SIMON TELEN

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simon.telen@mis.mpg.de ◇ https://simontelen.webnode.page ◇ September 2024

EMPLOYMENT

Max Planck Junior Research Group Leader *April 2023 - ...*
Max Planck Institute for Mathematics in the Sciences, Leipzig
I lead a research group entitled 'Numerical nonlinear algebra'

Veni postdoc fellow *June 2022 - April 2023*
Centrum Wiskunde & Informatica, Amsterdam
NWO Veni project 'New frontiers in numerical nonlinear algebra'

Postdoctoral researcher in applied mathematics *August 2021 - May 2022*
Max Planck Institute for Mathematics in the Sciences, Leipzig
Supervisor: Michael Joswig

Postdoctoral researcher in applied mathematics *October 2020 - July 2021*
Max Planck Institute for Mathematics in the Sciences, Leipzig
Supervisor: Bernd Sturmfels

EDUCATION

Doctor in engineering science 2016 - 2020
KU Leuven, Department of Computer Science
Supervisor: Marc Van Barel
Dissertation title: *Solving Systems of Polynomial Equations*

M.Sc. summa cum laude 2014 - 2016
KU Leuven
Mathematical Engineering
Master's thesis title: *Solving Systems of Polynomial Equations*

B.Sc. magna cum laude 2011 - 2014
KU Leuven
Major in Electrical Engineering
Minor in Mathematical Modelling of Living Systems

AWARDS AND GRANTS

Veni grant awarded by the Dutch Research Council (NWO Talent Programme) December 2021
for my research proposal entitled 'New frontiers in numerical nonlinear algebra' (€280.000).

Thematic Einstein Semester on Algebraic Geometry October 2019 - January 2020
A four month scholarship to participate in a research semester at TU Berlin.

Best poster award at the MEGA 2019 Conference June 2019
Universidad Complutense de Madrid, Spain
for our poster 'Robust Numerical Path Tracking for Polynomial Homotopies' with Marc Van Barel and Jan Verschelde.

Best poster presentation award at the ISSAC 2018 conference July 2018
City University of New York, USA
for our poster 'Truncated Normal Forms for Solving Polynomial Systems' with Bernard Mourrain and Marc Van Barel.

Erasmus program at Politecnico di Torino September 2014 - June 2015
A ten month scholarship to follow the program 'Ingegneria Matematica' in Turin.

RESEARCH INTERESTS

Numerical nonlinear algebra: methodology and applications.

- Solving systems of polynomial equations
- Discriminants and resultants
- Degenerations
- Toric geometry
- Euler integrals
- Tensors
- Numerical solution of multi-parameter, nonlinear eigenvalue problems
- Applications in particle physics and algebraic statistics

PUBLICATIONS

Publications in international peer reviewed journals

- Daniele Agostini, Claudia Fevola, Anna-Laura Sattelberger, and Simon Telen. "Vector spaces of generalized Euler integrals". In: *Communications in Number Theory and Physics* 18.2 (2024), pp. 327–370. DOI: https://dx.doi.org/10.4310/CNTP.2024.v18.n2.a2

- Claudia Fevola, Sebastian Mizera, and Simon Telen. "Principal Landau determinants". In: *Computer Physics Communications* 303 (2024), p. 109278. ISSN: 0010-4655. DOI: https://doi.org/10.1016/j.cpc.2024.109278

- Barbara Betti, Marta Panizzut, and Simon Telen. "Solving equations using Khovanskii bases". In: *Journal of Symbolic Computation* 126 (2025), p. 102340. ISSN: 0747-7171. DOI: https://doi.org/10.1016/j.jsc.2024.102340

- Claudia Fevola, Sebastian Mizera, and Simon Telen. "Landau Singularities Revisited: Computational Algebraic Geometry for Feynman Integrals". In: *Phys. Rev. Lett.* 132 (10 Mar. 2024), p. 101601. DOI: 10.1103/PhysRevLett.132.101601

- Saiei-Jaeyeong Matsubara-Heo, Sebastian Mizera, and Simon Telen. "Four lectures on Euler integrals". In: *SciPost Phys. Lect. Notes* (2023), p. 75. DOI: https://scipost.org/10.21468/SciPostPhysLectNotes.75

- Rob Claes, Karl Meerbergen, and Simon Telen. "Contour Integration for Eigenvector Nonlinearities". In: *SIAM Journal on Matrix Analysis and Applications* 44.4 (2023), pp. 1619–1644. DOI: 10.1137/22M1497985

- Dmitrii Pavlov, Bernd Sturmfels, and Simon Telen. "Gibbs manifolds". In: *Information Geometry* (2023). DOI: https://doi.org/10.1007/s41884-023-00111-2

- Timothy Duff, Simon Telen, Elise Walker, and Thomas Yahl. "Polyhedral homotopies in Cox coordinates". In: *Journal of Algebra and Its Applications* (2023), p. 2450073. DOI: https://doi.org/10.1142/S0219498824500737

- Bernd Sturmfels, Simon Telen, François-Xavier Vialard, and Max von Renesse. "Toric geometry of entropic regularization". In: *Journal of Symbolic Computation* 120 (2024), p. 102221. ISSN: 0747-7171. DOI: https://doi.org/10.1016/j.jsc.2023.102221

- Daniele Agostini, Taylor Brysiewicz, Claudia Fevola, Lukas Kühne, Bernd Sturmfels, Simon Telen, and Thomas Lam. "Likelihood degenerations". In: *Advances in Mathematics* 414 (2023), p. 108863. ISSN: 0001-8708. DOI: https://doi.org/10.1016/j.aim.2023.108863

· Michael Borinsky, Anna-Laura Sattelberger, Bernd Sturmfels, and Simon Telen. "Bayesian Integrals on Toric Varieties". In: *SIAM Journal on Applied Algebra and Geometry* 7.1 (2023), pp. 77–103. DOI: https://doi.org/10.1137/22M1490569

· Simon Telen and Nick Vannieuwenhoven. "A Normal Form Algorithm for Tensor Rank Decomposition". In: *ACM Trans. Math. Softw.* 48.4 (Dec. 2022). ISSN: 0098-3500. DOI: https://doi.org/10.1145/3555369

· Sebastian Mizera and Simon Telen. "Landau discriminants". In: *Journal of High Energy Physics* 2022.8 (2022), pp. 1–57. DOI: https://doi.org/10.1007/JHEP08(2022)200

· Matías R Bender and Simon Telen. "Toric eigenvalue methods for solving sparse polynomial systems". In: *Mathematics of Computation* 91.337 (2022), pp. 2397–2429. DOI: https://doi.org/10.1090/mcom/3744

· Bernd Sturmfels and Simon Telen. "Likelihood equations and scattering amplitudes". In: *Algebraic Statistics* 12.2 (2021), pp. 167–186. DOI: https://doi.org/10.2140/astat.2021.12.167

· Simon Telen, Marc Van Barel, and Jan Verschelde. "A Robust Numerical Path Tracking Algorithm for Polynomial Homotopy Continuation". In: *SIAM Journal on Scientific Computing* 42.6 (2020), A3610–A3637. DOI: 10.1137/19M1288036

· Simon Telen, Sascha Timme, and Marc Van Barel. "Backward error measures for roots of polynomials". In: *Numerical Algorithms* 87.1 (2021), pp. 19–39. DOI: https://doi.org/10.1007/s11075-020-00956-z

· Simon Telen. "Numerical root finding via Cox rings". In: *Journal of Pure and Applied Algebra* 224.9 (2020), p. 106367. ISSN: 0022-4049. DOI: https://doi.org/10.1016/j.jpaa.2020.106367

· Bernard Mourrain, Simon Telen, and Marc Van Barel. "Truncated normal forms for solving polynomial systems: Generalized and efficient algorithms". In: *Journal of Symbolic Computation* 102 (2021), pp. 63–85. ISSN: 0747-7171. DOI: https://doi.org/10.1016/j.jsc.2019.10.009

· Simon Telen, Bernard Mourrain, and Marc Van Barel. "Solving Polynomial Systems via Truncated Normal Forms". In: *SIAM Journal on Matrix Analysis and Applications* 39.3 (2018), pp. 1421–1447. DOI: https://doi.org/10.1137/17M1162433

· Simon Telen and Marc Van Barel. "A stabilized normal form algorithm for generic systems of polynomial equations". In: *Journal of Computational and Applied Mathematics* 342 (2018), pp. 119–132. ISSN: 0377-0427. DOI: https://doi.org/10.1016/j.cam.2018.04.021

Publications in conference proceedings

· Simon Telen, Bernard Mourrain, and Marc Van Barel. "Truncated normal forms for solving polynomial systems". In: *ACM Communications in Computer Algebra* 52.3 (2019), pp. 78–81. DOI: https://doi.org/10.1145/3313880.3313888

Book chapters

· Simon Telen. "Systems of polynomial equations: theory and practice". In: *Polynomial Optimisation, Moments, and Applications, Springer Optimization and Its Applications, edited by Michal Kočvara, Bernard Mourrain and Cordian Riener* (2023). DOI: https://doi.org/10.1007/978-3-031-38659-6

Preprints

· Simon Telen and Maximilian Wiesmann. "Euler Stratifications of Hypersurface Families". In: *arXiv:2407.18176* (2024)

· Dmitrii Pavlov and Simon Telen. "Santaló Geometry of Convex Polytopes". In: *arXiv:2402.18955* (2024)

· Kristian Ranestad, Rainer Sinn, and Simon Telen. "Adjoints and Canonical Forms of Tree Amplituhedra". In: *arXiv:2402.06527* (2024)

· Zaïneb Bel-Afia, Chiara Meroni, and Simon Telen. "Chebyshev Varieties". In: *arXiv:2401.12140* (2024)

· Fulvio Gesmundo, Leonie Kayser, and Simon Telen. "Hilbert Functions of Chopped Ideals". In: *arXiv:2307.02560* (2023)

· Kemal Rose, Bernd Sturmfels, and Simon Telen. "Tropical Implicitization Revisited". In: *arXiv:2306.13015* (2023)

· Saiei-Jaeyeong Matsubara-Heo and Simon Telen. "Twisted Cohomology and Likelihood Ideals". In: *arXiv:2301.13579* (2023)

· Paul Breiding, Mateusz Michałek, Leonid Monin, and Simon Telen. "The Algebraic Degree of Coupled Oscillators". In: *arXiv:2208.08179* (2022)

· Simon Telen. "Introduction to Toric Geometry". In: *arXiv:2203.01690* (2022)

· Kathlén Kohn, Ragni Piene, Kristian Ranestad, Felix Rydell, Boris Shapiro, Rainer Sinn, Miruna-Stefana Sorea, and Simon Telen. "Adjoints and Canonical Forms of Polypols". In: *arXiv:2108.11747* (2021)

· Matías R Bender and Simon Telen. "Yet Another Eigenvalue Algorithm for Solving Polynomial Systems". In: *arXiv:2105.08472* (2021)

SELECTED COLLOQUIA AND SEMINAR TALKS

For a complete list, see `https://simontelen.webnode.com/publications/`.

Euler discriminants in physics and statistics April 2024
Methusalem colloquium, KU Leuven

Computational algebraic geometry for Landau analysis January 2024
Motives and period integrals in quantum field theory and string theory, University of Oxford

Tensors, polynomials and applications November 2023
Chemnitz Mathematical Colloquium, TU Chemnitz

Twisted Cohomology and Likelihood Ideals February 2023
Amplitudes group meeting, IAS Princeton

Toric Geometry of Entropic Regularization November 2022
Oberseminar Osnabrück

Toric Geometry of Entropic Regularization May 2022
Angewandte analysis seminar, MPI MiS Leipzig

Landau Discriminants April 2022
ETH-ITS Zürich, Switzerland

Landau Discriminants November 2021
Amplitudes group meeting, IAS Princeton

Likelihood Equations and Scattering Amplitudes April 2021
HEP seminars at Southampton, University of Southampton

Eigenvalue Methods for Solving Polynomial Systems March 2021
N&O Seminar, CWI, Amsterdam

Solving Polynomial Systems via Truncated Normal Forms October 2020
NumPi Seminar, Università di Pisa

Numerical Root Finding via Cox Rings January 2020
Forschungsseminar Diskrete Mathematic/Geometrie, TU Berlin

Truncated Normal Forms December 2019
Algorithmic Algebra Seminar, TU Berlin

Numerical Root Finding via Cox Rings November 2019
Seminar Algebraische Geometrie, FU Berlin

Robust Numerical Path Tracking in Polynomial Homotopies April 2019
NUMA seminar, KU Leuven

Stabilized Algebraic Methods for Multivariate Polynomial Root Finding March 2019
Research visit with Tomas Pajdla, CIIRC

Stabilized Algebraic Methods for Multivariate Polynomial Root Finding December 2018
Research visit with Bernd Sturmfels, MPI Leipzig

Polynomial System Solving through Stabilized Representation of Quotient Algebras April 2018
Research visit with Tyler Jarvis, BYU, Provo

Polynomial System Solving and Numerical Linear Algebra September 2017
Research visit with Bernard Mourrain, INRIA, Sophia-Antipolis

SELECTED TALKS AND POSTERS AT CONFERENCES

For a complete list, see `https://simontelen.webnode.com/publications/`.

Introduction to positive geometry May 2024
Positive Solutions of Polynomial Systems Arising from Real-life Applications, University of Granada

Euler discriminants in physics and statistics April 2024
New Frontiers in Landau Analysis, The Higgs Centre for Theoretical Physics, Edinburgh

Santaló geometry of convex polytopes January 2024
Workshop on Applied and Computational Algebraic Geometry, ISAAC Newton Institute for mathematical sciences, Cambridge

Principal Landau Determinants October 2023
Tropical geometry and infrared divergences, IAS Princeton

Chebyshev varieties September 2023
Workshop on Computational and Applied Mathematics, on the occasion of Marc Van Barel's retirement, Selva di Fasano

Twisted cohomology and likelihood ideals August 2023
ICIAM, Waseda University, Tokyo

Structured root finding via eigenvalues: beyond toric varieties August 2023
Workshop on Hypergeometric Functions, Kobe University

Structured root finding via eigenvalues: beyond toric varieties July 2023
SIAM Conference on Applied Algebraic Geometry, TU Eindhoven

Vector Spaces of Generalized Euler Integrals January 2023
Joint Mathematics Meetings, Boston

Numerical Nonlinear Algebra in Particle Physics November 2022
DIAMANT Symposium, Leiden

Solving Polynomial Equations and Applications October 2022
Workshop on Solving Polynomial Equations and Applications, CWI Amsterdam

Generalized Euler Integrals: (Co)homology and Tropical Numerics September 2022
Convex and Tropical Geometry and Feynman Integrals, ETH Zürich

Toric Geometry of Entropic Regularization June 2022
MEGA 2022, Krakow

Complexity of Tensor Decomposition and Hilbert Functions November 2022
AGATES Algebraic Geometry and Complexity Theory Workshop, IMPAN, Warsaw

Landau Discriminants May 2022
Workshop on nonlinear algebra and combinatorics from physics, Harvard

Bayesian Integrals on Toric Varieties May 2022
Mini-workshop on algebraic statistics, Harvard

Discriminants from particle physics April 2022
Nonlinear algebra day, RWTH Aachen

Tropical Integration in Physics and Statistics March 2022
Feynman integrals and nonlinear algebra, MPI MiS Leipzig

A Normal Form Method for Numerical Tensor Rank Decomposition August 2021
SIAM Conference on Applied Algebraic Geometry, Texas A&M (online)

Likelihood Equations and Scattering Amplitudes February 2021
Geomplitudes, online meeting organized by UC Davis

Cox Homotopies: Tracking Homogeneous Coordinates on Toric Varieties January 2021
Joint Mathematics Meetings, Washington DC (online)

Numerical Root Finding via Cox Rings February 2020
Milestone conference of the thematic Einstein semester 'Algebraic Geometry', Berlin

Numerical Root Finding via Cox Rings (poster) October 2019
Opening conference of the thematic Einstein semester 'Algebraic Geometry', Berlin

Robust Numerical Path Tracking in Polynomial Homotopies July 2019
ICIAM conference, Valencia

Solving Nonlinear Eigenvalue Problems using Contour Integration July 2019
ICIAM conference, Valencia

Numerical Root Finding via Cox Rings July 2019
SIAM AG conference, Bern

Robust Numerical Path Tracking for Polynomial Homotopies (poster) June 2019
MEGA conference, Madrid

Numerical Root Finding via Cox Rings (poster) June 2019
Conference 'Ideals, Varieties and Applications' (celebrating the influence of David Cox), Amherst

Truncated Normal Forms for Solving Polynomial Systems (poster) September 2018
ICERM nonlinear algebra semester, workshop 'Core Computational Methods', Providence

Truncated Normal Forms for Solving Polynomial Systems (poster) July 2018
ISSAC conference, New York

Truncated Normal Forms for Solving Polynomial Systems (poster) June 2018
CBMS conference on Applications of Polynomial Systems, Fort Worth

Structured Matrices in Polynomial System Solving May 2018
SIAM ALA conference, Hong Kong

Solving Nonlinear Eigenvalue Problems using Contour Integration May 2018
SIAM ALA conference, Hong Kong

Polynomial System Solving and Numerical Linear Algebra August 2017
SIAM AG conference, Atlanta

Matrices in Polynomial System Solving May 2017
Rencontre en Algèbre Linéaire Numérique Amiens-Calais, Amiens

Solving Systems of Polynomial Equations July 2016
ILAS conference, Leuven

STUDENTS

(Co-)supervision of PhD students

Leonie Kayser January 2023 - Present
Barbara Betti (with Marta Panizzut) October 2022 - Present
Dmitrii Pavlov (with Bernd Sturmfels) September 2022 - August 2024
Kemal Rose (with Bernd Sturmfels) October 2021 - February 2024

(Co-)supervision of Master's theses

Kuramoto varieties, Francesco Mascarin (September 2024)
Chebyshev varieties, Zaïneb Bel-Afia (April 2023 - September 2023)
Homotopy Continuation for Tensor Decomposition, Ronald Hauwaerts (September 2019 - June 2020)
Eigenvalue Methods for Solving Systems of Polynomial Equations, Wieter Jacobs (September 2019 - June 2020)
Contour Integration Methods for Solving Systems of Polynomial Equations, Sofie Vandemoortele (September 2019 - August 2020)
Towards a globally convergent iterative method for polynomial system solving, Charlotte Vermeylen (September 2018 - June 2019)
Solving bivariate polynomial systems via a two-parameter eigenvalue problem, Dries De Samblanx (January 2017 - June 2017)

TEACHING

For more information, see `https://simontelen.webnode.page/teaching/`.

Using Toric Geometry April-June 2024
11 lectures, 2 hours each and 11 exercise sessions, 90 minutes each
A course on toric varieties and their applications at MPI MiS Leipzig.

Positive Toric Geometry August 2023
2 lectures, 90 minutes each
A minicourse on positive toric varieties at Kobe University.

Geometry of Feynman integrals May-June 2023
4 lectures, 90 minutes each
A course on Euler/Feynman integrals from an algebraic perspective at MPI MiS Leipzig.

Introduction to Toric Geometry October 2021 - February 2022
13 lectures, 2 hours each
An introductory course on toric geometry at MPI MiS Leipzig, Germany.

Applications of Algebra in Informatics November 2018
I gave a lecture on algebraic structures in the context of the course 'Toepassingen van de Algebra in de Informatica' (G0Q59B) at KU Leuven.

ORGANIZATION

New Perspectives on Discriminants and their Applications June-July 2025
SLMath summer school with Eliana Duarte and Serkan Hosten, to be held at MPI MiS, Leipzig

MEGA (Effective Methods in Algebraic Geometry) July-August 2024
Member of the local organizing and executive committee of MEGA 2024, Leipzig

Combinatorial Algebraic Geometry from Physics May 2024
Co-organizer of a one-week workshop at MPI MiS, Leipzig

Nonlinear Algebra in Particle Physics July 2023
Minisymposium to be organized with Fatemeh Mohammadi at SIAM AG23, TU Eindhoven

A Hypergeometric Day May 2023
Seminar day organized with Christian Sevenheck at MPI MiS, Leipzig

Seminar Day on Algebra, Geometry and Computation March 2023
Held at CWI, Amsterdam

Workshop on Solving Polynomial Equations and Applications October 2022
Scientific co-organizer and lecturer at CWI Amsterdam

Nonlinear algebra in the sciences September 2022
Minisymposium organized with Paul Breiding at the DMV annual meeting 2022, Berlin

Workshop on Software and Applications of Numerical Nonlinear Algebra May-June 2021
Scientific co-organizer and lecturer, MPI MiS Leipzig

New trends in polynomial system solving August 2021
Minisymposium organized with Maggie Regan at SIAM AG21, Texas A&M (online)

Organizer of a reading seminar 'Intersection Theory' fall 2019
In the context of the research semester 'Algebraic Geometry', TU Berlin

Vice president of the SIAM Student Chapter, KU Leuven September 2017 - September 2019
Main organizer of:
Pi-day seminar, March 14, 2019,
Seminar on Open Problems in Mathematics, November 26, 2018,
Seminar on Mathematical Curiosities, March 14, 2018,
Workshop: 'An Introduction to Data Visualization and TikZ', October 25, 2017.

Organizer of a reading seminar 'Introduction to Nonlinear Algebra' spring 2019
KU Leuven

RESEARCH VISITS

Visiting researcher at Oxford University January 2024
A research visit with Erik Panzer in Oxford

Visiting researcher at IAS Princeton February 2023
A research visit with Sebastian Mizera and Nima Arkani-Hamed in Princeton

Visiting researcher at KU Leuven December 2022
A research visit with Fatemeh Mohammadi in Leuven

Visiting researcher at IAS Princeton November 2021
A research visit with Sebastian Mizera and Nima Arkani-Hamed in Princeton

Visiting researcher at KU Leuven February 2022
A research visit with Philippe Dreesen and Bart De Moor in Leuven

Visiting researcher at CIIRC March 2019
A research visit with Tomas Pajdla in Prague

Visiting researcher at MPI Leipzig December 2018
A research visit with Bernd Sturmfels in Leipzig

Visiting researcher at University of Illinois at Chicago August 2018
A research visit with Jan Verschelde in Chicago

Visiting researcher at Brigham Young University April 2018
A research visit with Tyler Jarvis in Provo

Visiting researcher at INRIA Sophia Antipolis Méditerranée September 2017
A research visit with Bernard Mourrain in Sophia Antipolis

SERVICE

I have refereed manuscripts submitted to the following journals:

· Linear and Multilinear Algebra
· SIAM Journal on Matrix Analysis and Applications
· Journal of Algebra and its Applications
· Linear Algebra and its Applications
· Numerical Algorithms
· Annales de l'Institut Henri Poincaré D.
· Foundations of Computational Mathematics
· Mathematics
· SIAM Journal on Scientific Computing
· Journal of Algebra
· European Journal of Combinatorics
· Journal of Symbolic Computation

Since March 2023, I am diversity officer of EMYA, the European Mathematical Society Young Academy.

Since June 2023, I am the scientific representative of the Max Planck Institute for Mathematics in the Sciences into the Chemistry, Physics and Technology Section of the Max Planck Society.

PROGRAMMING LANGUAGES

Matlab, Julia, LaTeX, Macaulay2: advanced. Maple: intermediate. Python, Fortran: beginner.