

Juan VIU-Sos

PHD IN MATHEMATICS
– GEOMETRY, TOPOLOGY AND SINGULARITIES –

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Introduction

Post-doctoral researcher at *IMPA - Instituto de Matemática Pura e Aplicada*, Rio de Janeiro (Brazil), supported by a *CAPES/PNPD* grant.

Keywords: complex singularities, low-dimensional topology, hyperplane arrangements, motivic integration, zeta functions, logarithmic vector fields, effective periods, computational algebra ([Sagemath](#) [↗](#)).

Articles and preprints

Publications

- **Motivic zeta functions on \mathbb{Q} -Gorenstein varieties** [↗](#), with E. León-Cardenal, J. Martín-Morales and W. Veys, *Advances in Mathematics* 370 (2020).
- **Configurations of points and topology of real line arrangements** [↗](#), with B. Guerville-Ballé, *Mathematische Annalen* 374 (2019), no. 1-2, 1–35.
- **Fundamental groups of real arrangements and torsion in the lower central series quotients** [↗](#), with E. Artal-Bartolo and B. Guerville-Ballé, *Experimental Mathematics* 29 (2020), no. 1, 28–35. .
- **A semi-canonical reduction for periods of Kontsevich-Zagier** [↗](#), to appear in *International Journal of Number Theory* (2021) .
- **On the minimal degree of logarithmic vector fields of line arrangements** [↗](#), with B. Guerville-Ballé, *Proceedings of the XIII International Conference Zaragoza-Pau on Mathematics and its Applications*, Monografías Matemáticas García de Galdeano, 40, 61-66 (2015).

Preprints

- preprint ○ **An introduction to p -adic and motivic integration, zeta functions and invariants of singularities** [↗](#), Lecture notes (2018).
- submitted ○ **On the equality of periods of Kontsevich-Zagier** [↗](#), arXiv:1912.01751, with J. Cresson.
- submitted ○ **Combinatorics of line arrangements and dynamics of polynomial vector fields** [↗](#), arXiv:1412.0137, with B. Guerville-Ballé.

Packages developed for Sagemath

- 2012 ○ **Computing the Igusa and Topological zeta functions of a Newton non-degenerated polynomial** [↗](#).

Ph.D Thesis

- 2012/2015 ○ **"Periods and line arrangements: contributions to the Kontsevich-Zagier periods conjecture and to the Terao conjecture."** [↗](#), *Université de Pau et des Pays de l'Adour/Universidad de Zaragoza*, Pau/Zaragoza (France/Spain).

Ph.D in Mathematics (*Number Theory, Algebraic Geometry and Vector Fields*) in LMAP (Équipe Algèbre et Géométrie). Supervised by Enrique Artal, Jacky Cresson and Vincent Florens. **Mention "Très honorable"/"Cum laude"**.

Jury and reviewers

- Pierre CARTIER (IHES, Reviewer–President)
- David MOND (Univ. of Warwick)
- Jean VALLÈS (Univ. de Pau)
- Masahiko YOSHINAGA (Hokkaido Univ., Reviewer)
- Michel WALDSCHMIDT (Univ. Paris VI)
- Jacques-Arthur WEIL (Univ. de Limoges)
- Michel GRANGER (Univ. d'Angers, Reviewer)

Previous career and education

Preceding position

- 2017/2019 ○ **Post-doctoral fellow at ICMC/Universidade de São Paulo with a FAPESP grant** (São Carlos, Brazil).
- 2016/2017 ○ **ATER (Teaching and research assistant position) at Institut Fourier (Université Grenoble Alpes)** (France).
- 2015/2016 ○ **ATER at Université de Pau et des Pays de l'Adour** (France).
- 2012/2015 ○ **Doctoral fellow in Pure Mathematics in co-tutorship, Université de Pau/Universidad de Zaragoza** (France/Spain).

Previous education

- 2011/2012 ○ **Master degree "Iniciación a la Investigación en Matemáticas", Universidad de Zaragoza, Bilbao-Zaragoza-Logroño** (Spain).

Master degree in Mathematical Research. Master's thesis in *Singularity Theory and Computacional Algebra* supervised by Enrique Artal: "Funciones Zeta y poliedro de Newton: Aspectos teóricos y computacionales".
- 2010/2011 ○ **Master degree "Mathématiques, Modélisation et Simulation", Université de Pau et des Pays de l'Adour** (France).

Double Diploma with the Universidad de Zaragoza. Master's Thesis in Knot Theory supervised by Vincent Florens: "Nœuds, entrelacs et coloriages".
- 2005/2011 ○ **B.S. in Mathematics (Licenciado en Matemáticas), Universidad de Zaragoza, Zaragoza** (Spain).

Research activities

Lectures in seminars and mini-courses

- 2020 ○ **Mini-course (4,5h) "An introduction to geometric motivic integration", Thematic Program on Singularity Theory, IMPA** (Rio de Janeiro, Brazil).
- 2018 ○ **Mini-course (20h) "An introduction to p -adic and motivic integration, zeta functions and new stringy invariants of singularities", Mini-cours pour doctorants, ICMC-USP** (São Carlos, Brazil).
- 2017 ○ **Mini-course (7h) "Line arrangements: combinatorics, geometry and topology", Mini-cours pour doctorants, ICMC-USP** (São Carlos, Brazil).

Talks in national and international conferences

- 2019 ○ **Configurations of points and new Zariski pairs of line arrangements, Workshop on Topological and Analytical Methods in Singularity Theory, CIMAT - Guanajuato** (Mexico).
- **Classification of trihedral singularities $\mathbb{C}^3/G_{d,q}$ via arithmetic properties and motivic zeta functions, Workshop "Zeta functions, singularities and applications", CIMAT - Zacatecas** (Mexico).
- **A new formula for the motivic and topological zeta functions from \mathbb{Q} -resolution of singularities, 12th Mini Workshop on Singularities, Geometry and Differential Equations and 1st Meeting on Foliations and Singularities, UFES, Vitoria** (Brazil).
- 2018 ○ **Motivic zeta functions on \mathbb{Q} -Gorenstein varieties and \mathbb{Q} -resolution of singularities, Lipschitz Geometry of Singularities, Oaxaca** (Mexico).
- **Motivic zeta functions, orbifold motivic measures and \mathbb{Q} -resolutions of singularities (Short Communication), International Congress of Mathematicians 2018, Rio de Janeiro** (Brazil).
- **Motivic zeta functions, orbifold motivic measures and \mathbb{Q} -resolutions of singularities, 15th International Workshop on Real and Complex Singularities, ICMC-USP** (Brazil).
- 2017 ○ **Combinatorics and topology of line arrangements via configurations of points, XI Encontro Regional de Topologia, USP-UNESP-UFSCar** (Brazil).
- **A geometrical construction of Zariski pairs of real line arrangements, VIII Rencontre Pau-Zaragoza d'Algèbre et Géométrie, Université de Pau** (France).

- **A geometrical construction of Zariski pairs of real line arrangements**, *IV Congreso de Jóvenes Investigadores de la RSME*, Universidad de Valencia (Spain).
- **Configurations of points and topology of real line arrangements**, *Congreso bienal de la Real Sociedad Matemática Española 2017*, Universidad de Zaragoza (Spain).
- 2016 ○ **A semi-canonical reduction for periods of Kontsevich-Zagier**, *Singularities and Topology*, Laboratoire J. A. Diudonné, Université de Nice (France).
- **A semi-canonical reduction for periods of Kontsevich-Zagier**, *Autour des Équations Différentielles*, Institut Fourier, Université de Grenoble Alpes (France).
- 2015 ○ **On the geometry of line arrangements and dynamics of polynomial vector fields**, *Geometry, topology and combinatorics of hyperplane arrangements and related problems*, Universidad de Zaragoza (Spain).
- **Una reducción semi-canónica para periodos de Kontsevich-Zagier**, *III Congreso de Jóvenes Investigadores de la RSME*, Universidad de Murcia (Spain).
- **On the geometry of line arrangements and polynomial vector fields**, *Functional Equations in LIMoges 2015*, XLIM, Université de Limoges (France).
- 2014 ○ **On periods of Kontsevich-Zagier**, *The 1st Workshop of JSPS-MAE Sakura Program "Geometry and Combinatorics of Hyperplane Arrangements and Related Problems"*, Hokkaido University (Japan).

Talks in seminars

- 2018 ○ **Motivic zeta functions, orbifold motivic measures and Q-resolutions of singularities**, *Singularity Theory Seminar*, ICMC-USP (São Carlos, Brazil).
- 2017 ○ **Configurations of points and topology of real line arrangements**, *Singularity Theory Seminar*, ICMC-USP (São Carlos, Brazil).
- **Configurations of points and topology of real line arrangements**, *Seminário de Topologia*, Universidade Federal de São Carlos (Brazil).
- **Arreglos de puntos y topología de configuraciones de rectas reales**, *Seminario de Geometría Algebraica*, Universidad Complutense de Madrid (Spain).
- **Configurations de points et topologie des arrangements de droites réelles**, *Séminaire Géométrie des systèmes Dynamiques*, Institut de Mathématiques de Bourgogne, Université de Bourgogne (France).
- **Configurations de points et topologie des arrangements de droites réelles**, *Séminaire Géométrie des espaces singuliers*, Laboratoire Paul Painlevé, Université de Lille 1 (France).
- **Une approche en géométrie réelle pour périodes de Kontsevich-Zagier**, *Séminaire Théorie des Nombres*, Institut de Mathématiques de Bordeaux, Université de Bordeaux (France).
- **Configurations de points et topologie des arrangements de droites réelles**, *Séminaire Géométrie*, Institut de Mathématiques de Bordeaux, Université de Bordeaux (France).
- **Configurations de points et topologie des arrangements de droites réelles**, *Séminaire du LMAP*, Université de Pau et des Pays de l'Adour (France).
- 2016 ○ **Arreglos de puntos y topología de configuraciones de rectas reales**, *Seminario de Geometría y Topología*, Universidad de Zaragoza (Spain).
- **Configurations de points et topologie des arrangements de droites réelles**, *Séminaire de Algèbre et Géométrie*, Institut Fourier, Université de Grenoble Alpes (France).
- **Configurations de points et topologie des arrangements de droites réelles**, *Séminaire de Géométrie et Topologie*, Institut Fourier, Université de Grenoble Alpes (France).
- **Configurations de points et topologie des arrangements de droites réelles**, *Séminaire de Géométrie, Groupes et Dynamiques*, École Normale Supérieure de Lyon (France).
- **Some contributions on periods of Kontsevich-Zagier and on logarithmic vector fields of line arrangements**, *Seminario de Geometría y Topología*, Universidad de Zaragoza (Spain).
- 2015 ○ **A semi-canonical reduction for periods of Kontsevich-Zagier**, *Seminar of Department of Mathematics*, Tokyo Gakugei University (Japan).

- **Some contributions on periods of Kontsevich-Zagier and on logarithmic vector fields of line arrangements**, *Seminar of Department of Mathematics*, Hokkaido University (Japan).
- **Géométrie des arrangements de droites, dynamique des champs de vecteurs polynomiaux et conjecture de Terao**, *Séminaire Topologie*, Institut Fourier, Université de Grenoble I (France).
- **Géométrie des arrangements de droites, dynamique des champs de vecteurs polynomiaux et conjecture de Terao**, *Séminaire Analyse*, Institut de recherche mathématique avancée, Université de Strasbourg (France).
- 2014 ○ **Combinatoria de configuraciones de rectas y campos vectoriales polinómicos**, *Seminario de Geometría y Topología*, Universidad de Zaragoza (Spain).
- **Forma semi-canónica para periodos de Kontsevich-Zagier**, *Seminario de Geometría y Topología*, Universidad de Zaragoza (Spain).
- 2013 ○ **On generalized colorings of knots and the Alexander polynomial**, *Séminaire de doctorants du LMAP*, Université de Pau et des Pays de l'Adour.
- **Introduction aux périodes**, *Séminaire de Géométrie*, Université de Pau et des Pays de l'Adour.
- 2012 ○ **Fonctions zêta d'une singularité**, *Séminaire de Géométrie*, Université de Pau et des Pays de l'Adour.

Research scholarships

- 2015 ○ **Hokkaido University and Tokyo Gakugei University (3 semaines) invited by M. Yoshinaga and A. Yasuhara** (Japan).
- 2014 ○ **Hokkaido University (3 semaines) invited by M. Yoshinaga** (Japan).
- 2011 ○ **Laboratoire de Mathématiques et de leurs Applications (1 month) invited by V. Florens**, *Université de Pau et des Pays de l'Adour* (France).

Posters

- 2018 ○ **Combinatorics and topology of line arrangements via configuration of points**, *International school on Singularities and Lipschitz Geometry*, Universidad Nacional Autónoma de México (Cuernavaca, Mexico).
- 2014 ○ **Algebraic Hilbert's 16th problem and line arrangements**, *The 2nd Franco-Japanese-Vietnamese Symposium on Singularities of the CNRS-JSPS-VAST*, Hokkaido University (Japan).
- **Periods of Kontsevich-Zagier: conjectures and reduction**, *Journées de l'École Doctoral*, Université de Pau et des Pays de l'Adour (France).
- 2013 ○ **Periods as volumes and the Kontsevich-Zagier conjecture**, *II Congreso de Jóvenes Investigadores de la RSME*, Universidad de Sevilla (Spain).

Awards

- 2014 ○ **1st prize awareness poster "Periods of Kontsevich-Zagier: conjectures and reduction"**, *Journées de l'École Doctoral*, Université de Pau et des Pays de l'Adour.
- 2013 ○ **2nd prize awareness poster "Periods as volumes and the Kontsevich-Zagier conjecture"**, *II Congreso de Jóvenes Investigadores de la RSME*, Universidad de Sevilla (Spain).

Dissemination activities

- 2014 ○ **Mini-course "Présentation du package TikZ"**, with **B. Guerville-Ballé**, *Laboratoire de Mathématiques et de leurs Applications*, Université de Pau et des Pays de l'Adour (France).
- 2012 ○ **Mini-course (3h) "Introduction à la Théorie de Nœuds"**, *Seminar for Master degree students*, Université de Pau et des Pays de l'Adour (France).
- 2011 ○ **Monitor-guide of the RSME-Imaginary's Exhibition (35h)**, *Real Sociedad Matemática Española - Instituto Universitario de Matemáticas y Aplicaciones*, Universidad de Zaragoza.

Responsibility positions and others

- 2013/2014 ○ **Co-organizer of the PhD math students seminar of LMAP**, Université de Pau et des Pays de l'Adour.

Teaching experience

ATER: Université Grenoble Alpes (76,5h, France)

- 2016/2017 ○ **MATH101-Langage mathématique, algèbre et géométrie**, *Lectures and exercises*, L1 Math/Info.
Logic, sets, functions, methods of proofs, real and complex algebraic calculus, geometry of the euclidean plane.

ATER: Université de Pau (192h, France)

- 2015/2016 ○ **Initiation à la modélisation statistique**, *Lectures and exercises*, L1 MIAHS.
Probabilised spaces. Conditional probability. Bernoulli's schema. Binomial and Normal distributions. Moivre-Laplace Theorem and applications: estimation and testing of statistical models.
- **Statistiques Descriptives**, *Lectures, exercises and lab works*, L1 MIAHS-Math-SDT.
Univariate analysis: definitions, numerical characterizations and graphics. Bivariate analysis: contingency tables and independence, linear regression and correlation coefficients of Bravais-Pearson and Spearman. Lab works over spreadsheet.
- **Fonctions et intégrales**, *Exercises*, L1 Mathématiques.
Trigonometric functions. Superior and inferior bounds in \mathbb{R} . Anti-derivatives. Riemann integral of a piecewise continuous function. Taylor's formulas and series, Landau notations, local study of functions.
- **Équations différentielles I**, *Exercises*, L2 Mathématiques.
First and second order ODEs. Analytic methods: undetermined coefficients and variation of parameters. Separation of variables. Series solutions of ODEs. Matrix exponentials. Linear differential systems. Euler's approximation method.

Teaching Assistant: Université de Pau (128h, France)

- 2014/2015 ○ **Arithmétique**, *Exercises*, L1 Mathématiques.
Logic and sets. Functions and applications. Binary relations. Groups and subgroups. Arithmetic for integers.
- **Algèbre Linéaire II**, *Exercises*, L1 MIAHS.
Matrix calculus. Gauss's method and inverse. Determinants and comatrices. Matrix's rank. Linear applications and change of basis.
- **Équations différentielles I**, *Exercises*, L2 Mathématiques.
- 2013/2014 ○ **Arithmétique**, *Exercises*, L1 Mathématiques.
- **Algèbre Linéaire II**, *Exercises*, L1 MASS.
- **Topologie et Calcul Différentiel**, *Exercises*, L2 Mathématiques.
Normed vector spaces. Limits and continuity. Complete and compact spaces. Continuous linear applications. Differential calculus. PDEs. Maximums and minimums.

Private academy

- 2009/2011 ○ **Teacher**, *Academia Enseñalia S.L.*, Zaragoza (Spain).
Supplementary exercises and individual tutorials for school, high school and undergraduate students in scientific subjects, specially in mathematics and statistics.

Attended scientific schools

- 2019 ○ **School "XX School of Mathematics Lluís Santaló 2019: p-Adic Analysis, Arithmetic and Singularities"**, *Universidad Internacional Menéndez Pelayo*, Santander (Spain).
- 2018 ○ **Course "Post-quantum Cryptography"**, *BCAM&UPV/EHU*, Bilbao (Spain).
- **International school "Singularity Theory"**, *ICMC-USP*, São Carlos (Brazil).

- **International school “Singularities and Lipschitz Geometry”**, *Universidad Nacional Autónoma de México*, Cuernavaca (Mexico).
- 2017 ○ **Graduate school “Introduction To Geometric Analysis: The Atiyah-Singer Index Theorem”**, *BCAM-UPV/EHU*, Bilbao (Spain).
- 2016 ○ **School “III EACA International School on Computer Algebra and its Applications”**, *Universidad de Sevilla*, Sevilla (Spain).
- 2014 ○ **Clay Mathematics Institute Summer School 2014 “Periods and Motives: Feynman amplitudes in the 21st century”**, *Instituto de Ciencias Matemáticas*, Madrid (Spain).
- 2013 ○ **School “Multiple Zeta Values, Multiple Polylogarithms and Quantum Field Theory”**, *Instituto de Ciencias Matemáticas*, Madrid (Spain).
- **Graduate School “New aspects on Singularity Theory”**, *Instituto de Ciencias Matemáticas*, Madrid (Spain).
- 2012 ○ **Doc-Course “Singularities and Applications”**, *Universidad de Sevilla*, Sevilla (Spain).
- **Doc-Course “Cohomología de haces, dualidad de Verdier y cohomología de intersección”**, *Universidad Complutense de Madrid*, Madrid (Spain).

Skills

Languages

- **Spanish** – Native speaker.
- **English** – C1 Level (*FCE*, 2013).
- **French** – C2 Level (*Dalf C1*, 2014).
- **Portuguese** – B2 level.

Computer skills

- Sage, Maple, Mathematica.
- Python, C/C++, Java.
- Fortran, Matlab, R.
- \LaTeX , TikZ/Pgf, Beamer.

Interests

- Drawing.
- Mountain sports (trekking, climbing).
- Organic agriculture.
- Dancing (lindy hop, rock).