Curriculum Vitae

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Personal Information

Name	Tobias Christopher Metzlaff
Birthday	8 April 1996 in Aachen, DE
Nationality	German

Education

Dec 2019 – Dec 2022	**Mathematics PhD** awarded by Université Côte d'Azur in Nice, FR Thesis *Groupes Cristallographiques et Polynômes de Chebyshev en Optimisation Globale* (Crystallographic Groups and Chebyshev Polynomials in Global Optimization) directed by E. Hubert at SFA Doctoral School PhD Thesis (2022COAZ4094) ☐
Apr 2018 – Oct 2019	**Mathematics MSc** awarded by RWTH Aachen University in Aachen, DE Thesis *Computational Improvements for Non-Commutative Gröbner Bases over* $\mathbb{Z}/m\mathbb{Z}$ directed by V. Levandovskyy at Chair D for Mathematics MSc Thesis ☐
Oct 2014 – Mar 2018	**Mathematics BSc** awarded by RWTH Aachen University in Aachen, DE Thesis *Periodische lineare diskrete Systeme und ihre Normalform* (Periodic Linear Discrete Systems and their Canonical Form) directed by E. Zerz at Chair D for Mathematics BSc Thesis ☐
Sep 2006 – Jun 2014	Municipal High School in Würselen, DE
Sep 2002 – May 2006	Catholic Elementary School in Broichweiden, DE

Career

Jan 2023 – Dec 2024	**Postdoctoral Researcher** at University of Kaiserslautern-Landau, Department of Mathematics with U. Thiel in Kaiserslautern, DE Funding *Symbolic Tools in Mathematics and their Application* granted by German Research Foundation's transregional collaborative research centre and Rheinland-Pfalz' research initiative SFB-TRR 195 ☐ SymbTools ☐
Oct 2021 – Dec 2021	**Secondee** at Numerical Algorithm Group with S. Bai in Oxford, GB
Dec 2020 – Feb 2021	**Secondee** at UiT The Arctic University of Norway, Department of Mathematics and Statistics with C. Riener in Tromsø, NO
Dec 2019 – Dec 2022	**Doctoral Researcher** at Centre Inria d'Université Côte d'Azur, Team AROMATH with E. Hubert and B. Mourrain in Sophia Antipolis, FR Funding *Polynomial Optimization Efficiency through Moments and Algebra* granted by European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Actions Poema ☐
Oct 2018 – Sep 2019	**Student Assistant** at RWTH Aachen University, Chair II for Mathematics in Aachen, DE
Oct 2016 – Mar 2018	**Student Assistant** at RWTH Aachen University, Chair C for Mathematics in Aachen, DE

Research Output

Articles in Journals

[Met25] **On symmetry adapted bases in trigonometric optimization** in *Journal of Symbolic Computation*, Vol. 127, Art. Num. 102369, 2025   arXiv 2310.05519 ☑   hal 04236200 ☑

[HMMR24] **Optimization of trigonometric polynomials with crystallographic symmetry and spectral bounds for set avoiding graphs** with E. Hubert, P. Moustrou and C. Riener to appear in *Mathematical Programming*, 2024   arXiv 2303.09487 ☑   hal 03768067 ☑

[HMR24] **Orbit Spaces of Weyl Groups Acting on Compact Tori: A Unified and Explicit Polynomial Description** with E. Hubert and C. Riener in *SIAM Journal on Applied Algebra and Geometry*, Vol. 8, Iss. 3, pp. 612–649, 2024   arXiv 2203.13152 ☑   hal 03590007 ☑

[LMZ23] **Computing free non-commutative Gröbner Bases over $\mathbb{Z}$ with Singular:Letterplace** with V. Levandovskyy and K. Abou Zeid in *Journal of Symbolic Computation*, Vol. 115, pp. 201–222, 2023   arXiv 2111.08518 ☑   hal 03085431 ☑

Articles in Proceedings and Communications

[Met23] **Symmetry Adapted Bases for Trigonometric Optimization** in *ACM Communications in Computer Algebra*, Vol. 57, Iss. 3, pp. 137–140, 2023

[HMMR22] **T-orbit spaces of multiplicative actions and applications** with E. Hubert, P. Moustrou and C. Riener in *ACM Communications in Computer Algebra*, Vol. 56, Iss. 2, pp. 72–75, 2022

[LMZ20] **Computation of free non-commutative Gröbner bases over $\mathbb{Z}$ with Singular:Letterplace** with V. Levandovskyy and K. Abou Zeid in *Proceedings of the 45th International Symposium on Symbolic and Algebraic Computation*, Vol. 127, pp. 312–319, 2020

Software Development

[GenCheby] **GeneralizedChebyshev** a Maple package for irreducible reduced root systems and the associated generalized Chebyshev polynomials   GeneralizedChebyshev ☑

[Oscar] **Oscar** a comprehensive Open Source Computer Algebra Research system for computations in algebra, geometry, and number theory   Oscar ☑

[SingLet] **Singular:Letterplace** a Singular extension for finitely presented modules over finitely presented associative non-commutative algebras   Letterplace ☑

Skills

Languages	German native, English fluent, French fluent
Programming	C++, Latex, Julia, Python, Html
Mathematical Software	Gap, Singular, Maple, Oscar

Scientific Events

Organization

2023/24	*Darstellungstheorie und darüber hinaus* (Representation theory and beyond) in Kaiserslautern, DE
2020	*POEMA ESR Day* in Amsterdam, NL

Talks and Posters

2024   **Spectral bounds for set avoiding graphs via polynomial optimization** at *33rd European Conference on Operational Research* in Copenhagen, DK

Chebyshev Moments at *Moments and Polynomials: Applications and Theory* in Konstanz, DE

Singularités symplectiques et invariants diagonaux (Symplectic singularities and diagonal invariants) at *19ème Journées Nationales de Calcul Formel* (19th JNCF) in Marseille, FR

Spektrale Schranken für Cayley Graphen (Spectral Bounds for Cayley Graphs) at *Algorithmische und Diskrete Mathematik* (Algorithmic and Discrete Mathematics) in Chemnitz, DE

2023   **Symmetry in Trigonometric Optimization** at *Symmetry, stability and interactions with computations* in Marseille, FR

Fundamental invariants of improper symplectic reflection groups at *SFB-TRR 195 Annual Meeting* in Saarbrücken, DE

Symmetry Adapted Bases for Trigonometric Optimization at *48th International Symposium on Symbolic and Algebraic Computation* in Tromsø, NO

Crystallographic Symmetries in Trigonometric Optimization at *SIAM Conference on Applied Algebraic Geometry* in Eindhoven, NL

Optimisation Trigonométrique avec Symétrie (Trigonometric Optimization with Symmetry) at *18ème Journées Nationales de Calcul Formel* (18th JNCF) in Marseille, FR

2022   **T-Orbit Spaces of Multiplicative Actions and Applications** at *47th International Symposium on Symbolic and Algebraic Computation* in Lille, FR

Polynomial description for the T-Orbit Spaces of Multiplicative Actions at *17ème Journées Nationales de Calcul Formel* (17th JNCF) in Marseille, FR

2021   **Orbit Spaces for exponential Weyl Group Actions and the Chromatic Number of** $\mathbb{R}^n$ at *POEMA Industrial Workshop* in Sophia Antipolis, FR

Regions of orthogonality of generalized Chebyshev polynomials as semi-algebraic set at *Modern Analysis Related to Root Systems with Applications* in Marseille, FR

2020   **Gröbner bases over** $\mathbb{K}$ **and** $\mathbb{Z}$ **in theory and practice** at *7th International Congress on Mathematical Software* in Braunschweig, DE

Computation of free non-commutative Gröbner Bases over $\mathbb{Z}$ **with Singular:Letterplace** at *45th International Symposium on Symbolic and Algebraic Computation* in Kalamata, GR

Further Attendance

2023   *Singularities and Algorithms* in Kaiserslautern, DE

Higher Structures in Algebra Geometry in Nordfjordeid, NO

Processes and Heat Kernels with Symmetries in Angers, FR

2022   *Computational Algebraic Geometry* in Kaiserslautern, DE

Topics in Real and Tropical Algebraic Geometry in Nordfjordeid, NO

4th POEMA Workshop in Tilburg, NL

2021   *POEMA Learning Week* in Toulouse, FR

Algebraic Combinatorics of the Symmetric Groups and Coxeter Groups in Cetraro, IT

16ème Journées Nationales de Calcul Formel (16th JNCF) in Marseille, FR

3rd POEMA Workshop in Sophia Antipolis, FR

2020   *15ème Journées Nationales de Calcul Formel* (15th JNCF) in Marseille, FR

1st POEMA Workshop in Florence, IT

Miscellaneous Experience

Leadership

2020 – 2022   **ESR Representative** for the POEMA network

Teaching

2024/25   **Algebraic Geometry** assistant of U. Thiel at University of Kaiserslautern-Landau

2024   **Character Theory** assistant of U. Thiel at University of Kaiserslautern-Landau

2023/24   **Representation Theory** assistant of G. Malle at University of Kaiserslautern-Landau

2023   **Quadratic Number Fields** assistant of U. Thiel at University of Kaiserslautern-Landau

2019   **Mathematik II** assistant of E. Triesch at RWTH Aachen University

2018/19   **Mathematik III** assistant of Y. Guo at RWTH Aachen University

2017/18   **Mathematik III** assistant of S. Dirksen at RWTH Aachen University

2017   **Mathematik II** assistant of S. Dirksen at RWTH Aachen University

2016/17   **Mathematik I** assistant of S. Dirksen at RWTH Aachen University

Certificates

2021   **Marketing your research experience & Identifying your skills and demonstrating them by storytelling** awarded by Association Bernard Gregory

2013   **Diplôme d'Études en Langue Française** (DELF) awarded by French Ministry of Education

Dissemination

2024   **Arctic MSCA Symposium** at UiT The Arctic University of Norway in Tromsø, NO

2021   **Researchers Night** at Université Côte d'Azur in Nice, FR

Tobias Metzlaff, October 2024