

# Tristan OZUCH(-MEERSSEMAN)

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## MAIN RESEARCH INTERESTS

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Geometric analysis, Einstein manifolds, Ricci Flows, 4-dimensional geometry and topology, applications to Physics.

## EMPLOYMENT

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- **Assistant Professor**  
2023 MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA  
2023 **C.L.E. Moore Instructor**  
2020 MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA

## EDUCATION

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2020 **PhD in Mathematics at ENS, Paris, France**  
2017 Advisor : Olivier BIQUARD,  
Subject : *Completion of the moduli space of Einstein 4-manifolds.*  
2017 **Graduated from ÉCOLE NORMALE SUPÉRIEURE(ENS), Paris, France**

## TEACHING

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- **Assistant Professor, MIT, Cambridge, MA, USA**  
2023 Fall 2023 Course-head: **Linear Algebra (18.06)**.  
Supervision of 3 undergraduate theses (SPURS & UROP)  
2023 **C.L.E. Moore Instructor, MIT, Cambridge, MA, USA**  
2020 Spring 2023 Course-head: **Differential Equations with theory (18.032)**.  
Spring 2022 *Undergraduate class aimed at mathematics majors, 25 students*  
Spring 2021 *Redefined the syllabus and wrote my own lecture notes*  
*In charge of a TA for recitations and a grader*  
Fall 2022 Course-head: **Seminar in Analysis (18.104)**.  
Fall 2021 *Undergraduate class on scientific writing and public presentations, 20 students*  
*Chose the topic of 'Optimal Transport, Theory and Applications'*  
*Supervised 8 theses in CS, 4 in pure maths, 3 in econ, 1 in scientific writing*  
Summer 2021 Supervision of 2 undergraduate research internships (UROPs).  
Summer 2022  
Fall 2020 Teaching assistant: **Multivariable Calculus (18.02)**.  
*Undergraduate class for all science majors*  
*Led recitations for 60 students (300 total in the class)*  
2020 **Teaching assistant, ENS, Paris, France**  
2017 2020 Course-head: **Mathematics for Humanities**.  
2019 *Designed a curriculum from scratch on topics in pure and applied mathematics*  
2018 *Introductory lectures on scientific reasoning, geometry, number theory, machine learning, game theory*  
2020 Coorganizer and jury of the **undergraduate theses in mathematics** at ENS.  
2019 *Reached out to professors in the math department to create 20 thesis topics*  
2018 *Put together a jury and evaluation grid, acted as link between thesis supervisors and students*  
2018 Supervision of **three undergraduate theses** in geometric analysis.

## GRANTS AND AWARDS

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- 2021 Young researcher fellowship at the Cluster of excellence, Münster University.
- 2019 Travel grant FSMP. Semester-long visit to Courant Institute.
- 2017-2020 PhD grant for graduate studies from ENS Ulm.
- 2017 Travel grant ENS. Semester-long visit to Northwestern University.
- 2016 Travel grant ENS. Semester-long visit to Berkeley University.
- 2015 Travel grant ENS. Semester-long visit to Penn State University.
- 2013-2017 Grant for Undergraduate studies ENS Ulm. 40 granted per year nationally.

## PUBLICATIONS AND PREPRINTS

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- 2022 *The spinorial energy for asymptotically Euclidean Ricci flow* (with J. Baldauf), arXiv:2206.09198, , To appear in a Special issue of **Advanced Nonlinear Studies** on "Geometric PDEs and Applications"
- 2022 *Families of degenerating Poincaré-Einstein metrics on  $\mathbb{R}^4$*  (with Carlos Alvarado and Daniel Santiago), arXiv:2206.07993, submitted
- 2022 *Spinors and mass on weighted manifolds* (with Julius Baldauf), **Commun. Math. Phys.** 394, 1153–1172 (2022).
- 2021 *Integrability of Einstein deformations and desingularizations*, to appear in **Comm. Pure Appl. Math.**
- 2021 *Dynamical (in)stability of Ricci-flat ALE metrics along Ricci flow* (with Alix Deruelle), to appear in **Calc. Var.**
- 2021 *Depth separation beyond radial functions* (with Luca Venturi, Samy Jelassi and Joan Bruna), **J. Mach. Learn. Res.** 23 (2022) 1-56
- 2020 *Higher order obstructions to the desingularization of Einstein metrics*, **Camb. J. Math.** Volume 9 (4), (2021) 901 – 976.
- 2020 *Completion of the Moduli Space of Einstein 4-manifolds.*, **École Normale Supérieure (Paris)**, 2020. tel-03137993
- 2020 *A Łojasiewicz inequality for Ricci-flat ALE spaces* (with Alix Deruelle), arxiv 2007.09937, in review at *Advances in Mathematics* since July 2020.
- 2019 *Noncollapsed degeneration of Einstein 4-manifolds II*, **Geometry & Topology**, 26 (2022) 1529–1634
- 2019 *Noncollapsed degeneration of Einstein 4-manifolds I*, **Geometry & Topology** 26 (2022) 1483–1528
- 2019 *Perelman's functionals on cones*, **J. Geom. Anal.** 30, 1–53 (2020).
- 2019 *How large isotopy is needed to connect homotopic diffeomorphisms (of  $T^2$ )* (with Dmitri Burago and Jinpeng Lu), **J. Topol. Anal.** Vol. 12, No. 04, pp. 1213-1222 (2020).

**Referee service:** Journal of Differential Geometry, Crelle's journal, Mathematical Reviews, zbMATH Open.

## LIST OF STUDENTS MENTORED

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### Graduate students

- Julius BALDAUF, MIT (co-advised with Bill Minicozzi)  
Sept. 2020 *Ricci flows and spin geometry* (one published paper, one submitted, one upcoming together, and others on his own).

### Undergraduate students

- May 2022 Carlos ALVARADO & Daniel SANTIAGO, MIT (UROP)  
May 2021 *Construction of families of degenerating Poincaré-Einstein metrics on  $\mathbb{R}^4$*  (one submitted paper).
- May 2022 Zachary HUNSUCKER, MIT (UROP)  
December 2021 *Schrödinger bridges along Ricci flow and quantum optimal transport*.
- June 2019 Raphaël BARBONI, Haohao LIU & Martin MALVY, ENS (bachelor thesis)  
February 2019 *Level set methods for mean curvature flow*.

## RESEARCH VISITS

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- August 2021 **Young Research Fellow at University of Münster**  
July 2021 *Invited by : Hans-Joachim HEIN*  
Studied toric Einstein metrics.
- December 2019 **Graduate Visiting Student at Courant institute**  
September 2019 *Advisor : Bruce KLEINER*  
Desingularization of Einstein manifolds and Ricci flows.
- July 2017 **Research Internship at Northwestern University**  
February 2017 *Advisor : Aaron NABER*  
Study of the degeneration of Einstein 4-manifolds.
- February 2017 **Research internship at ENS**  
September 2016 *Advisor : Olivier BIQUARD*  
Study of the desingularization of Einstein orbifolds and obstructions
- July 2016 **Research Internship at UC Berkeley/MSRI**  
February 2016 *Advisor : Richard BAMLER*  
Study of Ricci flows and Perelman's functionals on cones – Conditions on the possible conical singularities of a Ricci flow and construction of asymptotically conical expanding solitons. Presentation of several theorems of the proof of the "Codimension 4 conjecture" at the Graduate student seminar. Proofreading of Richard Bamler's notes on "Structure theory of singular spaces".
- July 2015 **Research Internship at Penn. State University**  
February 2015 *Advisor : Dmitri BURAGO*  
Study of some Geometric flows, Finslerian geometry and other topics in differential geometry. Some isotopy existence results proven (explicit constructions) by geometric flows.

## SEMINARS AND CONFERENCES

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### AS AN INVITED SPEAKER :

- May 2024 **Workshop on Analysis of Geometric Singularities**, CRM in Montréal.
- February 2024 **Séminaire d'analyse**, Toulouse, France.
- November 2023 **Recent advances in geometric analysis**, CIRM, Marseilles.
- July 2023 **Analysis, Geometry and Topology of Positive Scalar Curvature Metrics**, Oberwolfach.
- August 2023 **Analytic Methods in Complex Geometry**, University of Münster.
- August 2023 **Workshop On curvature and global shape**, University of Münster.
- July 2023 **Differentialgeometrie im Grossen**, Oberwolfach.
- July 2023 **Conference on Einstein spaces and special geometry**, Institut Mittag-Leffler, Stockholm.
- April 2023 **Geometric analysis Seminar** , Rutgers University
- April 2023 **PDE and Differential Geometry Seminar** , University of Connecticut
- March 2023 **Conference on Geometric Analysis**, Regensburg
- March 2023 **Ricci flow and related topics** , Warwick
- January 2023 **Colloquium of mathematics**, University of Notre Dame
- January 2023 **Colloquium of mathematics**, UC Davis
- January 2023 **Pure math seminar**, MIT
- December 2022 **Colloquium of mathematics**, Lehigh University
- November 2022 **Differential Geometry seminar**, UC Berkeley.
- November 2022 **Geometry/Topology seminar**, Stony Brook University.
- June 2022 **Canadian Mathematical Society Meeting**, Canadian mathematical society.
- May 2022 **CMSA workshop on scalar curvature, minimal surfaces, and initial data sets**, Harvard University.
- April 2022 **Metric measure spaces and convergence**. Institute of Mathematics of the National Autonomous University of Mexico
- April 2022 **Geometry & Topology seminar**, University of Science and Technology of China.
- April 2022 **KIT Geometric Analysis Seminar**, KIT.
- February 2022 **Cornell Analysis and Geometric analysis seminar**, Cornell University.
- February 2022 **BOWL Seminar**, Brussels, Oxford, Warwick, London.
- October 2021 **Geometric analysis seminar**, UCL.
- October 2021 **Séminaire d'analyse**, Université de Toulouse.
- October 2021 **Geometry Topology Dynamical Systems Seminar**, UT Dallas.
- October 2021 **Geometric analysis seminar**, MIT.
- September 2021 **Geometric analysis seminar**, Yale University.
- August 2021 **Workshop on Curvature and Global Shape**, University of Münster.
- July 2021 **International Conference on Geometric Analysis and PDEs**, Princeton University - Shanghai Jiaotong.
- July 2021 **Curvature constraints and spaces of metrics**, Institut Fourier Summer School.
- May 2021 **Numerical and Geometric Methods for Ricci-flat Metrics and Flows**, Simons Collaboration on Special Holonomy in Geometry, Analysis, and Physics.

- March 2021 **Geometric Analysis Seminar**, University of Chicago.
- March 2021 **Differential Geometry and Geometric Analysis Seminar**, Princeton University.
- November 2020 **UCSD Seminar on Cheeger–Colding theory, Ricci flow, Einstein metrics, and Related Topics**, UCSD.
- November 2020 **Stanford’s Geometry seminar**, Stanford University.
- November 2020 **BOWL Seminar**, Brussels, Oxford, Warwick, London.
- June 2020 **Oberseminar of Differential Geometry**, Münster.
- February 2020 **Séminaire Darboux**, Montpellier.
- December 2019 **Differential Geometry Seminar**, UC Berkeley.
- November 2019 **Geometric Analysis and Topology Seminar**, Courant institute, NYU.
- October 2019 **Geometry/Topology Seminar**, Stony Brook University.
- May 2019 **Convergence and Low Regularity in General Relativity**, Simons Center, Stony Brook.
- March 2019 **Geometry seminar**, Bruxelles.
- February 2019 **Geometry seminar**, Nantes.
- March 2018 **Masters-PhD meeting**, Jussieu.
- February 2018 **Geometry seminar of IMJ**, Paris Diderot.
- January 2018 **Graduate students seminar**, ENS.
- April 2016 **Graduate student seminar on the proof of Cheeger-Naber of the codimension 4 conjecture**, MSRI, Berkeley.

**AS A PARTICIPANT :**

- September 2022 **Special Holonomy: Progress and Open Problems 2022**  
Simons Center, Stony Brook University
- September 2022 **Sixth Annual Meeting: collaboration on special holonomy**  
Simons Foundation, NYC
- June 2022 **Simons collaboration meeting**  
University of Freiburg
- May 2021 **Atelier sur la Géométrie différentielle et l’analyse globale**  
UQAM
- October 2019 **Recent advances in nonlinear problems Symposium**  
Graduate Center, CUNY
- May 2019 **Master class in differential geometry : the structure of limit spaces**  
Institut Henri Poincaré, Paris
- December 2018 **Geometric analysis at IHP**  
Institut Henri Poincaré, Paris
- 27 July 2018 **McGill University Geometric Analysis Workshop 2018**
- 23 July 2018 **McGill University, Montréal**
- 1 June, 2018 **Geometric Analysis**
- 28 May, 2018 **ICMS, Edimburgh**
- 16 February 2018 **Géométrie : échanges et perspectives**  
Institut Henri Poincaré, Paris
- 9 December 2017 **Riemannian Geometry Past, Present and Future: an homage to Marcel Berger**, IHES, Bures-sur-Yvette
- 6 December 2017 **Berger, IHES, Bures-sur-Yvette**
- 13 October 2017 **Conference - Geometric Analysis at Roscoff**
- 9 October 2017 **Centre Henri Lebesgue, Roscoff**
- 21 July 2017 **Summer school in Geometric Analysis**
- 10 July 2017 **The Fields institute, Toronto**

"Ricci flow and intrinsic flat convergence" research team.

July 2016 **Differential geometry semester at MSRI,**  
February 2016 MSRI, Berkeley

## OTHER SKILLS

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**Languages** FRENCH : Native speaker.  
ENGLISH : Fluent.  
ITALIAN : Good command.

**Activities** Competitive swimming, running, cycling, whittling.