Curriculum Vitae

Martin Mion-Mouton

Adresse administrative
Aix-Marseille Université
Institut de Mathématiques de Marseille (I2M), UMR 7373
3 place Victor Hugo, Case 19
13331 Marseille Cedex 3, France

Born in Rouen, France, on October 25th, 1993

Email: martin.mion@mis.mpg.de ORCID profile: https://orcid.org/0000-0002-8814-0918
Webpage: https://personal-homepages.mis.mpg.de/mionmouton/

Current situation (since september 2023): Postdoctorate, Max-Planck institute for Mathematics in the sciences in Leipzig, in Anna Wienhard's research group.
From September 2024 to June 2025: research visit at the Institute of Mathematics of Marseille (I2M) in the framework of the Salto Programme, for a collaboration with Pierre Dehornoy.
Previous situations:

- Postdoctoral fellow, Technion university (mentor: Tali Pinsky), 2021-2023;
- Temporary Researcher and Teacher (*ATER*), Strasbourg university, 2020-2021;
- PhD student under contract, Strasbourg university, 2017-2020.

Education

Mathematics

2017 - 2020 **Ph.D in Mathematics**, University of Strasbourg, defended on 11 december 2020.
Title: *Some geometrical and dynamical global properties of Lagrangian contact structures.*
Advisor: Charles Frances.
Thesis committee: T. Barbot (rapporteur), S. Crovisier, S. Dumitrescu, E. Falbel (rapporteur), C. Frances, O. Guichard (president), A. Rechtman.
Recipient of the **best PhD poster award**, doctoral school MSII.

2016 - 2017 **Master 2 of fundamental Mathematics**, theme *Geometry and Topology*, *graduated with honors*, University of Strasbourg (Master 2 thesis under the supervision of Charles Frances).
Recipient of the **pre-doctoral fellowship** of the Labex IRMIA.

2015 - 2016 **Master 1 of fundamental Mathematics**, École Normale Supérieure de Lyon (Master 1 thesis under the supervision of Charles Frances).

2014 - 2015 **Bachelor of Sciences in fundamental Mathematics**, École Normale Supérieure de Lyon (graduate thesis under the supervision of Gwénaël Massuyeau).

2012 - 2014 **Preparatory classes** to french "Grandes écoles", Lycée Saint-Louis, Paris.
Undergraduate studies in Mathematics and Physics.

Music

2011 - 2012 **Bachelor of Arts in Percussion**, *graduated with highest honors*, National Conservatory of Music of the Region of Rouen (class of Catherine Favre and Ronan Quelen).

2012 Admission to the session 2012 of the **French Youth Orchestra** (conducted by Dennis Russell Davies).

Research

Research interests

- Rigid geometric structures, Parabolic Cartan geometries, Flag structures in dimension 3;
- Partially Hyperbolic diffeomorphisms, Anosov flows;
- Singular Lorentzian surfaces; Homomographic interval exchange maps.

My research interests lie at the intersection between differential geometry and differentiable dynamical systems. On a geometrical point of view, I am interested in rigid geometric structures on manifolds and in their singular counterparts on surfaces, and on a dynamical point of view in (partially) hyperbolic systems and one-dimensional dynamics. I am particularly interested by the interactions between these dynamical and geometrical objects, of which the following situations give typical examples: (partially) hyperbolic systems having smooth (central,) stable and unstable distributions; rigid geometric structures having a "large" group of automorphisms; singular Lorentzian surfaces whose lightlike foliations are suspensions of homomographic interval exchange maps.

Complete list of publications and preprints with abstracts

Preprints

6. Rigidity of singular de-Sitter tori with respect to their lightlike bi-foliation (2024). Submitted. (arXiv:2410.03260, hal-04661986)
   Abstract: In this paper, we introduce a natural notion of constant curvature Lorentzian surfaces with conical singularities, and provide a large class of examples of such structures. We moreover initiate the study of their global rigidity, by proving that de-Sitter tori with a single singularity of a fixed angle are determined by the topological equivalence class of their lightlike bi-foliation. While this result is reminiscent of Troyanov's work on Riemannian surfaces with conical singularities, the rigidity will come from topological dynamics in the Lorentzian case.

5. Reductions of path structures and classification of homogeneous structures in dimension three (avec E. Falbel et J. M. Veloso, 2024). Submitted. (arXiv:2406.11509, hal-04612815)
   Abstract: In this paper we show that if a path structure has non-vanishing curvature at a point then it has a canonical reduction to a $\mathbb{Z}/2\mathbb{Z}$-structure at a neighbourhood of that point. A simple implication of this result is that the automorphism group of a non-flat path structure is of maximal dimension three (a result by Tresse of 1896). We also classify the invariant path structures on three-dimensional Lie groups.

4. Geometric surgeries of three-dimensional flag structures and non-uniformizable examples (avec E. Falbel, 2024). Submitted. (arXiv:2406.02053, hal-04598551)
   Abstract: Dans cet article, nous introduisons une notion de chirurgie pour les structures drapeaux, qui sont des structures géométriques localement modelées sur l'espace des drapeaux de dimension trois sous l'action de $\mathrm{PGL}_3(\mathbb{R})$. Nous utilisons ces chirurgies pour construire de nouveaux exemples de structures drapeaux, de type uniformisable et de type non-uniformisable.

Publications

3. Geometrical compactifications of geodesic flows and path structures.
   Geometriae Dedicata **217**(2) (2022), 18. (doi:10.1007/s10711-022-00751-1)
   Abstract : In this paper, we construct a geometrical compactification of the geodesic flow of non-compact hyperbolic surfaces Σ without cusps having a finitely generated fundamental group, and we study the dynamical properties of the compactified flow. This compactification is done with respect to a uniformizable flag structure, for which $\mathrm{T}^1\Sigma$ is identified to the quotient of an open subset of the flag space by a discrete subgroup Γ of $\mathrm{PGL}_3(\mathbb{R})$. Our study relies on a detailed description of the dynamics of $\mathrm{PGL}_3(\mathbb{R})$ on the flag space, and on the construction of an explicit fundamental domain for the action of Γ.

2. Cartan connections and path structures with large automorphism groups (with E. Falbel et J.M. Veloso).
International Journal of Mathematics **32**(12) (2021). (doi:10.1142/S0129167X21400164)
Abstract: We classify compact manifolds of dimension three equipped with a path structure and a fixed contact form (which we refer to as a strict path structure) under the hypothesis that their automorphism group is non-compact. We use a Cartan connection associated to the structure and show that its curvature is constant.

1. Partially hyperbolic diffeomorphisms and Lagrangian contact structures.
Ergodic Theory and Dynamical Systems **42**(8) (2022), 2583-2629. (doi:10.1017/etds.2021.54)
Abstract: In this paper, we classify the three dimensional partially hyperbolic diffeomorphisms whose invariant distributions are smooth, such that $E^s \oplus E^u$ is a contact distribution and whose non-wandering set equals the whole manifold. We prove that up to a finite quotient or a finite power, they are smoothly conjugated either to the time-one map of an algebraic contact-Anosov flow, or to an affine partially hyperbolic automorphism of a nil-manifold. The rigid geometric structure induced by the invariant distributions plays a fundamental role in the proof.

Communications

Conferences

- April 2025, *Translation, Dilation, Affine and other Structures on Surfaces*, Institute of Mathematics of Toulouse.
- January 2025, workshop *Special structures in dynamics and geometry*, Institute of Mathematics of Jussieu.
- March 2024, *Aspects of ergodic theory for hyperbolic groups*, university of Leipzig (contributed talk).
- April 2023, *Anosov systems*, CIRM, Marseille (short talk).
- July 2022, *Complex Hyperbolic Geometry and Related Topics*, CIRM, Marseille.
- June 2022, *Geometric structures, compactifications and group actions*, Strasbourg university (short talk).
- December 2020, *Jeunes géomètres dynamiques*, GDR Platon.
- August 2019, *1st Joint Meeting Brazil-France in Mathematics* (session 10), IMPA, Rio de Janeiro.

Seminars

- January 2025, Darboux seminar, university of Montpellier.
- October 2024, Geometry seminar, university of Bordeaux.
- October 2024, Dynamical systems, Analysis and Geometry seminar, university of Avignon.
- April 2024, Geometry and Topology seminar, university of Luxembourg.
- March 2024, Spectral theory and Geometry seminar, Grenoble university.
- February 2024, seminar of Ergodic theory and dynamical systems, university Paris-13.
- February 2024, Ergodic theory seminar, Rennes university.
- February 2024, Geometry and Topology seminar, Aix-Marseille university.
- October 2023, Geometry seminar, Max-Planck institute for Mathematics in the Sciences, Leipzig.
- February 2023, Geometry and Topology seminar, Sorbonne university.
- January 2023, Differential Geometry seminar, Heidelberg university.

- March 2022, seminar Geometry and Topology, Technion university.
- March 2022, seminar The mathematics of motion, Technion university.
- October 2021, Geometry seminar, university of Bordeaux.
- October 2021, Darboux seminar, university of Montpellier.
- March 2021, seminar of Dynamical systems and geometry, university of Angers.
- March 2021, Teich seminar, university of Marseille.
- February 2021, seminar of Geometry, topology and dynamical systems, university Paris-Saclay.
- February 2021, seminar of Ergodic theory and dynamical systems, university Paris-13.

Ph.D student Seminars

- 2021, university of Strasbourg.
- 2019, university of Nantes.
- 2018, university of Dijon.
- 2017, university of Strasbourg.

Reading groups

- 2022, two talks (about *Circle and Seifert bundles* and *Torus bundles and their geometrization*) in a working seminar about *Three-manifolds and their geometrization*, Technion university.
- 2018, two talks (about *Oseledets theorem* and *Pesin's theory*) in a working seminar about *Brown-Fisher-Hurtado's results and Zimmer's programm*, Strasbourg university.

Scientific and administrative activities

- 2025, Co-organization of the summer school *Dynamics and geometry in dimension 1, 2 and 3*, CIRM. Initiator for this event of the funding project with the "Kick-off workshops" program of the Max-Planck Society.
- 2024, Co-organization of the Winter school in Geometry and Dynamics in Aussois.
- 2024, Co-organization of the Geometry seminar, MPI MiS, Leipzig.
- 2022, Collaboration with the university libraries of Lille university for the creation of the guide *Codes and softwares for research* in link with the *Passport for open science*.
- 2022, Organization of a working seminar about *Three-manifolds and their geometrization*, Technion university.
- 2021, Co-organization of a working seminar about *Mostow rigidity*, university of Strasbourg.

Awards and distinctions

- 2024, recipient of the programme SALTO of the Max-Planck society for a long research stay at the institute of Mathematics of Marseille.
- 2023, post-doctoral fellowship, Max-Planck institute for Mathematics in the sciences, Leipzig.
- 2021, post-doctoral fellowship,Technion.

- 2020, best poster award, doctoral school MSII, Strasbourg university.
- 2017, doctoral fellowship, Strasbourg university.
- 2016, pre-doctoral fellowship, labex IRMIA, Strasbourg university.

Visiting positions

- September 2024 – June 2025, visit at the *Institut de mathématiques de Marseille* for a collaboration with Pierre Dehornoy, with support of the joint programme CNRS-MPS SALTO.
  Theme of work: Anosov flows and transverse singular Lorentzian metrics.
- January 2023, visit at the *Institut de mathématiques de Jussieu Paris Rive Gauche* under invitation of Elisha Falbel.
  Theme of work: Rigidity of higher-dimensional partially hyperbolic diffeomorphisms.
- July 2022, visit at the *Institut de mathématiques de Jussieu Paris Rive Gauche*, under invitation of Elisha Falbel.
  Themes of work: Regularity of Lyapunov distributions and rigidity.
- September-October 2021, visit at the *Institut de mathématiques de Jussieu Paris Rive Gauche*, under invitation of Elisha Falbel.
  Theme of work: Rigidity of higher-dimensional path geometries.
- July 2019, visit at the *Instituto de Matemática e Estatistíca* (Saõ Paulo) under invitation of Uirá Matos, with support of the Fondation Louis D-Institut de France (project coordinated by M. Viana).
  Themes of work: Rigid geometric structures defined by distributions of specific growth vectors.

Selection of attended conferences

2025 *Translation, Dilation, Affine and other Structures on Surfaces*, Toulouse.
Special structures in dynamics and geometry, Jussieu.
2024 *Group Actions and Rigidity: Around the Zimmer Program*, CIRM, Luminy.
Aspects of ergodic theory for hyperbolic groups, Leipzig.
2023 *GRAZP: Groups and Rigidity Around the Zimmer Program*, Ventotene.
Anosov systems, CIRM, Luminy.
Spring school in geometry and dynamics, Lille university.
2022 *Israel Mathematical Union annual meeting*, Ben-Gurion University, Be'er Sheva.
Complex Hyperbolic Geometry and Related Topics, CIRM, Luminy.
Geometric structures, compactifications and group actions, Strasbourg.
Action now meeting, université du Technion.
2021 *Action now meeting*, institut Weizmann.
A Hyperbolic Day Online, en ligne.
Topics at the Interface of Low Dimensional Group Actions and Geometric Structures, IMS (Singapour), en ligne.
2020 *Jeunes géomètres dynamiques*, GDR Platon, online.
2019 *Paroles aux jeunes chercheurs en géométrie et dynamique*, GDR Platon, University of Lorraine.
1st Joint Meeting Brazil-France in Mathematics, IMPA (Rio de Janeiro).
Géométrie et Dynamique de A à Z in the honnor of Abdelghani Zeghib, University of Avignon.
2018 *Topology and Dynamics in the Swiss Alps*, Borel seminar, Les Diablerets.
Paroles aux jeunes chercheurs en groupes et géométrie, GDR Platon, University of Lyon 1.
Pseudo-riemannian geometry and Anosov representations, University of Luxembourg.
Geometry in Action, and Actions in Geometry, third edition, University of Lorraine.
Geometry in Action, and Actions in Geometry, 2$^{\text{nd}}$ edition, University of Luxembourg.
2017 *Conference in honor of Christophe Bavard*, University of Bordeaux.

Paroles aux jeunes chercheurs en systèmes dynamique et géométries, GDR Platon, University of Rennes.

2016 *Paroles aux jeunes chercheurs en géométrie et groupes*, GDR Platon, University of Strasbourg.

Teaching and scientific outreach

Teaching

Teaching assistant at the University of Strasbourg

2020 - 2021 Oral examinations in Mathematics.
Course on *Linear algebra*, first year undergraduate students in Mathematics and Physics.

2018 - 2021 Problem sessions on *Topology* and *Differential and Integral calculus*, for third year undergraduate students in Mathematics.

2017 - 2018 Course on *Elementary Logic and Set theory*, for 1st year undergraduate students in Mathematics.
Course on *Maple*, for 1st year undergraduate students in Mathematics.
Problem sessions on *Differential equations*, for 1st year undergraduate students in Biology.

Examinator in the **Lycée du Parc** (Lyon)

2015 - 2016 Oral examinations in Mathematics, for undergraduate students of selective 2nd year "MP*" of preparatory classes.

Supervision

2020 - 2021 Supervision of the master's thesis of Justin Rieber (M2 agrégation).
Subject: *Vector fields of the plane and Poincaré-Bendixson theorem.*

Scientific outreach

2022 Around the *Week of mathematics*, discussion with pupils, preparation of explicative videos, and presentation of the job of mathematician, in the elementary school of Mellionnec (Côtes-d'Armor, Britanny, France).

2018 - 2019 Voluntary supervision of a "Maths En Jeans" session (popularization in mathematics for High School students), Lycée Marc Bloch (Strasbourg).

2014 - 2015 Voluntary tutoring in Mathematics.

Other informations

Language skills: French (mother tongue), English (fluent), German (rudimentary).

Programming: Latex, Maple, Html.

Other teaching experiences

- 2020-2021: Tap Dance classes, choreographic center of Strasbourg.
- 2010-2012: Percussion and Musical theory classes, Music schools of Canteleu and Forges-les-Eaux (Normandy, France).

Associative experiences

- 2017-2021: Participation to the organization of dance festivals in the association *Lindy Spot*.
- 2014-2016: treasurer of the association *Champ Libre*, association for cinema of the *ENS de Lyon*.