

# FULVIO GESMUNDO

Institut de Mathématiques de Toulouse  
Université de Toulouse  
118, route de Narbonne  
F-31062 Toulouse Cedex, France  
✉ fgesmund@math.univ-toulouse.fr  
🌐 <https://fulges.github.io/>

---

## Personal Information

born in Florence (Italy), on January 20th, 1987  
Italian Citizenship

---

## Education

- 2013 – 2017 **Ph.D. in Mathematics at Texas A&M University.**  
Advisor: Prof. J. M. Landsberg  
Graduation: May 2017  
Thesis: Geometry and Representation Theory in the Study of Matrix Rigidity
- 2010 – 2012 **M.S. in Mathematics at Università degli Studi di Firenze (University of Florence).**  
Advisor: Prof. Giorgio Ottaviani.  
Graduation: April 2012.  
Thesis: Rango di tensori e Varietà Secanti  
(Tensor Rank and Secant Varieties)
- 2006 – 2010 **B.S. in Mathematics at Università degli Studi di Firenze (University of Florence).**  
Advisor: Dr. Donato Pertici.  
Graduation: April 2010.  
Thesis: Spazi Completamente Regolari e Compattificazione di Stone-Čech  
(Completely Regular Spaces and Stone-Čech Compactification)

---

## Grants and Awards

- Nov. 2023 – *ANR-CPJ Starting Package*  
Funding for a period of three years (200k euro).
- May 2017 *L. F. Guseman Prize*  
May 1st, 2017 - College Station, TX
- May 2016 *Bush School Travel Grant*  
May 20th, 2016 - College Station, TX
- March 2013 *Premio di Laurea Luigi Campedelli (Luigi Campedelli Thesis Prize)*  
Master's Thesis Award, March 11th, 2013 - Florence, Italy

### FELLOWSHIPS

- Fall 2022 *Simons Junior Leader*  
Institute of Mathematics of the Polish Academy of Sciences, Warsaw, Poland  
Duration: Six weeks
- Fall 2018 *Visiting Scholar*  
at Institute for Computational and Experimental Research in Mathematics, Providence, RI  
Duration: Three months
- Summer 2018 *Visiting Researcher*  
in the Research in Pairs program at CIRM Trento, Italy  
Duration: Four weeks

---

## Work experience

- 2023 – **Chaire Professeur Junior**, *Institut de Mathématiques de Toulouse*, Université de Toulouse.  
2022 – 2023 **PostDoc**, *University of Saarland, Saarbrücken*, Dept. of Mathematics and Computer Science.  
2020 – 2022 **PostDoc**, *Max Planck Institute for Mathematics in the Sciences*, Leipzig.  
2017 – 2020 **PostDoc**, *University of Copenhagen*, QMATH – Dept. of Mathematical Sciences.  
2013 – 2017 **Graduate Student**, *Texas A&M University*, Department of Mathematics.

### VISITING POSITIONS

- Fall 2022 **Simons Junior Leader**, *Institute of Mathematics of the Polish Academy of Sciences*, Warsaw.  
during a semester-long program on *Algebraic Geometry with Applications to Tensors and Secants*  
Fall 2018 **Visiting Scholar**, *Institute for Computational and Experimental Research in Mathematics*,  
Providence, RI.  
during a semester-long program on *Nonlinear Algebra*  
Fall 2014 **Visiting Scholar**, *Simons Institute for the Theory of Computing*, U.C. Berkeley.  
during a semester-long program on *Algorithms and Complexity in Algebraic Geometry*

---

## Teaching experience

- 2024 – **Junior Professor**, *Université de Toulouse*, Institut de Mathématiques.  
Teaching assistant for Geometry and Algebra, Spring 2024  
Lecturer and teaching assistant for Geometry and Algebra, Spring 2025  
Lecturer and teaching assistant for Geometry and Algebra, Spring 2026  
2023 **PostDoc**, *Saarland University*, Department of Computer Science.  
Teaching assistant for Quantum Computing, Spring 2023  
2021 **PostDoc**, *Max Planck Institute for Mathematics in the Sciences*.  
Designing and lecturing for the course Introduction to Enumerative Geometry  
<https://sites.google.com/view/intro-enumerative-geometry/>  
2019 **PostDoc**, *University of Copenhagen*, Department of Mathematics.  
Teaching assistant for Complex Analysis II, Spring 2019 and Fall 2019  
2013 – 2017 **Teaching Assistant**, *Texas A&M University*, Department of Mathematics.  
Teaching assistant experience four several undergraduate courses in Mathematics:  
Help Sessions in Linear Algebra (Spring 2013)  
Recitations in Calculus 1 (Fall 2013)  
Help Sessions in Linear Algebra (Spring 2014)  
Recitations in Calculus 2 (Spring 2015)  
Grader for Cryptography (Spring 2016 - Fall 2016)

### MENTORSHIP

#### Postdocs

**Chia-Yu Chang**, *Oct. 2024 – (current)*, Institut de Mathématiques de Toulouse.

#### PhD Students

**Leonie Kayser**, *Jan. 2023 – (current)*, MPI-MiS, Leipzig.

I serve as a *mentor*. In this capacity, I am actively involved in guiding the student's research and providing assistance in their mathematical development alongside their advisor.

#### Interns

**Taddeo Rocq**, *Summer 2024*, ENS Lyon.

Intern at Institut de Mathématiques de Toulouse for a 6 weeks

**Aryan Kusre**, *Summer 2024*, Chennai Mathematical Institute.

Intern at Institut de Mathématiques de Toulouse for a 10 weeks

---

## Organization

- May 2024 **JM Invariant at 60: A Conference on Tensor Invariants in Geometry and Complexity Theory**, Auburn University.  
Co-organizers: Austin Conner, Cameron Farnsworth, Frederic Holweck, Luke Oeding
- August 2023 **SIAM Minisymposium: Tensors in Algebraic Geometry**, SIAM Conference on Applied Algebraic Geometry.  
Co-organizers: Alessandro Oneto, Luca Sodomaco, Neriman Tokcan
- Sept 2022 - **Events within the Thematic Semester AGATES**, Institute of Mathematics of the Polish  
Nov. 2022 Academy of Sciences – Warsaw.  
**Summer School on the Geometry of Tensors** – Co-organizers: F. Galuppi, J. Jelisiejew  
**Kickoff Workshop** – Co-organizers: F. Galuppi, J. Jelisiejew  
**Workshop in Algebraic Geometry and Complexity Theory** – Co-organizers: W. Buczyńska, N. Vannieuwenhoven
- August 2021 **SIAM Minisymposium: Tensor Networks and Geometry**, SIAM Conference on Applied Algebraic Geometry.  
Co-organizers: M. Christandl, D. Stilck-França, A. H. Werner
- June 2018 **QMath Masterclass - Tensors: Geometry and Quantum Information**, University of Copenhagen and Niels Bohr International Academy.  
Co-organizers: S. Andersen, M. Christandl, A. H. Werner
- Oct. 2024 - **Maths-Info Seminar**, Institut de Mathématiques de Toulouse.  
(current) Co-organizers: C. Hardouin, P. Moustrou, M. Sablik, M. Skomra
- June 2021 - **Nonlinear Algebra Seminar**, Max Planck Institute for Mathematics in the Sciences.  
Dec. 2021 Co-organizers: B. Sturmfels, S. Telen

---

## Outreach

- 2019 **Kulturnatten**, University of Copenhagen.  
Collaboration in the event organized by QMATH on *cake cutting with straight edge and compass*.
- 2015 **Pi Day of the Century**, Texas A&M University.  
Outreach event geared towards elementary, middle and high school students, in collaboration with Texas A&M Math Circle.
- 2008 – 2012 **Gara matematica (Mathematics Contest)**, Dipart. di Matematica Ulisse Dini, Florence.  
Collaboration in proctoring and grading in an annual contest for high school students.

---

## Publications

- 1 **Algebraic metacomplexity and representation theory**, (w/ M. van den Berg, P. Dutta, C. Ikenmeyer, V. Lysikov), 40th Comp. Compl. Conf. (CCC 2025), vol. 339, pp. 26:1–26:35, (2025) doi:10.4230/LIPIcs.CCC.2025.26.
- 2 **Geometric complexity theory for product-plus-power**, (w/P. Dutta, C. Ikenmeyer, G. Jindal, V. Lysikov), J. Symb. Computation, 131, 102458, 2025, doi:10.1016/j.jsc.2025.102458.
- 3 **The next gap in the subrank of 3-tensors**, (w/J. Zuiddam), Lin. Alg. Appl., vol. 722, pp.1-11, 2025, doi:10.1016/j.laa.2025.04.027.
- 4 **Linear preservers of secant varieties and other varieties of tensors**, (w/B. Lovitz, Y. Han), J. Symb. Computation, 131, 102449, 2025, doi:10.1016/j.jsc.2025.102449.
- 5 **Bernstein-Gelfand-Gelfand meets geometric complexity theory: resolving the  $2 \times 2$  permanents of a  $2 \times n$  matrix**, (w/A. Huang, H. Schenck, J. Weyman), Trans. Amer. Math. Soc., vol. 378(5), pp. 3573-3596, 2025, doi:10.1090/tran/9376.
- 6 **Collineation varieties of tensors**, (w/H. Keneshlou), Collectanea Math., online first, 2025, doi:10.1007/s13348-025-00467-x.
- 7 **Hilbert Functions of Chopped Ideals**, (w/L. Kayser, S. Telen), J. Algebra 666, pp. 415-445, 2025, doi:10.1007/s13366-024-00776-5.

- 8 **Quatroids and Rational Plane Cubics**, (w/T. Brysiewicz, A. Steiner), *Beiträge Alg. Geom.*, 65(4), pp. 923–972 2024, doi:10.1007/s13366-024-00776-5.
- 9 **Quantum max-flow in the bridge graph**, (w/V. Lysikov, V. Steffan), *Transformation Groups*, online first, 2024, doi:10.1007/s00031-024-09863-2.
- 10 **Fixed-parameter debordering of Waring rank**, (w/P. Dutta, C. Ikenmeyer, G. Jindal, V. Lysikov), *STACS 2024, Leibniz Int. Proc. Inf. (LIPIcs)*, 289, pp. 30:1-30:15, 2024, doi:10.4230/LIPIcs.STACS.2024.30.
- 11 **Homogeneous Algebraic Complexity Theory and Algebraic Formulas**, (w/P. Dutta, C. Ikenmeyer, G. Jindal, V. Lysikov), *ITCS 2024, Leibniz Int. Proc. Inf. (LIPIcs)*, 287, pp. 43:1-43:23 2024, doi:10.4230/LIPIcs.ITCS.2024.43.
- 12 **Decompositions and Terracini loci of cubic forms of low rank**, (w/L. Chiantini), *Deformation of Artinian Algebras and Jordan Types*, *CONM*, vol 805, pp. 139–156, 2024, doi:10.1090/conm/805/16131.
- 13 **Partial Degeneration of Tensors**, (w/M. Christandl, V. Lysikov, V. Steffan), *SIAM J. Mat. An. (SIMAX)*, 45(1), pp. 771–800, 2024, doi:10.1137/23M1554898.
- 14 **A Gap in the Subrank of Tensors**, (w/M. Christandl, J. Zuiddam), *SIAM J. Appl. Geom. Alg (SIAGA)*, vol. 7 (4), pp. 742–76, 2023, doi:10.1137/22M154327.
- 15 **Geometry of Tensors: Open problems and research directions**, A report on the AGATES Kickoff Workshop, 2023.
- 16 **Algebraic Compressed Sensing**, (w/P. Breiding, M. Michałek, N. Vannieuwenhoven), *Appl. Comp. Harm. An.*, 65, 374–406, 2023, doi:10.1016/j.acha.2023.03.006.
- 17 **Dimension of Tensor Network Varieties**, (w/A. Bernardi, C. De Lazzari), *Comm. Cont. Math.*, 25(10), 2250059, 2023, doi:10.1142/S0219199722500596.
- 18 **Degree-restricted strength decompositions and algebraic branching programs**, (w/P. Ghosal, C. Ikenmeyer, V. Lysikov), *FSTTCS 2022 - Leibniz International Proceedings in Informatics (LIPIcs)*, 250, 20:1-20:15, 2022, doi:10.4230/LIPIcs.FSTTCS.2022.20.
- 19 **The Geometry of Discotopes**, (w/C. Meroni), *Le Matematiche* 77 (1), 2022, doi:10.4418/2022.77.1.8.
- 20 **Optimization at the boundary of the tensor network variety**, (w/M. Christandl, D. Stilck França, A. Werner), *Phys. Rev. B* 103 (19), 195139, 2021, doi:10.1103/PhysRevB.103.195139.
- 21 **The Degree of Stiefel Manifolds**, (w/T. Brysiewicz), *Enumerative Combinatorics and Applications*, vol. 1(3), n. S2R20, 2021, doi:10.54550/ECA2021V1S3R20.
- 22 **Border rank non-additivity for higher order tensors**, (w/M. Christandl, M. Michałek, J. Zuiddam), *SIAM J. Matrix Anal. Appl.*, 42(2), 503–527, 2021, doi:10.1137/20M1357366.
- 23 **Geometric conditions for strict submultiplicativity of rank and border rank**, (w/E. Ballico, A. Bernardi, E. Ventura, A. Oneto), *Ann. Mat. Pura ed Appl.* vol. 200, 187–210, (2021), doi:10.1007/s10231-020-00991-6.
- 24 **Towards a Geometric Approach to Strassen’s Asymptotic Rank Conjecture**, (with A. Conner, J. M. Landsberg, E. Ventura, Y. Wang), *Collectanea Math.* vol. 72, 63–86, (2021), doi:10.1007/s13348-020-00280-8.
- 25 **SARS-CoV-2 transmission routes from genetic data: a Danish case study**, (w/A. Bluhm, M. Christandl, F. R. Klausen, L. Mancinska, V. Steffan, D. Stilck França, A. Werner), *PLOS ONE* 15 (10), e0241405, 2020, doi:10.1371/journal.pone.0241405.
- 26 **Kronecker powers of tensors and Strassen’s laser method**, (w/A. Conner, J. M. Landsberg, E. Ventura), *ITCS 2020, Leibniz International Proceedings in Informatics (LIPIcs)*, 151, 10:1–10:28 (2020), doi:10.4230/LIPIcs.ITCS.2020.10.
- 27 **Partially symmetric versions of Comon’s problem via simultaneous rank**, (w/A. Oneto, E. Ventura), *SIAM J. Matrix Anal. Appl.*, 40(4), 1453–1477, (2019), doi:10.1137/18M1225422.
- 28 **Explicit polynomial sequences with maximal spaces of partial derivatives and a question of K. Mulmuley**, (w/J. M. Landsberg), *Theory of Computing* 15(3), 1–24, (2019), doi:10.4086/toc.2019.v015a003.
- 29 **Border rank is not multiplicative under the tensor product**, (w/M. Christandl, A. K. Jensen), *SIAM J. Appl. Alg. Geom (SIAGA)*, Vol. 3 (2), 231–255, (2019), doi:10.1137/18M1174829.
- 30 **On the partially symmetric rank of tensor product of  $W$ -states and other symmetric tensors**, (w/E. Ballico, A. Bernardi, M. Christandl), *Rend. Lincei Mat. Appl.* 30, 93–124 (2019), doi:10.4171/RLM/837.

- 31 **A note on the cactus rank for Segre-Veronese varieties**, (w/E. Ballico, A. Bernardi), *J. Algebra* Vol. 526, pp. 6-11 (2019), doi:10.1016/j.jalgebra.2019.01.027.
- 32 **Matrix Product States and the Quantum max-flow/min-cut conjectures**, (w/J. M. Landsberg, M. Walter), *J. Math. Phys.*, Vol. 59 (10), 102205 (2018), doi:10.1063/1.5026985.
- 33 **Geometric Complexity Theory and matrix powering**, (w/C. Ikenmeyer, G. Panova), *Diff. Geom. and Appl.*, Vol. 55, 106-127 (2017), doi:10.1016/j.difgeo.2017.07.001.
- 34 **Geometric Aspects of Iterated Matrix Multiplication**, *J. Algebra*, Vol. 461, pp.42-64, (2016), doi:10.1016/j.jalgebra.2016.04.028.
- 35 **Complexity of linear circuits and geometry**, (w/J. Hauenstein, C. Ikenmeyer, J. M. Landsberg), *FoCM*, Vol. 16 (3), 599-635, (2016), doi:10.1007/s10208-015-9258-8.
- 36 **An asymptotic bound for secant varieties of Segre varieties**, *Ann. Univ. Ferrara*, Vol.59 (2), 285-302, (2013), doi:10.1007/s11565-013-0175-y.

## PREPRINTS

- 1 **Marvelous slices of orthogonal matrices**, (w/T. Brysiewicz), arXiv:2602.02668, 2026.
- 2 **Waring decompositions of special binomials**, (w/L. Chiantini, S. Marziali), arXiv:2512.13805, 2025.
- 3 **Polynomials of small slice rank and strength**, (w/C. Flavi, A. Oneto, E. Ventura), arXiv:2509.12322, 2025.
- 4 **Identifiability through special linear measurements**, (w/A. Grosdos, A. Uschmajew), arXiv:2505.24328, 2025.
- 5 **Characteristic polynomials and eigenvalues of tensors**, (w/F. Galuppi, E. Turatti, L. Venturello), arXiv:2308.10957, 2023.
- 6 **Tensors with maximal symmetries**, (w/A. Conner, J. M. Landsberg, E. Ventura), arXiv:1909.09518, 2019.

---

## Selected Seminars

### HIGHLIGHTS

- November 2025 **New tensors for matrix multiplication upper bounds via Strassen's laser method**, *Workshop on Matrix Multiplication*, Simons Institute - Berkeley.
- July 2025 **Boundary components of orbit-closures**, *INABAG Conference*, Trento, IT.
- July 2024 **Geometry and asymptotics in the study of tensors**, *MEGA 2024*, Leipzig - Germany.
- May 2024 **Algebraic Geometry and Complexity Theory**, *Mathematical Colloquium*, Bern - Switzerland.
- Dec. 2023 **Geometric methods for lower bounds in complexity theory**, *IRIT Scientific Day*, Toulouse, FR.

### OTHER INVITED SEMINARS

- November 2025 **Polynomials of small symmetric slice rank**, *Complexity and Linear Algebra Seminar*, Simons Institute - Berkeley.
- November 2025 **New tensors for matrix multiplication upper bounds via Strassen's laser method**, *Workshop on Matrix Multiplication*, Simons Institute - Berkeley.
- October 2025 **Matrix multiplication and tensor networks: complexity and quantum physics**, *Séminaire Calcul Quantique*, IRIT, Toulouse.
- July 2025 **Boundary components of orbit-closures**, *INABAG Conference*, Trento, IT.
- April 2025 **Tensor networks, equations and geometry**, *Geometry Seminar*, TU Dresden, Germany.
- March 2025 **Apolarity theory, zero-dimensional schemes and their role in complexity theory**, *Workshop in Algebraic Complexity, Geometry, and Representations*, Warwick, UK.
- Dec. 2024 **Geometry of Tensor Networks**, *Journée LPT-IMT*, Toulouse.
- Nov. 2024 **Geometric Methods in Complexity Theory**, *Quantum Information Colloquium*, Bochum - Germany.
- Sept. 2024 **Subrank of tensors in geometry and invariant theory**, *Sém. Méd. Géom. Alg.*, Genova - Italy.
- May 2024 **Collineation varieties of tensors**, *Geometry Seminar*, Texas A&M University - College Station, TX.
- Oct. 2023 **Characteristic polynomials of tensors**, *Nonlinear Algebra Seminar*, MPI Leipzig, DE.
- July 2023 **A Gap in the Subrank of Tensors**, *SIAM Conf. Applied Algebraic Geometry (SIAM AG23)*, TU Eindhoven, NL.

- May 2023 **Rank algorithms, Hilbert functions and non-saturated ideals**, *Workshop Cactus v. Secants*, Toulouse Mathematics Institute.
- April 2023 **Tensor subrank and the geometry of small orbits**, *Seminario di Algebra, Geometria Algebrica e Applicazioni*, UniTo-PoliTO, Torino.
- March 2023 **Border rank and homogeneous complexity classes**, *7th Workshop on Algebraic Complexity Theory (WACT 2023)*, U. Warwick.
- Nov. 2022 **Optimization on Tensor Network Varieties**, *AGATES Workshop on Tensors in statistics, optimization and machine learning*, IMPAN – Warsaw.
- July 2022 **Lower bounds for algebraic branching programs via intersection theory**, *Applied Algebraic Geometry Seminar*, Dipartimento di Matematica e Informatica Ulisse Dini - Firenze.
- April 2022 **Tensor subrank and homomorphism duality**, *Workshop on geometry and complexity theory*, Toulouse Mathematics Institute.
- Oct. 2021 **Geometry of Tensor Networks**, *Séminaire Calcul Formel*, Université de Limoges.
- Aug. 2021 **Geometry of Direct Sums and Kronecker Powers of Tensors**, *SIAM Conf. Applied Algebraic Geometry (SIAM AG21)*, Texas A&M University - College Station, TX.
- April 2021 **Geometry of Tensor Network Varieties**, *Algebra and Geometry Seminar*, Università degli Studi di Trieste.
- March 2021 **Border rank under direct sum: from Schönhage to tensor networks**, *Quantum Information, Algebra and Geometry Seminar*, Università degli Studi di Trento.
- Dec. 2020 **Varieties of sums of powers, Stiefel manifolds and their degrees**, *Algorithmic Mathematics and Complexity Theory Seminar*, TU Berlin.
- Nov. 2020 **Segre reembedding of secant varieties and multiplicativity of rank and border rank**, *Real Algebraic Geometry Seminar*, University of Konstanz.
- Oct. 2020 **Approaching the boundary of tensor network varieties**, *Geometry Seminar*, Texas A&M University - College Station, TX.
- March 2020 **Border rank and tensor product: geometry and complexity**, *Nonlinear Algebra Seminar Online*, Max Planck Institute for Math. in the Sciences - Leipzig.
- Sept. 2019 **Tensors, Symmetries and Matrix Multiplication**, *Congresso UMI 2019*, Università di Pavia - Italy.
- Jul. 2019 **Rank, border rank, multiplicativity and entanglement**, *SIAM Conf. Applied Algebraic Geometry (SIAM AG19)*, University of Bern - Switzerland.
- Jan. 2019 **Tensors with Symmetries and Matrix Multiplication**, *Workshop on Theoretical Computer Science and Algebraic Geometry*, Max Planck Institute for Informatics - Saarbrücken - Germany.
- Sept. 2018 **Barriers for Geometric Methods in Complexity Theory**, *UMI-SIMAI-PTM Joint Meeting*, Wroclow - Poland.
- July 2018 **SLOCC transformations, tensor restriction and Strassen's asymptotic rank conjecture**, *Quantum Information, Algebra and Geometry Seminar*, Università degli Studi di Trento.
- April 2018 **Cactus rank and multihomogeneous polynomials**, *Geometry Seminar*, Texas A&M University - College Station, TX.
- Feb. 2018 **Multiplicativity of rank and border rank**, *Seminario di Geometria*, Dipartimento di Matematica e Informatica Ulisse Dini - Firenze.
- Sept. 2017 **On multiplicativity of various notions of rank**, *Geometry seminar*, Texas A&M University - College Station, TX.
- Jan. 2017 **Rigidità di matrici e complessità del prodotto matrice-vettore**, *Seminario di Geometria*, Dipartimento di Matematica e Informatica Ulisse Dini - Firenze.
- Jan. 2017 **Geometric Complexity Theory and matrix powering**, TU Berlin.
- July 2016 **Matrix Rigidity and the Complexity of Performing a Linear Map**, *DGA: Differential Geometry and Applications Conference*, Masaryk University - Brno.
- May 2016 **Geometry of Small Matrix Multiplication**, *Workshop on Software and Applications in Numerical A.G.*, University of Notre Dame.
- Nov. 2014 **The Geometry of Iterated Matrix Multiplication**, *Computational Algebraic Geometry Seminar*, UC Berkeley.

Last update: February 4, 2026.