

# Ramona Wolf

POSTDOCTORAL RESEARCHER IN THE QUANTUM INFORMATION THEORY GROUP AT ETH ZÜRICH

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## Employment

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### Postdoctoral Researcher

ETH ZÜRICH, QUANTUM INFORMATION THEORY GROUP

Scientific advisor: Prof. Dr. Renato Renner

*since Feb 2021*

*Zurich, Switzerland*

### Research Assistant

LEIBNIZ UNIVERSITÄT HANNOVER, QUANTUM INFORMATION THEORY GROUP

*Nov 2017 – Dec 2020*

*Hanover, Germany*

### Student Employee

LEIBNIZ UNIVERSITÄT HANNOVER, INSTITUTE FOR THEORETICAL PHYSICS

Tutor for several courses in theoretical physics

*Apr 2014 – Sep 2017*

*Hanover, Germany*

## Education

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### Doctor of Natural Sciences in Physics

LEIBNIZ UNIVERSITÄT HANNOVER

Thesis topic: [Microscopic Models for Fusion Categories](#)

Supervisor: Prof. Dr. Tobias J. Osborne

*Nov 2017 – Dec 2020*

*Hanover, Germany*

### Master of Science in Physics

LEIBNIZ UNIVERSITÄT HANNOVER

Thesis topic: Fusion in tensor categories

Thesis supervisor: Prof. Dr. Tobias J. Osborne

*Oct 2015 – Sep 2017*

*Hanover, Germany*

### Bachelor of Science in Physics

LEIBNIZ UNIVERSITÄT HANNOVER

Thesis topic: Quantum key distribution in the non-asymptotic regime

Thesis supervisor: Prof. Dr. Tobias J. Osborne

*Oct 2012 – Nov 2015*

*Hanover, Germany*

## Awards & Funding

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### Funding for a summer school on quantum key distribution

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 and Martin Sandfuchs).

*November 2022*

### Grant for the program “Research in Pairs” at MFO

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.*

*October 2021*

### **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.

### **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**

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### **Swiss Quantum Days**

*February 2023*

VILLARS-SUR-OLLON, SWITZERLAND

Talk: Why security proofs are unavoidable in quantum cryptography

### **Seminar "Case Studies: Applications of Quantum Technology"**

*November 2022*

QUANTUM ENGINEERING MASTER'S PROGRAMME AT ETH ZÜRICH, SWITZERLAND

Lecture: Quantum cryptography

### **Applied Cryptography Group Seminar**

*October 2022*

APPLIED CRYPTOGRAPHY GROUP AT ETH ZÜRICH, SWITZERLAND

Talk: Randomness in quantum cryptography

### **Workshop "Quantum Innovators in Science and Engineering"**

*October 2022*

INSTITUTE FOR QUANTUM COMPUTING, UNIVERSITY OF WATERLOO, CANADA

Invited Talk: True randomness from quantum physics

### **Workshop "Higher categories and topological order"**

*September 2022*

AMERICAN INSTITUTE OF MATHEMATICS, SAN JOSÉ, USA

Invited Talk: A physicist's view on fusion categories

### **Quantum Key Distribution Summer School**

*August 2022*

INSTITUTE FOR QUANTUM COMPUTING, UNIVERSITY OF WATERLOO, CANADA

Lecture: Composability

### **Quantum Center General Meeting**

*July 2022*

SCHATZALP, SWITZERLAND

Talk: True randomness from quantum physics

### **Quantum Group Seminar**

*June 2022*

QUANTUM GROUP AT UNIVERSITY OF GHENT, BELGIUM

Talk: An introduction to quantum cryptography

### **GAPT Seminar**

*March 2022*

CARDIFF UNIVERSITY, WALES (ONLINE)

Invited talk: From subfactors to conformal field theories via lattice models

### **HEP-GR Seminar**

*February 2022*

INSTITUT FÜR THEORETISCHE PHYSIK, UNIVERSITÄT LEIPZIG, GERMANY

Invited talk: From subfactors to conformal field theories via lattice models

### University Quantum Symmetries Lectures

February 2022

NORTH CAROLINA STATE UNIVERSITY, USA (ONLINE)

Invited talk: Computing  $F$ -symbols of endomorphism fusion categories

### QSIT Lunch Seminar

December 2021

ETH ZÜRICH, SWITZERLAND

Talk: Challenges for practical device-independent quantum key distribution

### AMS Fall Western Virtual Sectional Meeting

October 2021

ONLINE (FORMERLY AT UNIVERSITY OF NEW MEXICO, USA)

Invited talk: From subfactors to CFTs via physical models

### Workshop “Device-Independent Quantum Key Distribution”

September 2021

ETH ZÜRICH, SWITZERLAND

Talk: Composability in QKD

### Online Student Seminar on Quantum Symmetries

July 2020

OHIO STATE UNIVERSITY, USA (ONLINE)

Invited talk: Towards a Haagerup CFT

### Quantum Machine Learning Journal Club

March 2019

CENTRE FOR QUANTUM TECHNOLOGIES, SINGAPORE

Talk: Efficient learning for deep quantum neural networks (video available on [youtube](#))

## Academic Service and Teaching

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### Organization

- Workshop “[Device-Independent Quantum Key Distribution](#)” (August 31–September 2 2021) at ETH Zürich
- Group seminar of the Quantum Information Theory Group at Leibniz Universität Hannover (2018–2020)

### Lecturer

INCLUDES ORGANIZING AND GIVING LECTURES, GRADING STUDENT TALKS

- Seminar “Security of Quantum Key Distribution” (2020), held as an online seminar (videos available on [youtube](#))

### Teaching Assistant

INCLUDES MAKING EXERCISE SHEETS, GIVING EXERCISE CLASSES, SUBSTITUTING FOR THE LECTURER

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

### Student Supervision

- At ETH Zürich:
  - Composability of blind quantum computing – P. Arabadjieva (Semester project)
  - A proof of composable security for relativistic quantum key distribution – M. Haberland (Master project)
  - Foundations of quantum random number generation – A. Efimova (Semester project)
  - Computing key rates for device-independent QKD – M. Sandfuchs (Master project)
- At Leibniz Universität Hannover:
  - Anyon chains with multiplicities – C. Schridde (Master project)
  - Source-device-independent quantum random number generation – M. Steinbach (Bachelor project)
  - Noise robustness of quantum neural networks – D. Scheiermann (Bachelor project)
  - Microscopic models for the Haagerup fusion category – A. Hahn (Master project)
  - Trivalent categories – C. Schridde (Bachelor project)

### Referee for Scientific Journals

Physical Review {A, B, Letters, Research, X Quantum}, Communications in Mathematical Physics, Annals of Physics, Quantum Science and Technology, Quantum Machine Intelligence, Canadian Journal of Physics

## Publications

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### Quantum advantage in cryptography

February 2023

WITH R. RENNER

Publication: *AIAA Journal*, 1–16.

Preprint: [arXiv:2206.04078](https://arxiv.org/abs/2206.04078)

### Security of differential phase shift QKD from relativistic principles

January 2023

WITH M. SANDFUCHS, M. HABERLAND, AND V. VILASINI

Preprint: [arXiv:2301.11340](https://arxiv.org/abs/2301.11340)

### Computing associators of endomorphism fusion categories

August 2022

WITH D. BARTER AND J.C. BRIDGEMAN

Publication: *SciPost Physics* **13**, 029 (2022)

Preprint: [arXiv:2110.03644](https://arxiv.org/abs/2110.03644)

### Critical lattice model for a Haagerup conformal field theory

June 2022

WITH R. VANHOVE, L. LOOTENS, M. VAN DAMME, T. OSBORNE, J. HAEGEMAN, AND F. VERSTRAETE

Publication: *Physical Review Letters* **128**, 231602 (2022)

Preprint: [arXiv:2110.03532](https://arxiv.org/abs/2110.03532)

### Quantum key distribution – An introduction with exercises

August 2021

TEXTBOOK

Publication: *Lecture Notes in Physics* **988**, Springer International Publishing

### Device-independent quantum key distribution with random key basis

May 2021

WITH R. SCHWONNEK, K. T. GOH, I. W. PRIMAATMAJA, E. Y.-Z. TAN, V. SCARANI, AND C. C.-W. LIM

Publication: *Nature Communications* **12**, 2880 (2021)

Preprint: [arXiv:2005.02691](https://arxiv.org/abs/2005.02691)

### Generalized string-nets for unitary fusion categories without tetrahedral symmetry

September 2020

WITH A. HAHN

Publication: *Physical Review B* **102**, 115154 (2020)

Preprint: [arXiv:2004.07045](https://arxiv.org/abs/2004.07045)

### Gauging defects in quantum spin systems: A case study

April 2020

WITH J. BRIDGEMAN, A. HAHN, AND T. J. OSBORNE

Publication: *Physical Review B* **101**, 134111 (2020)

Preprint: [arXiv:1910.10619](https://arxiv.org/abs/1910.10619)

### Training deep quantum neural networks

February 2020

WITH K. BEER, D. BONDARENKO, T. FARRELLY, T. J. OSBORNE, R. SALZMANN, AND D. SCHEIERMANN

Publication: *Nature Communications* **11**, 808 (2020) (part of the collection “2020 Top 50 Physics Articles”)

Preprint: [arXiv:1902.10445](https://arxiv.org/abs/1902.10445)

### Entanglement detection by violations of noisy uncertainty relations: A proof of principle

June 2019

WITH Y.-Y. ZHAO, G.-Y. XIANG, X.-M. HU, B.-H. LIU, C.-F. LI, G.-C. GUO, AND R. SCHWONNEK

Publication: *Physical Review Letters* **122**, 220401 (2019)

Preprint: [arXiv:1810.05588](https://arxiv.org/abs/1810.05588)

### The F-symbols for the H3 Fusion Category

June 2019

WITH T. J. OSBORNE AND D. E. STIEGEMANN

Preprint: [arXiv:1906.01322](https://arxiv.org/abs/1906.01322)

**From categories to anyons: a travelogue**

*November 2018*

WITH K. BEER, D. BONDARENKO, A. HAHN, M. KALABAKOV, N. KNUST, L. NIERMANN, T. J. OSBORNE,  
C. SCHRIDDE, S. SECKMEYER, AND D. E. STIEGEMANN

Preprint: [arXiv:1811.06670](https://arxiv.org/abs/1811.06670)