

# Philipp Reichenbach

## Curriculum Vitae

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### Education

09/2018 – 06/2023

**PhD student in Mathematics**, *Technische Universität Berlin and Berlin Mathematical School*, Main Research Area: Computational Invariant Theory, Total Grade: *summa cum laude* (with distinction).

04/2016 – 08/2018

**Master Studies in Mathematics**, *Universität Bonn*, Main Area: Algebraic Geometry, secondary subject: Computer Science; Total Grade: 1.1 “*excellent*”.

10/2012 – 03/2016

**Bachelor Studies in Mathematics**, *Technische Universität Berlin*, Main Area: Algebra, secondary subject: Philosophy; Total Grade: 1.1 “*very good*”.

### Employments

since 09/2023

**Forschungsreferent (Research Officer) for Cryptology**, *Agentur für Innovation in der Cybersicherheit GmbH*.

09/2018 – 08/2023

**Research Assistant**, *Technische Universität Berlin*, Research group *Algorithmic Algebra*, financed by the ERC Advanced Grant *COCAN: Complexity and Condition in Algebra and Numerics*.

04/2014 – 03/2016

**Tutor for Mathematics**, *Technische Universität Berlin*, Institut für Mathematik.

### Honors and Awards

#### Academic

10/2018

**Admission as Phase II Student at BMS**, *Berlin Mathematical School*.

11/2016

**2nd Prize for “Best Bachelor Degree/Thesis”**, *Technische Universität Berlin*, Dies Mathematicus.

11/2016

**3rd Prize for “Best Presentation”**, *Technische Universität Berlin*, Dies Mathematicus.

05/2012

**1st Prize in Mathematics of the Dr. Hans Riegel Fachpreis**, awarded by Dr. Hans Riegel Stiftung in cooperation with the Freie Universität Berlin. Award for a project thesis in school, prize money: 600 €.

04/2012

**Abiturprize of the Deutsche Mathematiker Vereinigung**. Award for excellent grades in the advanced course of mathematics in school.

#### Others

11/2012

**Welcome for volunteers in sports**, *Rotes Rathaus Berlin*, invited by the governing mayor of Berlin. due to victory of *ttc berlin eastside* in Women Table Tennis Champions League 2012

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## Publications

### Published

1. **Symmetries in Directed Gaussian Graphical Models.**  
With Visu Makam and Anna Seigal. *Electronic Journal of Statistics*, 2023.
2. **Toric Invariant Theory for Maximum Likelihood Estimation in log-linear models.**  
With Carlos Améndola, Kathlén Kohn and Anna Seigal. *Algebraic Statistics*, 2021.
3. **Barriers for recent methods in geodesic optimization.**  
With Cole Franks. *LIPICs, Volume 200, 36th Computational Complexity Conference*, 2021.
4. **Invariant Theory and Scaling Algorithms for Maximum Likelihood Estimation.**  
With Carlos Améndola, Kathlén Kohn and Anna Seigal. *SIAM Journal on Applied Algebra and Geometry*, 2021.

### Preprints

5. **Complete Collineations for Maximum Likelihood Estimation.**  
With Gergely Bérczi, Eloise Hamilton and Anna Seigal. ArXiv:2311.03329.
6. **Tensor Rank and Complexity.**  
With Giorgio Ottaviani. ArXiv:2004.01492.

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## Theses

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| 08/2023 | <b>PhD thesis</b> , <i>Invariant Theory in Computational Complexity and Algebraic Statistics</i> , Supervisor: Prof. Dr. Peter Bürgisser, External examiner: Prof. Dr. Jan Draisma, DOI: 10.14279/depositonce-18306.<br>Grade: summa cum laude (with distinction) |
| 08/2018 | <b>Master thesis</b> , <i>Vector bundles on elliptic curves and an associated Tannakian category</i> , Advisor: Dr. Johannes Anschütz, Second Advisor: Prof. Dr. Peter Scholze.<br>Grade: 1.0 "very good"   |
| 01/2016 | <b>Bachelor thesis</b> , <i>Stabilisator der Determinante und maximal lineare Teilräume</i> , Advisor: Prof. Dr. Peter Bürgisser, Second Advisor: Prof. Dr. Jörg Liesen.<br>Grade: 1.0 "very good"  |
| 12/2011 | <b>Project thesis (in school)</b> , <i>Visualisierungen ausgewählter komplexer Funktionen mit Hilfe eines PCs</i> , Advisor: Dr. Sabiene Zänker.  |

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## Teaching Experience

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| 07/2019 – 04/2023                | <b>2nd examiner in oral exams</b> , <i>Technische Universität Berlin</i> , Courses: Algebra I, Algebra II, Variations on Bézout's Theorem, Algebraic Curves, Representation Theory of Quivers, Selected Topics in Representation Theory.<br>References: Peter Bürgisser, Dirk Kussin |
| 04/2015 – 03/2016                | <b>Student member of election committee for tutors</b> , <i>Technische Universität Berlin</i> .  |
| 04/2014 – 03/2016<br>Summer 2015 | <b>Tutor for <i>Linear Algebra for Mathematicians</i></b> , <i>Technische Universität Berlin</i> .<br><b>TU tutor plus</b> , <i>Technische Universität Berlin</i> , training for tutors in mathematics.  |

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## Research Stays

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| 07/2022 | <b>Visited my co-author Anna Seigal at Harvard University, MA, United States</b> , several days. |
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06/2022 Visited Michael Walter and his research group on Quantum Information, Ruhr Universität Bochum, Germany, one week.

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## Selected Conferences and Talks

- 11/2022 **AGATES: Algebraic Geometry with Applications to Tensors and Secants**, IMPAN, Warsaw, Poland.  
Invited talk about *Barriers for Tensor Scaling* in the workshop on *Algebraic Geometry and Complexity Theory*. Participant in the workshop on *Tensors in statistics, optimization and machine learning*.
- 09/2022 **Geometry in Complexity and Computations**, Universität Konstanz, Germany.
- 06/2022 **CCAAGS'22: Combinatorial, Computational, and Applied Algebraic Geometry**, University of Washington, United States.  
Poster about *Symmetries in directed Gaussian graphical models*.
- 08/2021 **SIAM Conference on Applied Algebraic Geometry 2021**, Virtual, Texas A&M University, United States.  
Invited talk about *Transitive DAGs as Gaussian group models* in the Minisymposium on *Applied Invariant Theory: Statistics and Algorithms*.
- 07/2021 **Computational Complexity Conference 2021**, Virtual, Toronto, Canada.  
Talk on the accepted paper *Barriers for recent methods in geodesic optimization*.
- 05/2021 **AMS Spring Western Sectional Meeting**, Virtual, San Francisco State University, United States.  
Invited talk about *Invariant Theory for Maximum Likelihood Estimation* in the Special Session on *Quivers, Tensors, and their Applications*.
- 04/2020 **Nonlinear Algebra Seminar Online (NASO)**, Virtual, Leipzig, Germany.  
Invited talk titled *Invariant Theory and Matrix Normal Models*.
- 02/2020 **Milestone Conference - Thematic Einstein Semester: Varieties, Polyhedra, Computation**, Berlin, Germany.  
Contributed talk titled *Invariant theory and scaling algorithms for maximum likelihood estimation*.
- 11/2019 **Buildings, Varieties, and Applications**, Leipzig, Germany.  
Contributed talk on *Bounds on the weight margin*.
- 10/2019 **Opening Conference - Thematic Einstein Semester: Varieties, Polyhedra, Computation**, Berlin, Germany.
- 07/2019 **SIAM Conference on Applied Algebraic Geometry 2019**, Bern, Switzerland.

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## Mathematical Societies

- since 09/2021 Society for Industrial and Applied Mathematics (SIAM)  
since 10/2018 Phase II student of the Berlin Mathematical School  
since 2013 Deutsche Mathematiker Vereinigung (German Mathematical Society)

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## Voluntary Service

- Summer Term 2017 Mentor in the student dormitory *Hermann-Wandersleb-Ring 6*  
01/2011 – 03/2016 Cashier/responsible for the cashpoint in Champions-League matches of the table tennis club *ttc berlin eastside e.V.* (the club won the Women Champions League in 2012, 2014 and 2016)  
2009 – 2014 different voluntary services in *ttc berlin eastside e.V.*; e.g. coaching younger teammates, organizational help for matches of the 1st women team