# Ramona **Wolf**

Junior Professor at University of Siegen

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## Employment

**Junior Professor** *since Oct 2024*

University of Siegen *Siegen, Germany*

**Junior Research Group Leader** *Feb 2024 – Sep 2024*

University of Siegen *Siegen, Germany*

**Postdoctoral Researcher** *Feb 2021 – Jan 2024*

ETH Zurich, Quantum Information Theory Group *Zurich, Switzerland*

Scientific advisor: Prof. Dr. Renato Renner

**Research Assistant** *Nov 2017 – Dec 2020*

Leibniz University Hanover, Quantum Information Theory Group *Hanover, Germany*

**Student Employee** *Apr 2014 – Sep 2017*

Leibniz University Hanover, Institute for Theoretical Physics *Hanover, Germany*

Tutor for several courses in theoretical physics

## Education

**Doctor of Natural Sciences in Physics** *Nov 2017 – Dec 2020*

Leibniz University Hanover *Hanover, Germany*

- Thesis topic: Microscopic Models for Fusion Categories
- Supervisor: Prof. Dr. Tobias J. Osborne

**Master of Science in Physics** *Oct 2015 – Sep 2017*

Leibniz University Hanover *Hanover, Germany*

- Thesis topic: Fusion in tensor categories
- Thesis supervisor: Prof. Dr. Tobias J. Osborne

**Bachelor of Science in Physics** *Oct 2012 – Nov 2015*

Leibniz University Hanover *Hanover, Germany*

- Thesis topic: Quantum key distribution in the non-asymptotic regime
- Thesis supervisor: Prof. Dr. Tobias J. Osborne

## Funding & Awards

### Research Funding

**STRAI - Spatio-Temporal Traces of Information** *August 2025*

WEAVE Lead Adgency Program of the DFG

Collaborative grant together with Renato Renner (ETH Zurich) via the WEAVE program, a cross-European initiative for collaborative research projects.

**Grant for starting a junior research group** *May 2023*

via the NRW Rückkehrprogramm (Germany)

Grant for starting a junior research group within the framework "Programm zur Förderung der Rückkehr des hochqualifizierten Forschungsnachwuchses aus dem Ausland" (programme to promote the return of highly qualified young researchers from abroad) of the Ministry of Culture and Science NRW, Germany.

## Conference Funding

**Funding for the second edition of the QKD summer school** *December 2024*

granted by the National Center of Competence in Research "SwissMAP" (Switzerland)

Funding for the second edition of our one-week summer school on quantum key distribution at the SwissMAP research station in Les Diablerets (Switzerland) provided by the NCCR SwissMAP, taking place in August 2026 (together with Renato Renner, Martin Sandfuchs, and Carla Ferradini).

**Funding for a summer school on quantum key distribution** *November 2022*

granted by the National Center of Competence in Research "SwissMAP" (Switzerland)

Funding to hold a one-week summer school on quantum key distribution at the SwissMAP research station in Les Diablerets (Switzerland) provided by the NCCR SwissMAP, taking place in August 2024 (together with Renato Renner, Martin Sandfuchs, and Carla Ferradini).

## Awards

**QSIT INSPIRE Postdoc Award** *July 2021*

awarded by the NCCR "Quantum Science and Technology" (Switzerland)

The QSIT INSPIRE Postdoc Award supports outstanding female researchers at the beginning of their career who conduct their research in one of the laboratories of the NCCR QSIT network in Switzerland.

## Funding for Research Stays and Travel Grants

**Grant for "Research in Teams" at BIRS** *January 2025*

granted by the Banff International Research Station (Canada)

Grant for a two-week research stay at the Banff International Research Station in Banff (Canada), taking place in August 2025 (together with Andreas Bluhm).
Project title: *Composable security of quantum position-based cryptography*.

**Grant for SRS$^2$ ("Short reserch stay at the SwissMAP Research Station")** *March 2023*

granted by the National Center of Competence in Research "SwissMAP" (Switzerland)

Grant for a two-week research stay at the SwissMAP research station in Les Diablerets (Switzerland) provided by the NCCR SwissMAP, taking place July 30–August 12 2023 (together with Andreas Bluhm).
Project title: *Mutually mistrustful quantum key distribution*.

**Grant for "Research in Pairs" at MFO** *October 2021*

granted by Mathematisches Forschungsinstitut Oberwolfach (Germany)

Grant for a two-week research stay at Mathematisches Forschungsinstitut Oberwolfach (MFO), taking place December 4–17 2022 (together with Thomas Cope and Alexander Hahn).
Project title: *A framework for verifying the existence of conformal field theories from subfactors*.

**Travel grant for the workshop "Quantum Symmetries" at MSRI** *January 2020*

granted by the Mathematical Sciences Research Institute, Berkeley (USA)

This grant covered the travel costs for participation in the workshop Quantum Symmetries at the Mathematical Sciences Research Institute in Berkeley, California (January 27–31 2020).

**Oberwolfach Leibniz Graduate Student Grant** *October 2019*

granted by Mathematisches Forschungsinstitut Oberwolfach (Germany)

The OWLG program supports junior researchers by covering the travel costs for a stay at the MFO. Granted to support participation in the workshop Subfactors and Applications (1944) at MFO (October 27–November 2 2019).

# Talks

## Invited Talks

| | | |
|---|---|---|
| 08/2025 | **Young Researchers Conference on Quantum Information,** Composition of (quantum) communication protocols | *Hannover, Germany* |
| 03/2025 | **DPG Spring Meeting,** Device-independent randomness amplification | *Bonn, Germany* |
| 12/2024 | **Indo-German Frontiers of Engineering Symposium,** Quantum cryptography: Shaping the future of secure communication | *Mumbai, India* |
| 11/2024 | **Event "EIN Quantum Coffee",** Quantum vs. classical cryptography and women in academia | *Online* |
| 10/2024 | **Conference "Quantum Photonics Spotlight 2024",** Attacks on quantum key distribution: A cautionary tale | *Paderborn, Germany* |
| 09/2024 | **Workshop "Foundations of Quantum Computing",** Commuting operations factorise | *Royal Holloway, UK* |
| 08/2024 | **Workshop "Quantum Redemption",** Commuting operations factorise | *Mehedeby, Sweden* |
| 12/2023 | **Workshop "Subfactors and Fusion (2-)Categories",** Computing $F$-symbols for the quantum double via tube algebras (Video) | *Banff, Canada* |
| 11/2023 | **Workshop "Machine Learning",** Quantum cryptography: Shaping the future of secure communication | *DLR Ulm, Germany* |
| 10/2023 | **Workshop "Quantum Correlations of Nature II",** Commuting operations factorise | *Siegen, Germany* |
| 10/2022 | **Workshop "Quantum Innovators in Science and Engineering",** True randomness from quantum physics | *Waterloo, Canada* |
| 09/2022 | **Workshop "Higher categories and topological order",** A physicist's view on fusion categories | *AIM San José, USA* |
| 10/2021 | **AMS Fall Western Virtual Sectional Meeting,** From subfactors to CFTs via physical models | *Online* |

## Contributed Talks

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|---|---|---|
| 01/2024 | **Conference "Quantum Information Processing" (QIP),** Commuting operations factorise (Video) | *Taipei, Taiwan* |
| 08/2023 | **Conference "Quantum Cryptography" (QCrypt),** Security of DPS QKD from relativistic principles (talk given by coauthor Martin Sandfuchs) | *Maryland, USA* |
| 07/2023 | **Conference "Theory of Quantum Computation, Communication and Cryptography" (TQC),** Security of DPS QKD from relativistic principles (talk given by coauthor Martin Sandfuchs) | *Aveiro, Portugal* |
| 02/2023 | **Swiss Quantum Days,** Why security proofs are unavoidable in quantum cryptography | *Villars, Switzerland* |
| 07/2022 | **Quantum Center General Meeting,** True randomness from quantum physics | *Davos, Switzerland* |

## Lectures at Summer Schools etc.

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|---|---|---|
| 08/2025 | **Quantum Future Academy,** Quantum Communication | *Aachen, Germany* |
| 06/2025 | **IMPRS-QST Summer School,** Security of quantum key distribution | *Kufstein, Austria* |
| 02/2025 | **Bonn Cologe Graduate School Weekend Seminar,** Security of quantum cryptography | *Bad Honnef, Germany* |
| 10/2024 | **TheoQS Autumn School,** Quantum key distribution | *Paderborn, Germany* |
| 07/2024 | **European Quantum Technology Summer School,** Quantum communication (Video) | *Strasbourg, France* |
| 05/2024 | **PenteQost Spring School on Quantum Science,** Quantum key distribution | *Siegen, Germany* |
| 05/2023 | **Quantum Communication School,** Security of quantum key distribution | *Padova, Italy* |
| 11/2022 | **Quantum Engineering Master Seminar "Applications of Quantum Technology",** Quantum cryptography | *Zürich, Switzerland* |
| 08/2022 | **Quantum Key Distribution Summer School,** Composability | *Waterloo, Canada* |

## Panel Discussions

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|---|---|---|
| 11/2024 | **Forum für die Quantenkommunikation in Deutschland,** Discussion panel: Status of quantum communication in Germany in research and industry | *HHI Berlin, Germany* |
| 08/2023 | **Conference "Quantum Cryptography" (QCrypt),** Discussion panel: QKD and PQC: Pros and Cons (Video) | *Maryland, USA* |

### Seminar Talks

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|---|---|---|
| 04/2025 | **Student seminar "Quantum Paper Club",** Randomness amplification with Bell tests | *Zürich, Switzerland* |
| 01/2025 | **European Quantum Algebra Lectures (EQuAL),** Computing $F$-symbols for the center of a fusion category via tube algebras | *Online* |
| 10/2024 | **CQIF Seminar,** The quest for secure quantum communication | *Cambridge, UK* |
| 06/2024 | **Applied quantum algorithms seminar (Leiden University),** The power of coherent attacks in QKD | *Online* |
| 04/2024 | **Student seminar "Theory Talks",** The physics of randomness (Video) | *Zürich, Switzerland* |
| 06/2023 | **Quantum Information & Computing Seminar,** The power of coherent attacks in QKD | *Grenoble, France* |
| 10/2022 | **Applied Cryptography Group Seminar,** Randomness in quantum cryptography | *Zürich, Switzerland* |
| 08/2022 | **Mathematics and Statistical Sciences Seminar,** The role of randomness in quantum cryptography | *Alberta, Canada* |
| 06/2022 | **Quantum Group Seminar,** An introduction to quantum cryptography | *Ghent, Belgium* |
| 03/2022 | **GAPT Seminar (Cardiff University),** From subfactors to conformal field theories via lattice models | *Online* |
| 02/2022 | **HEP-GR Seminar,** From subfactors to conformal field theories via lattice models | *Leipzig, Germany* |
| 02/2022 | **University Quantum Symmetries Lectures (North Carolina State University),** Computing $F$-symbols of endomorphism fusion categories | *Online* |
| 12/2021 | **QSIT Lunch Seminar,** Challenges for practical device-independent quantum key distribution | *Zürich, Switzerland* |
| 07/2020 | **Student Seminar on Quantum Symmetries (Ohio State University),** Towards a Haagerup CFT | *Online* |
| 03/2019 | **Quantum Machine Learning Journal Club,** Efficient learning for deep quantum neural networks (Video) | *CQT, Singapore* |

## Teaching and Supervision

### Lecturer

- **Summer semester 2025:** Lecture "Theoretical Physics 3: Electrodynamics", Physics Bachelor's course at the University of Siegen
- **Winter semester 2024/25:** Lecture "Quantum Cryptography", Physics Master's course at the University of Siegen
- **Summer semester 2020:** Seminar "Security of Quantum Key Distribution", Physics Master's seminar at Leibniz Universität Hannover, online (Videos)

### Teaching Assistant

Includes making excercise sheets, giving excercise classes, substituting for the lecturer

Quantum Field Theory I, Quantum Mechanics, Advanced Quantum Mechanics, Classical Mechanics, Theory of Heat, Computational Physics, Electrodynamics, Statistical Physics

### Supervision of PhD Students

- At Universität Siegen (main supervisor):
  - Ritu Dhaulakhandi (ongoing, started in 2024)
- At ETH Zürich (official second supervisor):
  - Carla Ferradini: Quantum cryptography and quantum foundations (ongoing, started in 2023)
  - Martin Sandfuchs: Information-theoretic tools for quantum cryptography (ongoing, started in 2022)

### Student Supervision

- At Universität Siegen: 3 Master's projects (ongoing)
- At ETH Zürich: 5 Master's projects, 1 Bachelor's project, 5 Semester projects
- At Leibniz Universität Hannover: 2 Master's projects, 3 Bachelor's projects

### External Examiner

- PhD Thesis proposal committee, Mariana Navarro Asan-Srain, ICFO (2025)
- PhD committee Victoria Schmiesing, Leibniz University Hanover (2025)
- PhD committee Michele Masini, Université libre de Bruxelles (2024)

## Academic Service

### Organization of Academic Events

- Initiator and main organizer of the biennial summer school on quantum key distribution, whose first edition was held in August 18–23 2024 at the SwissMAP Research Station in Les Diablerets, Switzerland. The second edition is planned for August 16–21 2026.
- Main organizer of the workshop "Device-Independent Quantum Key Distribution" (August 31–September 2 2021) at ETH Zurich
- Organization of the group seminar of the Quantum Information Theory Group at Leibniz University Hanover (2018–2020)

### Committee Work

- QCrypt 2024, 2025, Technical Program Committee
- QIP 2025, Technical Program Committee
- Young Quantum Information Scientists 2024 (YQIS24), Program Chair

### Associate Editor

- for npj Quantum Information (since March 2025)

### Reviewer

- Scientific journals: Physical Review {A, B, Letters, Applied, Research, X, X Quantum}, Quantum, Communications in Mathematical Physics, Annals of Physics, Quantum Science and Technology, Quantum Machine Intelligence, Canadian Journal of Physics, Journal of Physics B, Quantum Topology, Journal of Cybersecurity
- Conference sub-reviewer: TQC 2025, QIP 2022, QCrypt 2022
- Grants: DAAD, BMBF

### Other Activities

- Postdoc representative of the Scientific Staff Association (AMP) at the physics department at ETH Zurich (February 2022–January 2024)
- Representative for the AMP at the departmental conference of the physics department at ETH Zurich

## Outreach

### Rent a Prof

*July 2025*

Rent a Prof is an initiative of the Faculty of Science and Technology at the University of Siegen, in which schools can "rent" a professor to visit their classes and give a lecture on current research results and new findings (see also this link).

## Media Coverage

### Quantum Views

*January 2025*

A perspective on our paper "Security of differential phase shift QKD from relativistic principles" (published in Quantum 9, 1611 (2025)), published in Quantum Views.

### Neue Zürcher Zeitung (Swiss daily newspaper)

*November 2023*

An in-depth article in the Swiss daily newspaper NZZ (in German) about the implications for data security as quantum computers approach the potential ability to break current encryption, and whether post-quantum cryptography or rather quantum cryptography is the answer. In this context, it talks about a rebuttal to challenges and objections that are often raised regarding the usability of quantum cryptography that I co-authored.

## Publications


[1] M. Sandfuchs, M. Haberland, V. Vilasini, and R. Wolf, *Security of differential phase shift QKD from relativistic principles*, Quantum **9**, 1611 (2025).

[2] A. Kulikov, S. Storz, J. D. Schär, M. Sandfuchs, R. Wolf, F. Berterottière, C. Hellings, R. Renner, and A. Wallraff, *Device-independent randomness amplification*, Preprint at arXiv:2412.17931 (2024) .

[3] E. Y.-Z. Tan and R. Wolf, *Entropy bounds for device-independent quantum key distribution with local Bell test*, Physical Review Letters **133**, 120803 (2024).

[4] R. Renner and R. Wolf, *Commuting operations factorise*, Preprint at arXiv:2308.05792 (2023).

[5] R. Renner and R. Wolf, *The debate over QKD: A rebuttal to the NSA's objection*, Preprint at arXiv:2307.15116 (2023).
To appear as a chapter of the book "Quantum technologies: Trends and implications for cyber defense", edited by J. Jang-Jaccard et al., published by Springer.

[6] M. Sandfuchs and R. Wolf, *Coherent attacks are stronger than collective attacks on DIQKD with random postselection*, Preprint at arXiv:2306.07364 (2023).

[7] R. Renner and R. Wolf, *Quantum advantage in cryptography*, AIAA Journal, **61**, 1895–1910 (2023).

[8] D. Barter, J. C. Bridgeman, and R. Wolf, *Computing associators of endomorphism fusion categories*, SciPost Physics **13**, 029 (2022).

[9] R. Vanhove, L. Lootens, M. Van Damme, R. Wolf, T. J. Osborne, J. Haegeman, and F. Verstraete, *Critical lattice model for a Haagerup conformal field theory*, Physical Review Letters **128**, 231602 (2022).

[10] R. Wolf, *Quantum key distribution: An introduction with exercises*, Lecture Notes in Physics **988**, Springer International Publishing (2021).

[11] R. Schwonnek, K. T. Goh, I. W. Primaatmaja, E. Y.-Z. Tan, R. Wolf, V. Scarani, and C. C.-W. Lim, *Device-independent quantum key distribution with random key basis*, Nature Communications **12**, 2880 (2021).

[12] A. Hahn and R. Wolf, *Generalized string-nets for unitary fusion categories without tetrahedral symmetry*, Physical Review B **102**, 115154 (2020).

[13] J. C. Bridgeman, A. Hahn, T. J. Osborne, and R. Wolf, *Gauging defects in quantum spin systems: A case study*, Physical Review B **101**, 134111 (2020).

[14] K. Beer, D. Bondarenko, T. Farrelly, T. J. Osborne, R. Salzmann, D. Scheiermann, and R. Wolf, *Training deep quantum neural networks*, Nature Communications **11**, 808 (2020).

[15] Y.-Y. Zhao, G.-Y. Xiang, X.-M. Hu, B.-H. Liu, C.-F. Li, G.-C. Guo, R. Schwonnek, and R. Wolf, *Entanglement detection by violations of noisy uncertainty relations: A proof of principle*, Physical Review Letters **122**, 220401 (2019).

[16] T. J. Osborne, D. E. Stiegemann, and R. Wolf, *The F-symbols for the $\mathcal{H}_3$ fusion category*, Preprint at arXiv:1906.01322 (2019).

[17] K. Beer, D. Bondarenko, A. Hahn, M. Kalabakov, N. Knust, L. Niermann, T. J. Osborne, C. Schridde, S. Seckmeyer, D. E. Stiegemann, and R. Wolf, *From categories to anyons: A travelogue*, Preprint at arXiv:1811.06670 (2018).