

# Juan VIU-Sos

PHD IN MATHEMATICS  
– GEOMETRY, TOPOLOGY AND SINGULARITIES –

IMPA, office 315  
Estr. Dona Castorina, 400  
Rio de Janeiro - RJ  
22460-320 (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

- **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* (2020) .
- **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)

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## Previous career and education

### Current position

- 2019/2021 ◦ **Post-doc à l'IMPA (Instituto de Matemática Pura e Aplicada), financé par une bourse CAPES/PNPD, Rio de Janeiro (Brésil).**

### 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 coloriage".

- 2005/2011 ◦ **B.S. in Mathematics (Licenciado en Matemáticas), Universidad de Zaragoza, Zaragoza (Spain).**

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## 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

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- 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 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

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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

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).

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## Skills

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### Languages

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| <ul style="list-style-type: none"> <li>○ <b>Spanish</b> – Native speaker.</li> <li>○ <b>French</b> – C2 Level (<i>Dalf C1</i>, 2014).</li> </ul> | <ul style="list-style-type: none"> <li>○ <b>English</b> – C1 Level (<i>FCE</i>, 2013).</li> <li>○ <b>Portuguese</b> – B2 level.</li> </ul> |
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### Computer skills

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| <ul style="list-style-type: none"> <li>○ Sage, Maple, Mathematica.</li> <li>○ Fortran, Matlab, R.</li> </ul> | <ul style="list-style-type: none"> <li>○ Python, C/C++, Java.</li> <li>○ <math>\text{\LaTeX}</math>, TikZ/Pgf, Beamer.</li> </ul> |
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## Interests

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| <ul style="list-style-type: none"> <li>○ Drawing.</li> <li>○ Organic agriculture.</li> </ul> | <ul style="list-style-type: none"> <li>○ Mountain sports (trekking, climbing).</li> <li>○ Dancing (lindy hop, rock).</li> </ul> |
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