

# Juan VIU-SOS

PHD IN MATHEMATICS  
– GEOMETRY, TOPOLOGY AND SINGULARITIES –

ICMC, 3-154  
Av. Trabalhador Sancerlense  
400 - Centro, São Carlos - SP  
13566-590 (BRAZIL)  
☎ +33 (0)6 10 58 11 81  
✉ [jviusos@math.cnrs.fr](mailto:jviusos@math.cnrs.fr)  
📄 [jviusos.github.io](https://github.com/jviusos)



## 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

- **Configurations of points and topology of real line arrangements** [↗](#), arXiv:1702.00922, with B. Guerville-Ballé, *Math. Ann.* 374 (2019), no. 1-2, 1–35.
- **Fundamental groups of real arrangements and torsion in the lower central series quotients** [↗](#), arXiv:1704.04152, with E. Artal-Bartolo and B. Guerville-Ballé (to appear in *Experimental Mathematics*, 2018).
- **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

- submitted ○ **Motivic zeta functions on  $\mathbb{Q}$ -Gorenstein varieties** [↗](#), arXiv:1911.03354, with E. León-Cardenal, J. Martín-Morales and W. Veys.
- preprint ○ **Ineffectiveness of homotopical invariants on Nakanishi's 4-move conjecture for knots** [↗](#), arXiv:1808.05518, with B. Guerville-Ballé.
- submitted ○ **A semi-canonical reduction for periods of Kontsevich-Zagier** [↗](#), arXiv:1509.01097.
- submitted ○ **Combinatorics of line arrangements and dynamics of polynomial vector fields** [↗](#), arXiv:1412.0137, with B. Guerville-Ballé.

### Modules on symbolic computation developed for Sagemath

- 2014 ○ **Filtration and dynamics of logarithmic vector fields of line arrangements in the affine plane** [↗](#).
- 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)

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## Previous career and education

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- 2017/2019 ◦ **Post-doctoral fellow at ICMC/Universidade de São Paulo with a FAPESP grant** (Brazil).
- 2016/2017 ◦ **ATER (Teaching and research assistant position) at Institut Fourier (Université Grenoble Alpes)** (½ year) (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

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- 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).

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## Research activities

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### Lectures in seminars and mini-courses

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- 2018 ◦ **Mini-course (20h) "An introduction to  $p$ -adic and motivic integration, zeta functions and new stringy invariants of singularities."**, ICMC-USP (São Carlos, Brazil).
- 2017 ◦ **Mini-course (7h) "Line arrangements: combinatorics, geometry and topology"**, ICMC-USP (São Carlos, Brazil).

### Talks in national and international conferences

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- 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

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- 2015 ○ **Hokkaido University and Tokyo Gakugei University (3 weeks) invited by M. Yoshinaga and A. Yasuhara** (Japan).
- 2014 ○ **Hokkaido University (3 weeks) 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

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- 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

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- 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

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- 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

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

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## Teaching experience

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

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- 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)

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- 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)

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- 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

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- 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.

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## Schools and Conferences

### Scientific school

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- 2018 ○ **International school "Singularity Theory"**, *ICMC-USP*, São Carlos (Brazil).
- **International school "Singularities and Lipschitz Geometry"**, *Universidad Nacional Autónoma de México*, Cuernavaca (Mexico).

- 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).

### Conference attendance

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- 2016 ○ **Conference “The 4th Franco-Japanese-Vietnamese Singularities”**, *Université de Savoie*, Chambéry (France).
- **Conference “Summer Conference on Hyperplane Arrangements (SCHA)”**, *Hokkaido University*, Sapporo (Japan).
- **Conference “XV Encuentro de Álgebra Computacional y Aplicaciones (EACA 2016)”**, *Universidad de Logroño*, Logroño (Spain).
- 2015 ○ **Workshop “Real Analytic Geometry and Trajectory of Vector Fields”**, *Centre international de rencontres mathématiques*, Marseille (France).
- **Conference “Winter Braids V”**, *Université de Pau et des Pays de l’Adour*, Pau (France).
- 2014 ○ **The 2nd Franco-Japanese-Vietnamese Symposium on Singularities of the CNRS-JSPS-VAST**, *Hokkaido University*, Sapporo (Japan).
- **Conference “Winter Braids IV”**, *Institute de Mathématiques de Bourgogne*, Dijon (France).
- 2013 ○ **Conference “II Congreso de Jóvenes Investigadores de la Real Sociedad Matemática Española”**, *RSME – Universidad de Sevilla*, Sevilla (Spain).
- **Conference “Algebra and Geometry and Topology of Singularities: Conference on the occasion of the 60th birthday of I. Luengo”**, *Instituto de Ciencias Matemáticas*, La Cristalera, Miraflores de la Sierra (Spain).
- **III Workshop of Singularities in Zaragoza**, *IUMA, Universidad de Zaragoza*, Zaragoza (Spain).
- 2012 ○ **Conference “Winter Braids III”**, *Institut Fourier*, Grenoble (France).
- **Conference “XII International Conference Zaragoza-Pau on Applied Mathematics and Statistics 2012”**, *Universidad de Zaragoza – Université de Pau et des Pays de l’Adour*, Jaca (Spain).
- **Conference “Arrangements in Pyrénées”**, *Université de Pau et des Pays de l’Adour*, Pau (France).
- 2011 ○ **II Workshop of Singularities in Zaragoza**, *IUMA, Universidad de Zaragoza*, Zaragoza (Spain).
- **Workshop “Atelier thématique d’Algebre et Géometrie Bilbao-Pau-Zaragoza”**, *Université de Pau et des Pays de l’Adour*, Bayonne (France).

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## Skills

### Languages

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

### Computer skills

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

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## Interests

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