Philipp Reichenbach

Curriculum Vitae

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Employments

since 09/2023 **Forschungsreferent (Research Officer) for Cryptology**, *Agentur für Innovation in der Cybersicherheit GmbH (Cyberagentur)*.

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.

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"*.

Honors and Awards

Academic

11/2024 **SIAM Review SIGEST Award**, *together with Carlos Améndola, Kathlén Kohn and Anna Seigal*, awarded by the Society for Industrial and Applied Mathematics (SIAM), Link to corresponding MATH+ news.
This prestigious award recognizes the paper *Invariant Theory and Scaling Algorithms for Maximum Likelihood Estimation*. The corresponding award paper *A Bridge between Invariant Theory and Maximum Likelihood Estimation* was published in SIAM Review.

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

Publications

Published

1. **A Bridge between Invariant Theory and Maximum Likelihood Estimation.**
With Carlos Améndola, Kathlén Kohn and Anna Seigal. *SIAM Review*, 2024.
2. **Symmetries in Directed Gaussian Graphical Models.**
With Visu Makam and Anna Seigal. *Electronic Journal of Statistics*, 2023.
3. **Toric Invariant Theory for Maximum Likelihood Estimation in log-linear models.**
With Carlos Améndola, Kathlén Kohn and Anna Seigal. *Algebraic Statistics*, 2021.
4. **Barriers for recent methods in geodesic optimization.**
With Cole Franks. *LIPIcs, Volume 200, 36th Computational Complexity Conference,* 2021.
5. **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

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

Theses

08/2023 **PhD thesis**, *Invariant Theory in Computational Complexity and Algebraic Statistics*, Supervisor: Prof. Dr. Peter Bürgisser, External examiner: Prof. Dr. Jan Draisma, DOI: 10.14279/depositonce-18306.
Grade: summa cum laude (with distinction)

08/2018 **Master thesis**, *Vector bundles on elliptic curves and an associated Tannakian category*, Advisor: Dr. Johannes Anschütz, Second Advisor: Prof. Dr. Peter Scholze.
Grade: 1.0 "very good"

01/2016 **Bachelor thesis**, *Stabilisator der Determinante und maximal lineare Teilräume*, Advisor: Prof. Dr. Peter Bürgisser, Second Advisor: Prof. Dr. Jörg Liesen.
Grade: 1.0 "very good"

12/2011 **Project thesis (in school)**, *Visualisierungen ausgewählter komplexer Funktionen mit Hilfe eines PCs*, Advisor: Dr. Sabiene Zänker.

Teaching Experience

07/2019 – 04/2023 **2nd examiner in oral exams**, *Technische Universität Berlin*, Courses: Algebra I, Algebra II, Variations on Bézout's Theorem, Algebraic Curves, Representation Theory of Quivers, Selected Topics in Representation Theory.
References: Peter Bürgisser, Dirk Kussin

04/2015 – 03/2016 **Student member of election committee for tutors**, *Technische Universität Berlin*.

04/2014 – 03/2016 **Tutor for *Linear Algebra for Mathematicians***, *Technische Universität Berlin*.

Summer 2015 **TU tutor plus**, *Technische Universität Berlin*, training for tutors in mathematics.

Research Stays

07/2022 **Visited my co-author Anna Seigal at Harvard University**, *MA, United States*, several days.

06/2022 **Visited Michael Walter and his research group on Quantum Information**, *Ruhr Universität Bochum, Germany*, one week.

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.

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)

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