Curriculum vitae Tobias Markus Raphael Wolf

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Date of Birth: August 16, 1991
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Education

- **Ph.D., Physics** ETH Zürich Apr 2016 – Apr 2021
  Dissertation: Electronic properties of twisted-layer graphene systems
  Advisors: Dr. Gianni Blatter and Dr. Oded Zilberberg
- **M.Sc., Physics** ETH Zürich Sep 2014 – Mar 2016
- **B.Sc., Physics** ETH Zürich Sep 2011 – Sep 2014

Fellowships and Grants

- **PostDoc.Mobility Fellowship** Swiss National Science Foundation (SNSF) Sep 2021 – Sep 2023
  Award: 107'000 CHF | Grant No. 203152 | Project: *Quantum engineered van der Waals materials*

Research Experience

- **Postdoctoral Research Fellow** The University of Texas at Austin Sep 2021 – present
  Center for Complex Quantum Systems | Supervisor: Dr. Allan H. MacDonald
  - Main research: Flavor magnetism and superconductivity in graphene multilayers, Collective mode spectra and correlation energy, Fractional Quantum Hall states in ideal bands
  - Methods: Continuum models, Mean-field methods, Time-dependent Hartree-Fock, Monte Carlo.
  - Collaboration with experimental groups (one preprint on optical imaging of flavor order).

- **Doctoral Researcher** ETH Zürich Apr 2016 – Aug 2021
  Institute for Theoretical Physics | Supervisor: Dr. Gianni Blatter
  - Main research: Flat electronic bands and tunable flavor magnetism in graphene-based moiré materials
  - Methods: Continuum models, Tight-Binding, Mean-field methods

Publications

Submitted and under review

[arXiv1] T. M. R. Wolf, N. Wei, H. Zhou, and C. Huang, "Magnetism in the Dilute Electron Gas of Rhombohedral Multilayer Graphene", preprint (2024), arXiv:2408.15884.

[arXiv2] T. M. R. Wolf, Y.-C. Chao, A. H. MacDonald, and J.-J. Su, "Intraband collective excitations in fractional Chern insulators are dark", preprint (2024), arXiv:2406.10709.

[arXiv3] T. Xie, T. M. R. Wolf, S. Xu, Z. Cui, R. Xiong, Y. Ou, P. Hays, L. F. Holleis, Y. Guo, O. I. Sheekey, et al., "Optical Imaging of Flavor Order in Flat Band Graphene", preprint (2024), arXiv:2405.08074.

Peer-reviewed

[P1] T. M. R. Wolf and C. Huang, "Quasi-boson approximation yields accurate correlation energy in the 2D electron gas", Physical Review Research **6**, 033296 (2024).

[P2] Y. Zeng, T. M. R. Wolf, C. Huang, N. Wei, S. A. A. Ghorashi, A. H. MacDonald, and J. Cano, "Gate-tunable topological phases in superlattice modulated bilayer graphene", Physical Review B **109**, 195406 (2024).

[P3] C. Huang, T. M. R. Wolf, W. Qin, N. Wei, I. V. Blinov, and A. H. MacDonald, "Spin and orbital metallic magnetism in rhombohedral trilayer graphene", Physical Review B **107**, L121405 (2023).

[P4] W. Qin, C. Huang, T. M. R. Wolf, N. Wei, I. Blinov, and A. H. MacDonald, "Functional renormalization group study of superconductivity in rhombohedral trilayer graphene", Physical Review Letters **130**, 146001 (2023).

[P5] T. M. R. Wolf, M. F. Holst, M. Sigrist, and J. L. Lado, "Nonunitary multiorbital superconductivity from competing interactions in Dirac materials", Physical Review Research **4**, L012036 (2022).

[P6] T. M. R. Wolf, O. Zilberberg, G. Blatter, and J. L. Lado, "Spontaneous valley spirals in magnetically encapsulated twisted bilayer graphene", Phys. Rev. Lett. **126**, 056803 (2021).

[P7] T. M. R. Wolf, "Electronic properties of twisted-layer graphene systems", 10.3929/ethz-b-000475934, PhD thesis (ETH Zurich, 2021).

[P8] T. M. R. Wolf, J. L. Lado, G. Blatter, and O. Zilberberg, "Electrically Tunable Flat Bands and Magnetism in Twisted Bilayer Graphene", Phys. Rev. Lett. **123**, 096802 (2019), arXiv:1905.07651.

[P9] A. Strkalj, M. S. Ferguson, T. M. R. Wolf, I. Levkivskyi, and O. Zilberberg, "Tunneling into a Finite Luttinger Liquid Coupled to Noisy Capacitive Leads", Phys. Rev. Lett. **122**, 126802 (2019).

[P10] T. M. R. Wolf, O. Zilberberg, I. Levkivkskyi, G. Blatter, I. Levkivskyi, and G. Blatter, "Substrate-induced topological minibands in graphene", Phys. Rev. B **98**, 125408 (2018), arXiv:1805.10670.

Conference Contributions and Seminar Talks

2024
- *Optical excitons in monolayer TMDs proximate to rhombohedral graphene multilayers*, APS March Meeting 2024, Minneapolis, USA, March 08, 2024 *(Contributed talk)*.
- *Theory for monolayer-TMD optical excitons proximate to graphene multilayers*, MRSEC Annual Meeting 2024, Austin, USA, February 20, 2024 *(Poster)*.

2023
- *Optical excitons in monolayer TMDs proximate to graphene multilayers*, MRSEC Student/Postdoc seminar, Austin, USA, November 26, 2023 *(Seminar)*.
- *Quasi-boson and time-dependent Hartree-Fock study of the 2D electron gas*, RCQM Workshop 2023 on Flat Bands Strong Correlations and Topology, Houston, USA, November 06, 2023 *(Poster)*.
- *Spin and Orbital Magnetism in Rhombohedral Trilayer Graphene*, RCQM Workshop 2022 on Strange Metals and Emergent Phases in Materials and Structures, Houston, USA, October 31, 2023 *(Poster)*.
- *Correlation energy in bernal bilayer graphene under strong displacement field*, APS March Meeting 2023, Las Vegas, USA, March 05, 2023 *(Talk)*.

2022
- *Spin and valley magnetism in graphene multilayers*, ITP Condensed Matter Seminar, ETH Zürich,

Switzerland, August 05, 2022 *(Talk)*.
- *Spin and valley metallic magnetism in ABC trilayer graphene*, International Conference on Complexity and Topology in Quantum Matter, Würzburg, Germany, July 25, 2022 *(Talk)*.
- *Graphene-based van der Waals materials*, LANL Condensed Matter Seminar, Los Alamos, USA, July 13, 2022 *(Talk)*.
- *Spin and orbital metallic magnetism in ABC trilayer graphene*, Quantum Materials Summer School 2022, Toronto, Canada, May 01, 2022 *(Poster)*.
- *Broken flavor symmetries in rhombohedral multilayer graphene*, APS March Meeting 2022, Chicago, USA, March 14, 2022 *(Talk)*.
- *Topology flat bands and interactions in graphene-based van der Waals materials*, Center for Complex Quantum Systems / Condensed Matter Seminars, The University of Texas at Austin, USA, February 24, 2022 *(Talk)*.

2021
- *Spontaneous Valley Spirals in Magnetically Encapsulated Twisted Bilayer Graphene*, Towards Strong Correlations in van der Waals heterostructures and 2D materials, online, organised by Yonathan Anahory (Racah Institute, Israel) and Milorad Milosevic (University of Antwerp, Belgium), March 25, 2021 *(Invited talk)*.
- *Spontaneous Valley Spirals in Magnetically Encapsulated Twisted Bilayer Graphene*, APS March Meeting, online, organised by the American Physical Society, March 15–19, 2021 *(Talk)*.

2020
- *Spontaneous Valley Spirals in Magnetically Encapsulated Twisted Bilayer Graphene*, CMD2020GEFES, online, organised by the Spanish Royal Physics Society and the European Physical Society, August 31, 2020–September 04, 2020 *(Poster award)*.
- *Moiré band engineering and correlations in graphene-based materials*, QSIT Lunch Seminar, online, ETH Zürich, April 12, 2020 *(Talk)*.
- *Moiré band engineering and magnetic instabilities in van der Waals materials*, NCCR QSIT General Meeting, Arosa, Switzerland, February 05–07, 2020 *(Talk)*.

2019
- *Metamaterials from twisted honeycomb lattices*, Visit Aalto university, Aalto, Finland, November 11–15, 2019 *(Invited talk)*.
- *Electrically Tunable Flat Bands and Magnetism in Twisted Bilayer Graphene*, Trends in theory of correlated materials, Kyoto, Japan, October 07–09, 2019 *(Talk)*.
- *Electrically Tunable Flat Bands and Magnetism in Twisted Bilayer Graphene*, SPS Annual Meeting, Lausanne, Switzerland, August 26–30, 2019 *(Talk)*.
- *Real- and reciprocal space spectral properties of moiré graphene*, NCCR QSIT General Meeting, Arosa, Switzerland, February 04–06, 2019 *(Poster)*.

2018
- *Substrate-induced topological minibands in graphene*, Quantum Complex Matter, Rome, Italy, June 11–15, 2018 *(Poster)*.
- *Substrate-induced topological minibands in graphene*, QSIT Lunch Seminar, Zürich, Switzerland, April 12, 2018 *(Talk)*.
- *Substrate-induced topological minibands in graphene*, NCCR QSIT General Meeting, Arosa, Switzerland, February 07–09, 2018 *(Poster)*.

2017
- *Scattering of Dirac electrons by trigonal periodic structures and signatures of optical absorption*, Recent trends in light–matter interaction (EPFL and ETHZ school), Lausanne, Switzerland, September 04–08,

2017 *(Poster)*.
- *(2+1)D Dirac Fermions and engineered periodic potentials*, QSIT Junior Meeting, Passug, Switzerland, June 01–03, 2017 *(Talk)*.
- *Out-of-equilibrium many-body manifestation of interaction-free measurement: the Elitzur-Vaidman bomb*, NCCR QSIT General Meeting, Arosa, Switzerland, February 01–03, 2017 *(Poster)*.

2016
- *Optical characterization of weak hexagonal superlattice potentials in graphene*, Topological Matter School, San Sebastián, Spain, August 22–26, 2016 *(Poster)*.
- *Optical characterization of weak hexagonal superlattice potentials in graphene*, Quantum Materials and Electronic Devices (MaNEP Swiss Workshop), Les Diablerets, Switzerland, July 06–08, 2016 *(Poster)*.
- *Optical characterization of weak hexagonal superlattice potentials in graphene*, European Graphene Forum, Paris, France, June 01–03, 2016 *(Poster)*.
- *Magneto-optical characterization of super-lattices in graphene*, NCCR QSIT Winter School, Arosa, Switzerland, February 01–03, 2016 *(Poster)*.

Honors and Awards

- **Research Poster Award** 2020
  CMD2020GEFES Conference | For the poster contribution "Spontaneous Valley Spirals in Magnetically Encapsulated Twisted Bilayer Graphene."
- **VMP Teaching Assistant Award** 2018
  ETH Zürich | Awarded by the math and physics students association for outstanding exercise class teaching, based on student surveys.

Teaching Experience

- **Teaching Assistant** Institute for Theoretical Physics, ETH Zürich Sep 2016 – Mar 2021
  - Statistical Physics (2016, 2018, 2020)
  - Quantum Mechanics I and II (2017, 2019)
  - Electrodynamics (2018, *TA award*)
  - Solid State Theory (2020)
- **Teaching Assistant** D-MATH and D-PHYS, ETH Zürich Sep 2013 – Jun 2016
  - Analysis I and II (2 years total)
  - Physics I and II (1 year total)
- **Teacher for 5-Day Course** D-MAVT, ETH Zürich Jun 2015
  - Physics I and II for engineers; Special course to prepare students for end of year exam ("AMP PVK")
  - Held full responsibility and autonomy over course content and delivery

Academic Service

- **Referee for PRL and PRB** American Physical Society 2017 – present
  Provided critical evaluations for 25 articles in Physical Review B and Physical Review Letters
- **Career Development Chair** MRSEC SLC, The University of Texas at Austin Jun 2022 – Jun 2023
  Served as board member on the Student Leadership Council (SLC), organized monthly student/postdoc seminars and invited one external career scientist for the MRSEC-wide seminar
- **Public Relations Manager** Scientific Staff Association (AMP), ETH Zürich Mar 2016 – Mar 2018
  Served as board member, responsible for public communication such newsletter and event announcements.

Memberships

- American Physical Society (2018–present)
- MaNEP Switzerland Network (2016–present)

Broader Skills

- Scientific computing with Julia and Python (numpy, scipy, matplotlib, PyTorch, etc.)
- Parallel computing in cloud environments (AWS EC2 and Jetstream2) and research clusters (TACC, USA and CSCS, Switzerland)
- Symbolic manipulation with Mathematica
- Advanced programmatic typesetting with LaTeX
- Adobe Illustrator and Blender (3D) for scientific figures, posters, and illustrations
- Terminal and version management (ssh, git, GitLab, GitHub)
- Basics in C++ and Fortran
- German *(native)* and English *(proficient)*