Ramona **Wolf**

Postdoctoral Researcher in the Quantum Information Theory Group at ETH Zürich

HIT K 41.3, Wolfgang-Pauli-Str. 27, 8093 Zürich, Switzerland

rawolf@phys.ethz.ch | ramonawolf.com | Google Scholar | ArXiv

Employment

Postdoctoral Researcher — *Zurich, Switzerland*

ETH Zürich, Quantum Information Theory Group — *since Feb 2021*

Scientific advisor: Prof. Dr. Renato Renner

Research Assistant — *Hanover, Germany*

Leibniz Universität Hannover, Quantum Information Theory Group — *Nov 2017 – Dec 2020*

Student Employee — *Hanover, Germany*

Leibniz Universität Hannover, Institute for Theoretical Physics — *Apr 2014 – Sep 2017*

- Tutor for several courses in theoretical physics
- Assistant at the Freshmen Welcome Days

Education

Doctor of Natural Sciences in Physics — *Hanover, Germany*

Leibniz Universität Hannover — *Nov 2017 – Dec 2020*

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

Master of Science in Physics — *Hanover, Germany*

Leibniz Universität Hannover — *Oct 2015 – Sep 2017*

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

Bachelor of Science in Physics — *Hanover, Germany*

Leibniz Universität Hannover — *Oct 2012 – Nov 2015*

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

Publications & Preprints

Book

Quantum Key Distribution — *August 2021*

An Introduction with Exercises

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

Peer-Reviewed Journals

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

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

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

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

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

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

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

Preprints

Quantum Advantage in Cryptography *June 2022*

with R. Renner

Preprint: arXiv:2206.04078

The F-Symbols for the H3 Fusion Category *June 2019*

with T. J. Osborne and D. E. Stiegemann

Preprint: arXiv: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, D. E. Stiegemann

Preprint: arXiv:1811.06670

Talks

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)

Awards & Funding

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

GRANTED BY THE NATIONAL CENTER OF COMPETENCE IN RESEARCH "SWISSMAP" (SWITZERLAND)

Funding for 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).

Grant for the program "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*.

QSIT INSPIRE Postdoc Award *July 2021*

AWARDED BY THE NATIONAL CENTER OF COMPETENCE IN RESEARCH "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).

Academic Service and Teaching

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)

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

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/grading excercise sheets, giving excercise classes, helping students with talks, substituting for the lecturer

- Lecture “Quantum Field Theory I” (2022)
- Lecture “Advanced Quantum Mechanics” (2022)
- Lecture “General Mechanics” (2021)
- Lecture “Theory of Heat” (2021)
- Proseminar “Self-similarity and fractals” (2020)
- Lecture “Computational Physics” (2019/2020)
- Proseminar “Special topics of classical theoretical physics” (2019)
- Several courses in theoretical physics for undergraduate students (2014-2017)

Student Supervision

- At ETH Zürich:
  - 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)