Rev. Lett. 118, 240403 (2017).
19. V. P. Singh, C. Weitenberg, J. Dalibard, and L. Mathey, *Superfluidity and relaxation dynamics of a laser-stirred 2D Bose gas*, Phys. Rev. A 95, 043631 (2017).
20. N. Fläschner, B. S. Rem, M. Tarnowski, D. Vogel, D.-S. Lühmann, K. Sengstock, and C. Weitenberg, *Experimental reconstruction of the Berry curvature in a Floquet Bloch band*, Science 352, 1091 (2016).
21. D.-S. Lühmann, C. Weitenberg, and K. Sengstock, *Emulating molecular orbitals and electronic dynamics with ultracold atoms*, Phys. Rev. X 5, 031016 (2015).
22. L. Chomaz, L. Corman, T. Bienaimé, R. Desbuquois, C. Weitenberg, S. Nascimbène, J. Beugnon, and J. Dalibard, *Emergence of coherence via transverse condensation in a uniform quasi-two-dimensional Bose gas*, Nature Commun. 6, 6172 (2015).
23. L. Corman, L. Chomaz, T. Bienaimé, R. Desbuquois, C. Weitenberg, S. Nascimbène, J. Dalibard, and J. Beugnon, *Quench-induced supercurrents in an annular Bose gas*, Phys. Rev. Lett. 113, 135302 (2014).
24. R. Desbuquois, T. Yefsah, L. Chomaz, C. Weitenberg, L. Corman, S. Nascimbène, and J. Dalibard, *Fit-free determination of scale invariant equations of state: application to the two-dimensional Bose gas*, Phys. Rev. Lett. 113, 020404 (2014).
25. M. Endres, M. Cheneau, T. Fukuhara, C. Weitenberg, P. Schauß, C. Gross, L. Mazza, M. C. Bañuls, L. Pollet, I. Bloch, and S. Kuhr, *Single-site- and single-atom resolved measurement of correlation functions*, Appl. Phys. B 113, 27 (2013).

26. R. Desbuquois, L. Chomaz, T. Yefsah, J. Léonard, J. Beugnon, C. Weitenberg, and J. Dalibard, *Superfluid behavior of a two-dimensional Bose gas*, Nature Phys. 8, 645 (2012).
27. M. Endres, M. Cheneau, T. Fukuhara, C. Weitenberg, P. Schauß, C. Gross, L. Mazza, M. C. Bañuls, L. Pollet, I. Bloch, and S. Kuhr, *Observation of correlated particle-hole pairs and string order in low-dimensional Mott insulators*, Science 334, 200 (2011).
28. C. Weitenberg, S. Kuhr, K. Mølmer, and J. F. Sherson, *Quantum computation architecture using optical tweezers*, Phys. Rev. A 84, 032322 (2011).
29. C. Weitenberg, P. Schauß, T. Fukuhara, M. Cheneau, M. Endres, I. Bloch, and S. Kuhr, *Coherent light scattering from a two-dimensional Mott insulator*, Phys. Rev. Lett. 106, 215301 (2011).
30. C. Weitenberg, M. Endres, J. F. Sherson, M. Cheneau, P. Schauß, T. Fukuhara, I. Bloch, and S. Kuhr, *Single-spin addressing in an atomic Mott insulator*, Nature 471, 319 (2011).
31. J. F. Sherson*, C. Weitenberg*, M. Endres, M. Cheneau, I. Bloch, and S. Kuhr, *Single-atom resolved fluorescence imaging of an atomic Mott insulator*, Nature 467, 68 (2010).
32. M. Bellion, L. Santen, H. Mantz, H. Hähl, A. Quinn, A. Nagel, C. Gilow, C. Weitenberg, Y. Schmitt, and K. Jacobs, *Protein adsorption on tailored substrates: long-range forces and conformational changes*, J. Phys. Cond. Mat. 20, 404226 (2008).
33. R. Peter, M. Hilt, F. Ziebert, J. Bammert, C. Erlenkämper, N. Lorscheid, C. Weitenberg, A. Winter, M. Hammele, and W. Zimmermann, *Stripe-hexagon competition in forced pattern-forming systems with broken up-down symmetry*, Phys. Rev. E 71, 046212 (2005).

Publications under Review (Preprints)

34. M. N. Kosch, L. Asteria, H. P. Zahn, K. Sengstock, C. Weitenberg, *Multi-frequency optical lattice for dynamic lattice-geometry control*, arXiv:2207.03811 (2022).

Other Publications

35. C. Weitenberg, *Microscopes go molecular*, Nature Physics, News & Views, https://doi.org/10.1038/s41567-022-01712-x (2022).
36. M. Aidelsburger and C. Weitenberg, *Topologische Materie – ultrakalt. Ultrakalte Atome liefern neue Einblicke in topologische Quantenmaterie,* Physik Journal 20(7), 46-51 (2021).
37. C. Weitenberg, *Fluorescence imaging of quantum gases*, Chapter 7 in “Quantum gas experiments: exploring many-body states”, P. Törmä, K. Sengstock, Editors (Imperial College Press, 2014).
38. C. Weitenberg, *Suprafluidität in zwei Dimensionen*, Physik in unserer Zeit 43, 266 (2012).

Invited Talks at International Conferences

1. International Conference CT.QMAT22 Würzburg, 25.07.-29.07.2022, “Novel tools for studying lattice physics with ultracold atoms”.
2. DAMOP Conference, Orlando, Florida, 31.05.-03.06.2022, “Accessing new optical-lattice regimes with a matter-wave microscope”.
3. DPG Spring Meeting Erlangen, 14.-18.03.2022 (online), “Mater-wave microscope for sub-lattice-resolved imaging of 3D quantum systems“.
4. Cold-atom Online Meeting CoOLMe 2021, 17.-19.11.2021 (online), “Studying optical lattice physics with a quantum gas magnifier”.
5. Center for Quantum Dynamics Colloquium, 10.11.2021, Heidelberg, “Quantum gas magnifier for sub-lattice-resolved imaging of three-dimensional quantum systems”.

6. Annual SFB Workshop 2021, 01.-02.11.2021 (online), Highlight Talk “Tailoring quantum gases by Floquet engineering”.
7. Workshop “Non-equilibrium dynamics and exotic phases in quantum gases”, 02.07.2021-05.07.2021, Renmin University of China & University of Bonn (online), “Observation of spontaneous density-wave pattern via engineering of pair tunneling”.
8. KITP program “Interacting topological matter: atomic, molecular and optical systems (topology21)”, 01.08.2021-13.08.2021, Kavli Institute for Theoretical Physics (online), “Experimental Floquet techniques for realizing topological models with ultracold atoms”
9. Workshop “Correlations in mesoscopic Fermi systems”, 21.05.2021, Universität Heidelberg (online), “Preparation and detection tools for mesoscopic quantum systems of cold atoms”.
10. Group Seminar Quantum Optics Group LMU Munich, 04.05.2021 (online), “Quantum gas magnifier for sub-lattice-resolved imaging of three-dimensional quantum systems“.
11. 735. WE-Heraeus-Seminar “Exploring quantum many-body physics with ultracold atoms and molecules” (online), 14.-18.12.2020, “Unsupervised machine learning of topological phase transitions from cold-atom data”.
12. IMPRS Seminar MPI-PKS Dresden (online), 22.04.2020, “Prospects for engineering anyons in atomic few-body systems”.
13. CUI Young Researchers Workshop “Frontiers in nonequilibrium dynamics of multicomponent systems in the few to many-body crossover”, 10.02.-12.02.2020, University of Hamburg, “Prospects for engineering anyons in atomic few-body systems”.
14. QPQI Colloquium at University of Science and Technology of China, 19.12.2019, Hefei, China, “Topological effects in Floquet-engineered ultracold matter”.
15. Colloquium at University of Bonn, 29.10.2019, “Quanten-Vielteilchen-Physik mit ultrakalten Atomen: von topologischer Materie zu anyonischen Teilchen”.
16. BEC 2019 Conference, 07.09.-13.09.2019, Sant Feliu, Spain, “Ultracold topological matter via Floquet engineering”.
17. YAO: Young Atom Opticians 2019, 28.07.-02.08.2019, University of Hamburg, “Ultracold topological matter engineered by Floquet driving”.
18. International Conference NTTI 2019 and BEC 2019, 15.-19.07.2019, Hiroshima, Japan, “Topological phases of ultracold atoms in Floquet-driven optical lattices”.
19. DAMOP Meeting, 27.-31.05.2019, Milwaukee, Wisconsin, USA, “New approaches to topological phases with ultracold atoms”.
20. Colloquium am MPIPKS Dresden, Germany, 25.04.2019, “New approaches to topological states with ultracold atoms“.
21. Cecam Workshop “Condensed matter analogies in mechanics, optics and cold atoms”, 01.-04.04.2019, Tel Aviv, Israel, “New approaches to topological phases with ultracold atoms”.
22. APS March Meeting, 04.-08.03.2019, Boston, USA, “Identifying quantum phase transitions using artificial neural networks on experimental data”.
23. International School/Workshop “Anyon physics of ultracold atomic gases”, 10.-14.12.2018, Kaiserslautern, Germany, “Prospects for engineering anyons with ultracold atoms”.
24. UQUAM Seminar, 08.11.2018, MPQ Garching, Germany, “New approaches to topological states with ultracold atoms”.
25. International Conference on Quantum Optics 2018, 25.02.-03.03.2018, Obergurgl, Austria, “Topology and dynamics in driven hexagonal lattices”.

26. Mini Symposium “Periodically driven systems in theory and experiment”, 28.11.2017, Kaiserslautern, Germany, “Topology and dynamics in driven hexagonal lattices”.
27. 4th international UQUAM Workshop, 16.-19.10.2017, Venice, Italy, “Topology and dynamics in driven hexagonal lattices”.
28. DAMOP Meeting, 05.06.-09.06.2017, Sacramento, USA, “Observation of a dynamical topological phase transition in the non-equilibrium dynamics of ultracold quantum gases in driven optical lattices”.
29. Conference “Quantum science approaches to strongly correlated systems”, 29.05.-02.06.2017, Galileo Galilei Institute, Florence, Italy, “Berry curvature, quench dynamics and topological indices in driven optical lattices”.
30. Colloquium Optics and Condensed Matter, 02.05.2017, University of Bonn, Germany, “Observation of a dynamical phase transition in the non-equilibrium dynamics of ultracold quantum gases in driven optical lattices”.
31. APS March Meeting, 13.-17.03.2017, New Orleans, USA, “Observation of a dynamical phase transition in the non-equilibrium dynamics of ultracold quantum gases in driven optical lattices”.
32. Workshop “Topological Effects in Ultra-Cold Atoms”, 14.-18.11.2016, IIP Natal, Brazil, “Observation of a dynamical topological phase transition”.
33. Colloquium of the SFB/TR 49, 10.11.2016, Frankfurt, Germany, “Observation of a dynamical topological phase transition”.
34. Conference “Light induced dynamics and control of correlated quantum systems”, 20.-22.09.2016, Hohwacht, Germany, “Few-atom systems as simulators for attosecond physics”.
35. Workshop “Interacting Quantum Systems Driven out of Equilibrium”, 05.-06.05.2016, Rice University, Houston, Texas, USA “Experimental reconstruction of the Berry curvature in a Floquet Bloch band”.
36. AMOP-Colloquium, University of Cambridge, UK, 25.04.2016 “Experimental reconstruction of the Berry curvature in a Floquet Bloch band”.
37. Workshop “Geometry and Quantum Dynamics”, International Institute of Physics, Natal, Brazil, 26.-30.10.2015, “Experimental reconstruction of the Berry curvature in a topological Bloch band”.
38. Conference “Topological Phases in Condensed Matter and Cold Atomic Systems”, Institute for Advances Study, The Hong Kong University of Science and Technology, Hong Kong, 11.-19.12.2015, “Floquet engineering of artificial gauge fields and topological band structures”.
39. Workshop “Quantum Simulations with Ultracold Atoms”, Trieste, Italy, 16.-20.07.2012, “Superfluid behavior of a two-dimensional Bose gas”.
40. Conference “Newspin2”, Texas A&M University, College Station, Texas, 12.-17.12.2011, “Single-atom-resolved imaging and manipulation in an atomic Mott insulator”.
41. 20th International Laser Physics Workshop, Seminar on Physics of Cold Trapped Atoms, Sarajevo 12.07.2011, “Single-spin addressing in an atomic Mott Insulator”.

Contributions to PhD Schools

1. DFG FOR 2414 Online Summer School “Topology and interactions in optical lattices”, 30.09.2020-02.10.2020, lecture on “Detecting topology with ultracold atoms”.
2. APS March Meeting Tutorials, 12.03.2017, Tutorial on “Topological physics with cold atoms”.
3. “School on Interaction of Light with Cold Atoms”, 30.01-10.02.2017, ICTP-SAIFR/IFT-UNESP, São Paulo, Brazil, three lectures and exercise class on “ultracold atoms in optical lattices”

Public Talks

4. Public lecture “Maschinelles Lernen in der Quantenphysik” in the lecture series “Physik im Alltag”, 07.01.2019, University of Hamburg.
5. Public lecture “Die Quadratur des Quintenzirkels” in the lecture series “Physik im Alltag”, 19.01.2016, University of Hamburg.