

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 Doctorate** awarded by Université Côte d'Azur in Nice, FR
Thesis *Crystallographic Groups and Chebyshev Polynomials in Global Optimization*
directed by E. Hubert at Doctoral School of Applied Sciences PhD Thesis [↗](#)

Apr 2018 – Oct 2019 **Mathematics Master of Science** 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 Bachelor of Science** awarded by RWTH Aachen University in Aachen, DE
Thesis *Periodic Linear Discrete Systems and their Canonical Form*
directed by E. Zerz at Chair D for Mathematics BSc Thesis [↗](#)

EMPLOYMENT

since May 2026 **Assistant Professor** at Beijing Institute of Mathematical Sciences and Applications, CN

Feb 2025 – Mar 2026 **Postdoctoral Researcher** at LAAS CNRS with V. Magron and I. Klep in Toulouse, FR
Funding *nonCommutative polynOMial oPtimisation for qUanTum nEtworks*
granted by QuantERA II ERA-NET European Union's Horizon 2020 research and innovation programme COMPUTE [↗](#)

Jan 2023 – Jan 2025 **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 [↗](#)

Dec 2019 – Dec 2022 **Doctoral Researcher** at Centre Inria d'Université Côte d'Azur 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

PUBLICATIONS

PREPRINTS

- [KMMW25] **Exploiting Term Sparsity in Symmetry-Adapted Basis for Polynomial Optimization** with I. Klep, V. Magron and J. Wang, under review, 2025
arXiv 2511.18019 [↗](#) hal 05380867 [↗](#)

ARTICLES IN JOURNALS

- [DM25] **Additive and Multiplicative Coinvariant Spaces of Weyl Groups in the Light of Harmonics and Graded Transfer** with S. Debus to appear in *Journal of Algebra*, 2025
doi 10.1016/j.jalgebra.2025.11.008 [↗](#) arXiv 2412.17099 [↗](#) hal 04853732 [↗](#)
- [Met25] **On symmetry adapted bases in trigonometric optimization** in *Journal of Symbolic Computation*, Special Issue on ISSAC 2023, Volume 127, 2025
doi 10.1016/j.jsc.2024.102369 [↗](#) arXiv 2310.05519 [↗](#) hal 04236200 [↗](#)
- [HMMR25] **Optimization of trigonometric polynomials with crystallographic symmetry and spectral bounds for set avoiding graphs** with E. Hubert, P. Moustrou and C. Riener in *Mathematical Programming Series A*, Vol. 213, pp. 517–573, 2025
doi 10.1007/s10107-024-02149-1 [↗](#) 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
doi 10.1137/23M158173X [↗](#) 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*, Special Issue on ISSAC 2020, Vol. 115, pp. 201–222, 2023
doi 10.1016/j.jsc.2022.08.007 [↗](#) 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
doi 10.1145/3637529.3637535 [↗](#)
- [HMMR22] **\mathbb{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
doi 10.1145/3572867.3572879 [↗](#)
- [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
doi 10.1145/3373207.3404052 [↗](#)

SOFTWARE

- [TSSOS] **TERMSPARSITYSUMSOF SQUARES** a Julia package for polynomial optimization with term and chordal sparsity, Contribution: symmetry reduction TSSOS [↗](#)
- [GenCheby] **GENERALIZEDCHEBYSHEV** a Maple package for irreducible reduced root systems and the associated generalized Chebyshev polynomials, Contribution: 100% GeneralizedChebyshev [↗](#)
- [SingLet] **SINGULAR:LETTERPLACE** a Singular extension for finitely presented modules over finitely presented associative non-commutative algebras, Contribution: $\mathbb{Z}\langle X \rangle$ Letterplace [↗](#)

For a detailed description of my research work: [Research Statement](#) [↗](#)

TEACHING EXPERIENCE

- 2024/25 **Algebraic Geometry** assistant of U. Thiel at University of Kaiserslautern-Landau, DE
2024 **Character Theory** assistant of U. Thiel
2023/24 **Representation Theory** assistant of G. Malle
2023 **Quadratic Number Fields** assistant of U. Thiel
2019 **Mathematics II** assistant of E. Triesch at RWTH Aachen University, DE
2018/19 **Mathematics III** assistant of Y. Guo
2017/18 **Mathematics III** assistant of S. Dirksen
2017 **Mathematics II** assistant of S. Dirksen
2016/17 **Mathematics I** assistant of S. Dirksen

MISCELLANEOUS EXPERIENCE

GRANTS

- Feb 2026 **SPP Grant Combinatorial Synergies** with S. Debus (5,000 EUR)

LEADERSHIP

- 2020 – 2022 **ESR Representative** for POEMA

SECONDMENTS

- Oct 2021 – Dec 2021 **Numerical Algorithm Group** with S. Bai and J. Fiala in Oxford, GB
Project: *polynomial optimization solvers for qcqp*
Dec 2020 – Feb 2021 **UiT The Arctic University of Norway** with C. Riener in Tromsø, NO
Project: *orbit spaces and chromatic numbers*

RESEARCH STAYS

- Oct 2025 **University of Klagenfurt** invited by A. Wiegele and D. Brosch in Klagenfurt, AT
Jan 2024 **TU Chemnitz** invited by C. Helmberg and S. Debus in Chemnitz, DE
Jun 2022 **UiT The Arctic University of Norway** invited by C. Riener in Tromsø, NO

CERTIFICATES

- 2021 Training: **Marketing your research experience & Identifying your skills and demonstrating them by storytelling** awarded by Association Bernard Gregory
2020 – 2022 Training: **Le Monde des Mathématiques Industrielles** awarded by Centre Inria d'Université Côte d'Azur
2010 – 2013 Language: **Diplôme d'Études en Langue Française** awarded by French Ministry of Education

DISSEMINATION

- 2024 **Arctic MSCA Symposium** at UiT The Arctic University of Norway in Tromsø, NO
Landeswettbewerb Mathematik at University of Kaiserslautern-Landau in Kaiserslautern, DE
2021 **Researchers Night** at Université Côte d'Azur in Nice, FR

SCIENTIFIC EVENTS

ORGANIZATION

- 2026 **ICMS Session: Symmetry Exploitation and Computational Aspects of Invariant Theory** in Waterloo, CA
SPP Workshop: Structuring Combinatorial Problems with Symmetry with S. Debus in Chemnitz, DE
- 2025 **POP Seminar** in Toulouse, FR
- 2023/24 **AGAG Seminar: Representation theory and beyond** in Kaiserslautern, DE
- 2020 **POEMA ESR Day** in Amsterdam, NL

TALKS, LECTURES AND POSTERS

- 2025 **A Symmetric TSSOS Hierarchy for Polynomial Optimization** at *European Conference on Computational Optimization (EUCCO)* in Klagenfurt, AT
Combining Sparsity and Symmetry Exploitation for SOS-Certificates at *Applications of Computer Algebra (30th ACA)* in Heraklion, GR
Symmetry in Trigonometric Optimization at *Séminaire Pluridisciplinaire d'Optimisation de Toulouse (66th SPOT)* in Toulouse, FR
- 2024 **Spectral bounds for set avoiding graphs via polynomial optimization** at *European Conference on Operational Research (33rd EURO)* 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 *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 *International Symposium on Symbolic and Algebraic Computation (48th ISSAC)* in Tromsø, NO
Crystallographic Symmetries in Trigonometric Optimization at *SIAM Conference on Applied Algebraic Geometry (SIAM AG)* in Eindhoven, NL
Optimisation Trigonométrique avec Symétrie (Trigonometric Optimization with Symmetry) at *Journées Nationales de Calcul Formel (18th JNCF)* in Marseille, FR
- 2022 **T-Orbit Spaces of Multiplicative Actions and Applications** at *International Symposium on Symbolic and Algebraic Computation (47th ISSAC)* in Lille, FR
Polynomial description for the T-Orbit Spaces of Multiplicative Actions at *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 *International Congress on Mathematical Software (7th ICMS)* in Braunschweig, DE
Computation of free non-commutative Gröbner Bases over \mathbb{Z} with Singular:Letterplace at *International Symposium on Symbolic and Algebraic Computation (45th ISSAC)* in Kalamata, GR

SKILLS

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