

# Marie-Charlotte Brandenburg

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## Curriculum Vitæ

Max Planck Institute for Mathematics in the Sciences  
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## Education and Professional Experience

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- 2020 – today      **Max Planck Institute for Mathematics in the Sciences**, Ph.D. Student  
Ph.D. Thesis: *Tropical Positivity and Semialgebraic Sets from Polytopes*  
Advisor: Rainer Sinn  
Research Group: Non-Linear Algebra (Bernd Sturmfels)
- 2019 – 2020      **Berlin Mathematical School | Freie Universität Berlin**, Ph.D. Student  
Advisor: Rainer Sinn  
Research Groups: Discrete Geometry and Topological Combinatorics (Günter M. Ziegler, Rainer Sinn, Matthias Beck) and Discrete Methods in Algebraic Geometry (Christian Haase)
- 2019              **Freie Universität Berlin**, M.Sc. Mathematics  
Master Thesis: *Competitive Equilibrium and Lattice Polytopes*  
Advisor: Christian Haase
- 2016 – 2017      **Minodes GmbH**, Data Analyst, Business Intelligence
- 2016              **Freie Universität Berlin**, B.Sc. Mathematics  
Bachelor Thesis: *A 4-Simple 4-Simplicial 8-Polytope*.  
Advisor: Günter M. Ziegler

## Publications

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- 2023              **Tropical Positivity and Determinantal Varieties**  
with Georg Loho and Rainer Sinn  
To appear in *Algebraic Combinatorics*.  
[arXiv:2205.14972](https://arxiv.org/abs/2205.14972)
- 2023              **Multivariate Volume, Ehrhart and  $h^*$ -Polynomials of Polytopes**  
with Sophia Elia and Leon Zhang  
*Journal of Symbolic Computation*, 114:209–230, January 2023.  
[doi:10.1016/j.jsc.2022.04.011](https://doi.org/10.1016/j.jsc.2022.04.011)
- 2022              **Competitive equilibrium always exists for combinatorial auctions with graphical pricing schemes**  
with Christian Haase and Ngoc Mai Tran  
*La Matematica. Official Journal of the Association for Women in Mathematics*, December 2022  
[doi:10.1007/s44007-022-00038-7](https://doi.org/10.1007/s44007-022-00038-7)

- 2022                    **Intersection Bodies of Polytopes**  
with Katalin Berlow, Chiara Meroni and Isabelle Shankar  
*Contributions to Algebra and Geometry*, 63(2):419–439, June 2022.  
[doi:10.1007/s13366-022-00621-7](https://doi.org/10.1007/s13366-022-00621-7)
- 2021                    **Investigation of hydro-mechanical processes in fluid-saturated fractured rock based on numerical model generation**  
with Nele Pollmann, Julia Gallas, Lucas Witte and Tobias Backers  
*IOP Conference Series: Earth and Environmental Science*, 833(1):012107, August 2021.  
[doi:10.1088/1755-1315/833/1/012107](https://doi.org/10.1088/1755-1315/833/1/012107)

## Preprints

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- 2022                    **Combinatorics of Correlated Equilibria**  
with Benjamin Hollering and Irem Portakal  
[arXiv:2209.13938](https://arxiv.org/abs/2209.13938)

## Published Conference Contributions

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- 2022                    **Extended Abstract: Competitive equilibrium always exists for combinatorial auctions with graphical pricing schemes**  
with Christian Haase and Ngoc Mai Tran  
In: L.F. Tabera Alonso (ed.), *Discrete Mathematics Days 2022*, pp. 64 – 70. Editorial Universidad de Cantabria, Santander, June 2022  
[doi:10.22429/Euc2022.016](https://doi.org/10.22429/Euc2022.016)

## Invited Conference Talks

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- September 2022    **Tropical Positivity and Determinantal Varieties**, *Geometry meets Combinatorics in Bielefeld* at Universität Bielefeld, Germany
- July 2022            **Tropical Positivity and Determinantal Varieties**, *Matroids, Ordered Structures, Arrangements in Combinatorics (MOSAIC)* at University of Manchester, England
- March 2022        **Intersection Bodies of Polytopes**, *Combinatorial Coworkspace* at Goethe-Universität Frankfurt, Germany
- March 2022        **The Positive Tropicalization of Low Rank Matrices**, *Discrete and Convex Day* at Freie Universität Berlin, Germany
- March 2022        **Competitive Equilibrium and Lattice Polytopes**, *Mini-Symposium on Lattice Polytopes* at KTH Royal Institute of Technology in Stockholm, Sweden and University of Nottingham, England

## Contributed Conference Talks

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- July 2022            **Competitive Equilibrium Always Exists**, *Discrete Mathematics Days* at University of Cantabria, Santander, Spain
- June 2022           **The Positive Tropicalization of Low Rank Matrices**, *VII Encuentro Colombiano de Combinatoria (ECCO)* at Universidad de los Andes, Pontificia Universidad Javeriana, and Universidad Sergio Arboleda in Bogotá, Colombia

December 2021 **Intersection Bodies of Polytopes**, *Conference for Women in Algebra and Symbolic Computation II* at Technische Universität Kaiserslautern, Germany

## Research Seminar Talks

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October 2022 **Competitive Equilibrium and Lattice Polytopes**, *Mathematical Operations Research Seminar* at University of Twente, Netherlands

August 2022 **Tropical Positivity and Determinantal Varieties**, *Copenhagen-Jerusalem Combinatorics Seminar* at University of Copenhagen, Denmark and Hebrew University of Jerusalem, Israel

May 2022 **The Positive Tropicalization of Low Rank Matrices**, *Research Seminar Algebra* at Friedrich-Schiller-Universität Jena, Germany

May 2022 **The Positive Tropicalization of Low Rank Matrices**, *Research Seminar Algebra and Geometry* at Universität Osnabrück, Germany

March 2022 **Competitive Equilibrium and Lattice Polytopes**, *Research Seminar Discrete Mathematics and Geometry* at Technische Universität Berlin, Germany

February 2022 **Intersection Bodies of Polytopes**, *Colloquium of the Graduate School "Facets of Complexity"* at Freie Universität Berlin, Germany

November 2021 **Intersection Bodies of Polytopes**, *Research Seminar Nonlinear Algebra* at Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany

May 2021 **The Positive Tropicalization of Low Rank Matrices**, *Research Seminar Nonlinear Algebra* at Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany

July 2020 **Multivariate Volume, Ehrhart and  $h^*$ -Polynomials of Polytopes**, *Research Seminar Discrete Geometry* at Freie Universität Berlin, Germany

October 2019 **Competitive Equilibrium and Lattice Polytopes**, *Research Seminar Algebra and Geometry* at Otto-von-Guericke-Universität Magdeburg, Germany

December 2018 **Product-Mix Auctions, Competitive Equilibrium and Lattice Polytopes**, *Colloquium of the Graduate School "Facets of Complexity"* at Freie Universität Berlin, Germany

## Posters

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December 2019 **Multivariate Volume, Ehrhart and  $h^*$ -Polynomials of Polytopes**, *Conference for Women in Algebra and Symbolic Computation I* at Technische Universität Kaiserslautern, Germany

## Teaching

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2020 **Linear Algebra II**  
Teaching Assistant for a class for first-year math students at Freie Universität Berlin, Germany

2019 **Panorama der Mathematik**  
Teaching Assistant for a class for first-year math teachers in training at Freie Universität Berlin, Germany

2018 **Geometry**  
Teaching Assistant for a class for advanced bachelor and early master students at Freie Universität Berlin, Germany

## Organization

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Summer 2022	<b>Nonlinear Algebra Seminar</b> Research Seminar of the Nonlinear Algebra Group at MPI MiS (Leipzig)
2022	<b>AlToGeLiS</b> Consortium for revealing structures of data with algebra, topology, and geometry
2019	<b>MATH+ Algebraic Geometry Research Retreat</b> Workshop within the MATH+ Thematic Einstein Semester on Algebraic Geometry

## Extended Stays

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June 2019 – September 2019	<b>Max Planck Institute for Mathematics in the Sciences</b> , Leipzig, Germany Research Group: Nonlinear Algebra
January 2019 – February 2019	<b>Simons Institute for the Theory of Computing</b> , Berkeley, CA, USA Program: Geometry of Polynomials