Juan Viu-Sos

PhD in Mathematics
– Geometry, Topology and Singularities –

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Introduction

Current position: Assistant Professor at *Universidad Politécnica de Madrid* (UPM), Spain.

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

Articles and preprints

Publications

- **Introduction to p-adic and motivic integration, zeta functions and invariants of singularities** , to appear in *Contemporary Mathematics* (2022).
- **On the equality of periods of Kontsevich-Zagier** , with J. Cresson, to appear in *Journal de Théorie des Nombres de Bordeaux* (2022).
- **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** , *International Journal of Number Theory 17 (2021), no. 01, 147-174*.
- **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 Mathématicas García de Galdeano, 40, 61-66, 2015.

Preprints

preprint
- **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

2019/2020 ○ **Post-doctoral fellow at *IMPA - Instituto de Matemática Pura e Aplicada* supported by a CAPES/PNPD grant**, Rio de Janeiro, Brazil.

2017/2019 ○ **Post-doctoral fellow at *ICMC/Universidade de São Paulo* supported by a FAPESP grant**, São Carlos, Brazil.

2016/2017 ○ **ATER (Teaching 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 & Computacional Algebra* supervised by Enrique Artal: "Funciones zeta y poliédro 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

2021 ○ **On zeta functions, weighted blow-ups and the Monodromy Conjecture for some surface singularities**, *Singularities in the Midwest (online edition)*, Univ. Wisconsin-Madison, USA.

2020 ○ **Generación de variantes aleatorias de exámenes**, *Workshop ENSEMAT 2020 "Usos y Avances en la Docencia de las Matemáticas en las Enseñanzas Universitarias"*, Universidad Politécnica de Madrid, Spain.

○ **Sobre la conjetura de la monodromia para singularidades cuasihomogéneas de superficie**, *Seminario de Álgebra, Geometría y Topología*, Universidad Complutense de Madrid, Spain.

○ **Embedded topology and combinatorics of line arrangements: some counter-examples using GeoGebra**, *14th Workshop of Young Researchers in Mathematics*, UCM-UAM-UC3M-IMI, Spain.

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 Q-resolutions of singularities (Short Communication)**, *International Congress of Mathematicians 2018*, Rio de Janeiro, Brazil.
- **Motivic zeta functions, orbifold motivic measures and 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

2020
- **Generación de variantes aleatorias de exámenes**, *Workshop ENSEMAT 2020 "Usos y Avances en la Docencia de las Matemáticas en las Enseñanzas Universitarias"*, Universidad Politécnica de Madrid, Spain.
- **Sobre la conjetura de la monodromia para singularidades cuasihomogéneas de superficie**, *Seminario de Álgebra, Geometría y Topología*, Universidad Complutense de Madrid, Spain.
- **Embedded topology and combinatorics of line arrangements: some counter-examples using GeoGebra**, *14th Workshop of Young Researchers in Mathematics*, UCM-UAM-UC3M-IMI, Madrid, Spain.

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 topologia 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

2020/··· ○ **Organizer of the international webimar "Iberoamerican Webminar of Young Researchers in Singularity Theory and related topics"**, *URL:* `iberosing.github.io`, Instituto de Matemática Interdisciplinar (IMI).

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

Teaching experience

Assistant Professor: Universidad Politécnica de Madrid (Spain)

2021/2022 ○ **Informática**, *Lectures and exercises*, S1 Ingeniería Civil.

> Programming in Matlab.

○ **Cálculo I**, *Lectures and exercises*, S1 Ingeniería Naval.

> Complex numbers, differential and integral calculus of one real variable, quadrature formulas, series.

2020/2021 ○ **Estadística y Optimización**, *Lectures and exercises*, S2 Ingeniería Civil.

> Descriptive statistics, probability theory, random variables, Central Limit theorem, inferential statistics, estimation, hypothesis testing.

○ **Cálculo I**, *Lectures and exercises*, S1 Ingeniería Naval.

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 MIASHS.

> 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 MIASHS-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 MIASHS.

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

Computer skills

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

Interests

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