

**Present position:** Senior Scientist  
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**Civil Status:** Married. Two children.  
**Languages:** English (fluent), German (fluent), Slovenian (native), Russian (conversational)



## Employment

- 2021–present: **Senior Scientist at ETH Zurich**
- 2020–2021: **Assistant Professor of Mathematics at Bentley University**
- 2018–2021: **Assistant Professor of Mathematics at Wesleyan University**
- 2017–2018: **Postdoc at the Max Planck Institute for Mathematics in the Sciences, Leipzig**
- 2016–2017: **Postdoctoral Research Associate in Mathematics at Brown University**

## Education

- 2011–2016: **PhD in Mathematics at Stanford University.** *Thesis Title:* Tropical Coordinates on the Space of Persistence Barcodes. *Advisor:* Gunnar Carlsson.
- 2005–2009: **Diploma in Mathematics: University of Ljubljana.** *Thesis Title:* The geometric meaning of Bass's conjecture. *Advisor:* Jaka Smrekar.

## Honors and Awards

- 2016: Polya Teaching Award (for outstanding teaching at Stanford University).
- 2011–2016: Melvin and Joan Lane Stanford Graduate Fellow.
- 2009: Prešernova Nagrada Award for the Diploma Thesis.

## Career Breaks

- Maternity leave, 08/2020–01/2021.
- Maternity leave, 12/2021–05/2022.

## Publications

- Sara Kališnik. **Alexander Duality for Parametrized Homology.** *Homology, Homotopy and Applications*, vol. 15(2), 2013, pp.227-243.
- Gunnar Carlsson, Sara Kališnik. **Symmetric and  $r$ -Symmetric Tropical Polynomials and Rational Functions.** *Journal of Pure and Applied Algebra*, vol. 220 (11), 2016, pp. 3610-3627.
- Sara Kališnik, Alireza Mashaghi. **Extended Topological Persistence and Contact Arrangements in Folded Linear Molecules.** *Frontiers in Applied Mathematics and Statistics*, 2016. <https://doi.org/10.3389/fams.2016.00006>.
- Sara Kališnik **Tropical Coordinates on the Space of Persistence Barcodes.** *Foundations of Computational Mathematics*, 2018. <https://doi.org/10.1007/s10208-018-9379-y>.
- Sara Kališnik, Davorin Lešnik. **Symmetric Polynomials in Tropical Algebra Semirings.** *Journal of Symbolic Computation*, 2018. <https://doi.org/10.1016/j.jsc.2018.04.008>.
- Paul Breiding, Sara Kališnik, Bernd Sturmfels, Madeleine Weinstein **Learning Algebraic Varieties from Samples.** *Revista Matemática Complutense*, 2018. <https://doi.org/10.1007/s13163-018-0273-6>.
- Sara Kališnik, Vitaliy Kurlin, Davorin Lešnik. **The Higher-Dimensional Skeletonization Problem.** *Advances in Applied Mathematics*, vol. 102, 2019. <https://doi.org/10.1016/j.aam.2018.07.004>
- Gunnar Carlsson, Vin de Silva, Sara Kališnik, Dmitriy Morozov. **Parametrized Homology via Zigzag Persistence.** *Algebraic & Geometric Topology*, vol.19 (2), 2019, 657-700. <https://doi.org/10.2140/agt.2019.19.657>.
- Anthea Monod, Sara Kališnik, Juan Ángel Patiño-Galindo and Lorin Crawford. **Tropical Sufficient Statistics for Persistent Homology.** *SIAM J. Appl. Algebra Geometry*, 3(2), 337-371, 2019. <https://doi.org/10.1137/17M1148037>.
- Sara Kališnik, Davorin Lešnik. **Symmetric Polynomials in Upper-bound Semirings.** *Journal of Symbolic Computation*, 2020. <https://doi.org/10.1016/j.jsc.2020.02.001>.
- Sara Kališnik, Christian Lehn, Vlada Limic. **Geometric and Probabilistic Limit Theorems in Topological Data Analysis.** *Advances in Applied Mathematics*, vol. 131, 2021, <https://doi.org/10.1016/j.aam.2021.102244>.
- Miguel O'Malley, Sara Kališnik, Nina Otter. **Alpha Magnitude.** *Journal of Pure and Applied Algebra*, vol. 227, 2023, <https://doi.org/10.1016/j.jpaa.2023.107396>.
- Sara Kališnik, Davorin Lešnik. **Finding the Homology of Manifolds using Ellipsoids.** *Journal of Applied and Computational Topology*, 2023, <https://doi.org/10.1007/s41468-023-00145-6>.

## Invited Conference Talks and Colloquia

- 07/2024: 9th European Congress of Mathematics 'Persistent Homology for Ellipsoid Complexes'. Seville, Spain.
- 05/2024: 'On the Applications of Topology' (Colloquium). Stony Brook University, NY, USA.
- 02/2024: Dagstuhl: Applied and Combinatorial Topology. *Magnitude, Alpha Magnitude and Applications*. Dagstuhl, Germany.
- 01/2024: GEOTOP-A International Conference, Applications of Geometry and Topology. *Applications of Alpha Magnitude*. Merida, Yucatan, Mexico.
- 06/2023: The Foundation of Computational Mathematics (Computational Topology and Geometry Session). *Applications of Alpha Magnitude*. Paris, France.
- 08/2022: Algebraic Topology and Topological Data Analysis: A Conference in Honor of Gunnar Carlsson. *Alpha Magnitude*. Minneapolis, Minnesota, USA (hybrid).
- 10/2021: International Conference on Advances in Interdisciplinary Statistics and Combinatorics (AISC 2021) (TDA in Statistics and Machine Learning). *Sampling Smooth Manifolds using Ellipsoids*. Chicago, Illinois, USA (hybrid).
- 04/2021: Topological Data Analysis. *Sampling Smooth Manifolds using Ellipsoids*. Chicago, Illinois, USA.
- 03/2021: 'Uvod v uporabno topologijo' (Colloquium). University of Ljubljana, Ljubljana, Slovenia.
- 10/2019: Special Session on Applied Topology: Theory and Applications at the AMS Fall Southeastern Sectional Meeting. *Geometric and Probabilistic Limit Theorems in Topological Data Analysis*. Gainesville, Florida, USA.
- 09/2019: Union College Mathematics Conference. *Strengthening topological signal with lenses*. Schenectady, NY, USA.
- 01/2019: Joint Math Meetings, AWM Workshop:WinCompTop: Applied and Computational Topology. *Learning Varieties from Samples*. Baltimore, Maryland, USA.
- 11/2018: A mini course at '5ta Escuela de Analisis Topologico de Datos'. *Learning Varieties from Samples*. CIMAT, Guanajuato, Mexico.
- 11/2018: Workshop on Topology: Identifying Order in Complex Systems. *Learning Varieties from Samples*. New Brunswick, New Jersey, USA.
- 06/2018: Symposium on Computational Geometry 2018. *Learning Varieties from Samples* Budapest, Hungary.
- 12/2017: Geometry and Topology of Data' workshop. *Tropical Sufficient Statistics for Persistent Homology*. Providence, RI, USA.
- 09/2017: Fall Eastern Sectional Meeting 2017. *A Higher-Dimensional Homologically Persistent Skeleton*. Buffalo, NY, USA.
- 07/2017: Applied and Computational Algebra and Geometry' MCA2017. *Tropical Coordinates on the Space of Persistence Barcodes*. Montréal, Canada.
- 07/2017: The Foundation of Computational Mathematics (Computational Topology and Geometry Session). *Tropical Coordinates on the Space of Persistence Barcodes*. Barcelona, Spain.
- 03/2017: Brown University SUMS 2017. *Math and Serendipity*. Providence, Rhode Island, USA.
- 01/2017: Workshop on non-linear algebra. *The Interplay between Persistent Homology and Tropical Algebra*. Leipzig, Germany.
- 12/2016: Union College Mathematics Conference. *Tropical Coordinates on the Space of Persistence Barcodes*. Schenectady, New York, USA.
- 11/2016: Geometry and Topology in Image and Shape Analysis at the AMS Sectional Meeting. *Tropical Coordinates on the Space of Persistence Barcodes*. Raleigh, North Carolina, USA.
- 10/2016: SIAM Central States Section conference. *Tropical Coordinates on the Space of Persistence Barcodes*. Little Rock, Arkansas, USA.
- 07/2016: Contributed talk at 'ATMCS7' conference. *Tropical Coordinates on the Space of Persistence Barcodes*. Turin, Italy.
- 07/2015: Young Topologists Meeting. *Parametrized homology and Parametrized Alexander Duality*. EPFL, Lausanne, Switzerland.
- 06/2015: Summer School on Computational Topology. *Parametrized homology and Parametrized Alexander Duality*. University of Ljubljana, Ljubljana, Slovenia.
- 04/2015: AWM Research Symposium. *Parametrized homology and Parametrized Alexander Duality*. University of Maryland, College Park, USA.
- 07/2013: Summer school on Computational Topology and Topological Data Analysis. *Classification of Hepatic Lesions using the Matching Metric*. University of Ljubljana, Ljubljana, Slovenia.

## Seminar Talks

- 05/2024: 'Magnitude, Alpha Magnitude and Applications'. EPFL, Switzerland.
- 04/2024: 'Magnitude and Alpha Magnitude'. University of Konstanz, Germany.
- 03/2024: 'Persistent Homology for Ellipsoid Complexes'. Datashape Seminar, Universite Paris Saclay, France.

- 05/2023: 'Parametrized Homology and Sensor Networks'. Symplectic Seminar, ETH, Zürich, Switzerland.
- 04/2021: 'Sampling Smooth Manifolds using Ellipsoids'. UPenn's Graduate Applied Topology Seminar, University of Pennsylvania, Pennsylvania, USA.
- 05/2018: 'Learning Varieties from Samples'. INRIA, Saclay, France.
- 04/2018: 'A Higher-Dimensional Homologically Persistent Skeleton'. Wesleyan University, Middletown, CT, USA.
- 04/2018: 'Learning Varieties from Samples'. University of Ljubljana, Ljubljana, Slovenia.
- 04/2018: 'A Higher-Dimensional Homologically Persistent Skeleton'. TU Munich, Munich, Germany.
- 03/2018: 'Tropical Coordinates on the Space of Persistence Barcodes'. Mathematical Institute, University of Oxford, Oxford, UK.
- 02/2018: 'A Higher-Dimensional Homologically Persistent Skeleton'. University of Liverpool, Liverpool, UK.
- 12/2017: 'A Higher-Dimensional Homologically Persistent Skeleton'. University of Ljubljana, Ljubljana, Slovenia.
- 11/2017: 'A Higher-Dimensional Homologically Persistent Skeleton'. IHP, Paris, France.
- 11/2017: 'Tropical Sufficient Statistic for Persistent Homology'. Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany.
- 06/2017: 'A Higher-Dimensional Homologically Persistent Skeleton'. Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany.
- 04/2017: 'A Higher-Dimensional Homologically Persistent Skeleton'. Columbia University, New York, NY, USA.
- 03/2017: 'A Short Introduction to Applied Topology'. Manchester University, Manchester, UK.
- 03/2017: 'Tropical Coordinates on the Space of Persistence Barcodes'. Swansea University, Swansea, UK.
- 02/2017: 'Tropical Coordinates on the Space of Persistence Barcodes'. The University of North Carolina at Greensboro, Greensboro, NC, USA.
- 02/2017: 'The Shape of Data'. The College of the Holy Cross, Worcester, Massachusetts, USA.
- 02/2017: 'Tropical Coordinates on the Space of Persistence Barcodes'. Wesleyan University, Middletown, Connecticut, US.
- 01/2017: 'A Short Introduction to Applied Topology'. Sheffield University, Sheffield, UK.
- 11/2016: 'Tropical Coordinates on the Space of Persistence Barcodes'. Ohio State University, Columbus, OH, USA.
- 10/2016: 'Tropical Coordinates on the Space of Persistence Barcodes'. Rochester University, Rochester, NY, USA.
- 04/2016: 'Tropical Coordinates on the Space of Persistence Barcodes'. Brown University, Providence, RI, USA.
- 02/2016: 'Tropical Coordinates on the Space of Persistence Barcodes'. University at Albany, SUNY, Albany, NY, USA.
- 01/2016: 'Functions on the Barcode Space'. University of Ljubljana, Ljubljana, Slovenia.
- 11/2015: 'Parametrized Homology & Parametrized Alexander Duality Theorem'. Columbia University, New York, NY, USA.
- 10/2015: 'Parametrized Homology & Parametrized Alexander Duality Theorem'. University of Pennsylvania, Philadelphia, PA, USA.
- 10/2015: 'Parametrized Homology & Parametrized Alexander Duality Theorem'. University of Ljubljana, Ljubljana, Slovenia.
- 12/2014: 'Parametrized Homology & Parametrized Alexander Duality Theorem'. University of Ljubljana, Ljubljana, Slovenia.
- 12/2013: 'The Structure and Stability of Persistence Modules'. University of Ljubljana, Ljubljana, Slovenia.
- 02/2013: 'Alexander Duality for Parametrized Homology'. Stanford University, Stanford, CA, USA.
- 05/2012: 'Topology and Data: Presenting Mapper'. Stanford University, Stanford, CA, USA.
- 09/2011: 'Topological Persistence and Duality'. Pomona College, Claremont, CA, USA.

**Selected Teaching Experience (only courses where I was or am the main instructor are listed)**

Title	Target audience	Term	Years
Mathematik II (in German)	B.Sc. (ETH)	spring	2024
Algebraic Topology I	math B.Sc. and M.S.c (ETH)	autumn	2023
Algebraic Topology II	math B.Sc. and M.S.c (ETH)	spring	2023
Algebraic Topology I	math B.Sc. and M.S.c (ETH)	autumn	2022
Student Seminar in Topological Data Analysis	math B.Sc. (ETH)	autumn	2021
Applied Calculus for Business II (section 1)	undergrads (Bentley University)	spring	2021
Applied Calculus for Business II (section 2)	undergrads (Bentley University)	spring	2021
Multivariable Calculus undergraduate	undergrads(Wesleyan University)	spring	2020
Algebraic Topology (graduate)	graduate students (Wesleyan University)	spring	2020
Point Set Topology	undergrads (Wesleyan University)	autumn	2019
Multivariable Calculus	undergrads (Wesleyan University)	autumn	2019
Applied Topology (graduate)	graduate students (Wesleyan University)	spring	2019
Applied Topology (undergraduate)	undergrads (Wesleyan University)	spring	2019
Linear Algebra	undergrads (Wesleyan University)	autumn	2018
Mathematics of Data	undergrads (MPI Leipzig)	autumn	2017
Applied Topology	undergrads (Brown University)	autumn	2016

**Additional teaching activities**

Summer schools and minicourses:

Course	Year	Event
One-week minicourse on Computational Topology at the REU program Summer@ICERM	2017	Brown University
One-month courses on Applied Topology and Linear Algebra in China	2018	organized by Special A
One-month courses on Calculus and Statistics in China	2019	organized by Special A

**Mentoring**

**Doctoral students**

Name	time period	Institution
Miguel O'Malley	2017-2023	Wesleyan University (USA), currently a postdoc at Leipzig University

**M.Sc. students**

Name	time period	Institution
Ana da Silva	Spring 2024	ETH
Reichert Timon	Fall 2023	ETH
Caroline Braun	Fall 2023	ETH
Nick Kunz	Fall 2023	ETH
Nadja Hausermann	Fall 2023	ETH
Eudes Robert	Fall 2023	ETH
Siddharth Setlur (with Steve Oudot)	Spring 2023	ETH
Hugo Druenne	Fall 2022	ETH

## B.Sc. students

Name	time period	Institution
Dominique Garmier	Spring 2024	ETH
Anna Walder	Spring 2024	ETH
Melissa Daniele	Spring 2024	ETH
Maria Morariu	Spring 2024	ETH
Naomi Rosenberg	Spring 2024	ETH
Simon Ruppanner	Spring 2024	ETH
Leon Dahlmeier	Spring 2024	ETH
Daniel Hostettler	Spring 2024	ETH
Manuel Thomas Zeier (with Patrick Schnider)	Fall 2023	ETH
Valentin Nussli	Fall 2023	ETH
Thomas Heinz	Fall 2023	ETH
Jonas Hoffmann	Fall 2023	ETH
Nahae Kühn	Spring 2023	ETH
Luisa Meinecke	Spring 2023	ETH
Julia Sollberger	Spring 2023	ETH
Julia Dürr	Spring 2023	ETH
Richard von Moos	Spring 2023	ETH
Anton Künzi	Spring 2022	ETH
Jonathan Patschorke	Spring 2022	ETH
Siddharth Setlur	Spring 2022	ETH

## Semester Projects

Name	time period	Institution
Philip Sandt	Spring 2024	ETH
Julia Sollberger	Spring 2024	ETH
Vladimir Nowak	Spring 2024	ETH
Siddharth Setlur	Fall 2023	ETH
Leon Renkin	Spring 2023	ETH

## Conference Organization

- August 18-22, 2025: **Geometric Realization of AATRN**, IMSI, Chicago, IL, USA.
- July 24-26, 2024: **Magnitude Workshop**, ETH.
- July 1-4, 2019: **Topology in Data Science session at the 33rd Summer Conference on Topology and its Applications** (with Christian Lehn), Johannesburg, Republic of South Africa.
- January 19, 2019: **AMS Special Session on Topological Data Analysis: Theory and Applications** (with Justin Curry and Mikael Vejdemo-Johansson), Baltimore, MD, USA.
- February 19-23, 2018: **TAGS - Linking Topology to Algebraic Geometry and Statistics** (with Christiane Gørgen and Vlada Limić), Leipzig, Germany.

## Outreach

- Since 2018 I have been a **co-director of the Applied Algebraic Topology Research Network** which hosts a weekly Online Seminar. **Our Channel has over 500 videos, over 5000 YouTube subscribers, and averages over 24 hours watched per day.**
- December 2022: Mathematics coffee lecture: **Gender bias in teaching evaluations** (organized by the Phi:male group at ETH).
- Co-organizer of the **Horizons seminar at Brown University** (the goal of the seminar was to facilitate discussions about diversity in mathematics, unconscious bias against women and minorities, and the imposter syndrome).

## References

- **Gunnar Carlsson, Stanford University**  
 e-mail : gunnar@math.stanford.edu  
 postal address : Department of Mathematics, 382-M, Building 380, Stanford, CA 94305, USA.

- **Heather Harrington, Max Planck Institute of Molecular Cell Biology and Genetics**
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  - postal address : Pfotenhauerstr. 108, 01307 Dresden, Germany.
- **Kathryn Hess, EPFL**
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  - postal address : EPFL SV BMI UPHESS, Station 8 CH-1015 Lausanne, Switzerland.
- **Ana Cannas da Silva, ETH Zurich (teaching)**
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