Tristan Ozuch(-Meersseman)

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Main research interests

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

Employment

2023 | **C.L.E. Moore Instructor**
2020 | Massachusetts Institute of Technology, Cambridge, MA

Education

2020 | **PhD Student at ENS**, Mathematics, Paris, France
2017 | Advisor : Olivier Biquard,
Subject : *Completion of the moduli space of Einstein 4-manifolds.*

2017 | **Student at École Normale Supérieure (ENS)**, Paris, France
2013 | 2016-2017 Pre-PhD Internships supervised by Olivier Biquard and Aaron Naber.
2015-2016 Master's degree (Analysis, Arithmetics, Geometry, Paris 11), with honors.
2014-2015 Master's degree (ENS, UPMC), with honors.
2013-2014 Bachelor's degree (ENS, UPMC), with honors.

Teaching

2023 | **C.L.E. Moore Instructor**, MIT, Cambridge, MA, USA

2020

Spring 2023 Spring 2022 Spring 2021	Course-head: **Differential Equations with theory** (18.032). *Undergraduate class aimed at mathematics majors, 25 students* *Redefined the syllabus and wrote my own lecture notes* *In charge of a TA for recitations and a grader*
Fall 2022 Fall 2021	Course-head: **Seminar in Analysis** (18.104). *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 Summer 2022	Supervision of 2 undergraduate research internships (UROPs).
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 2019 2018	Course-head: **Mathematics for Humanities**. *Designed a curriculum from scratch on topics in pure and applied mathematics* *Introductory lectures on scientific reasoning, geometry, number theory, machine learning, game theory*
2020 2019 2018	Coorganizer and jury of the **undergraduate theses in mathematics** at ENS. *Reached out to professors in the math department to create 20 thesis topics* *Put together a jury and evaluation grid, acted as like between thesis supervisors and students*
2018	Supervision of **three undergraduate theses** in geometric analysis.

Grants and awards

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

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* $\mathbf{R}^4$ (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 Lojasiewicz 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 $\mathbf{T}^2$) (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.

List of students mentored

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* $\mathbf{R}^4$ (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

August 2021 – July 2021 **Young Research Fellow at University of Münster**
Invited by : Hans-Joachim Hein
Studied toric Einstein metrics.

December 2019 – September 2019 **Graduate Visiting Student at Courant institute**
Advisor : Bruce Kleiner
Desingularization of Einstein manifolds and Ricci flows.

July 2017 – February 2017 **Research Internship at Northwestern University**
Advisor : Aaron Naber
Study of the degeneration of Einstein 4-manifolds.

February 2017 – September 2016 **Research internship at ENS**
Advisor : Olivier Biquard
Study of the desingularization of Einstein orbifolds and obstructions

July 2016 – February 2016 **Research Internship at UC Berkeley/MSRI**
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 – February 2015 **Research Internship at Penn. State University**
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

As an invited speaker :

May 2024	**Workshop on Analysis of Geometric Singularities**, CRM in Montréal.
July 2023	**Analytic Methods in Complex Geometry**, University of Münster.
July 2023	**Workshop On curvature and global shape**, University of Münster.
July 2023	**Conference on Einstein spaces and special geometry**, Institut Mittag-Leffler, Stockholm.
March 2023	**Conference on Geometric Analysis**, Regensburg, Germany
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** , USCD.
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
23 July 2018 **McGill University Geometric Analysis Workshop 2018**
McGill University, Montréal

1 June, 2018
28 May, 2018 **Geometric Analysis**
ICMS, Edimburgh

16 February 2018 **Géométrie : échanges et perspectives**
Institut Henri Poincaré, Paris

9 December 2017
6 December 2017 **Riemannian Geometry Past, Present and Future: an homage to Marcel Berger**, IHES, Bures-sur-Yvette

13 October 2017
9 October 2017 **Conference - Geometric Analysis at Roscoff**,
Centre Henri Lebesgue, Roscoff

21 July 2017
10 July 2017 **Summer school in Geometric Analysis**,
The Fields institute, Toronto
"Ricci flow and intrinsic flat convergence" research team.

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

Other Skills

Languages French : Native speaker
English : Fluent
Italian : Good command

Activities Competitive swimming, running, cycling, sculpting