# Javier A. Carvajal-Rojas


Personal & Contact Information

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Language skills: Spanish (native), English (fluent), French (basic).

Research Interests

Algebraic geometry and commutative algebra in positive and mixed characteristic, with a focus on Fano geometry and the geometry of Frobenius endomorphisms. I am interested in Frobenius actions on Fano-type varieties and their singularities. I am further interested in invariants, objects, and concepts defined via Frobenius actions, e.g. $F$-singularity theory, ordinarity, etc.

Education

**University of Utah**

Ph.D. in Mathematics, August 2018
Defense date: 26.04.2018
Advisor: Prof. Karl Schwede
Dissertation: Arithmetic aspects of strong $F$-regularity

**Universidad de Costa Rica**

B.S. in Mathematics, April 2013

- *Graduación de Honor*
- Minor in Physics

Employment history

**KU Leuven**

Postdoctoral Fellow, September 2022—September 2023
Mentor: Prof. Johannes Nicaise

**EPFL, The Swiss Federal Institute of Technology in Lausanne**

*Collaborateur Scientifique* (Postdoc), September 2018—September 2022
Mentor: Prof. Zsolt Patakfalvi (Chair of Algebraic Geometry)

**Universidad de Costa Rica**

*Professor interino* (Lecturer), March 2013—July 2013 (One semester lecturer).

## Publications

1. **J. Carvajal-Rojas**, A. Stäbler, Tame fundamental groups of pure pairs and Abhyankar's lemma, *to appear in Algebra & Number Theory.* arXiv1910.02111
2. **J. Carvajal-Rojas**, A. Stäbler, On the behavior of $F$-signatures, splitting primes, and test modules under finite covers, *Journal of Pure and Applied Algebra* (2022), 107165, doi: https://doi.org/10.1016/j.jpaa.2022.107165.
3. **J. Carvajal-Rojas**, Finite torsors over strongly $F$-regular singularities, *Épijournal de Géometrie Algébrique* **6** (2022), 1–30, doi: https://doi.org/10.46298/epiga.2022.7532
4. **J. Carvajal-Rojas**, L. Ma, T. Polstra, K. Schwede, K. Tucker, Covers of rational double points in mixed characteristic, *Journal of Singularities*, **23** (2021), 127–150, doi: http://doi.org/10.5427/jsing.2021.23h
5. **J. Carvajal-Rojas**, K. Schwede, K. Tucker, Bertini Theorems for $F$-signature and Hilbert–Kunz multiplicity, *Mathematische Zeitschrift*, **299** (2021), 1131–1153, doi: https://doi.org/10.1007/s00209-021-02712-y
6. **J. Carvajal-Rojas**, D. Smolkin, The uniform symbolic topology property for diagonally $F$-regular algebras, *Journal of Algebra*, **548** (2020), 25–52, doi: https://doi.org/10.1016/j.jalgebra.2019.11.017
7. B. Bhatt, **J. Carvajal-Rojas**, P. Graf, K. Schwede, K. Tucker, Étale fundamental groups of strongly $F$-regular schemes, *International Mathematics Research Notices*, **14** (2019), 4325–4339, rnx253, doi: https://doi.org/10.1093/imrn/rnx253
8. **J. Carvajal-Rojas**, K. Schwede, K. Tucker, Fundamental groups of $F$-regular singularities via $F$-signature, *Annales scientifiques de l'École Normale Supérieure*, (4) **51** (2018), no. 4, 993–1016, doi: https://doi.org/10.24033/asens.2370
9. D. Campos-Salas, **J. Carvajal-Rojas**, M. Villarino, On the monotonicity of the correction term in Ramanujan's factorial approximation, *The Mathematical Gazette*, (539) **97** (2013), 274–275, doi: https://doi.org/10.1017/S002555720000591X

## Submitted Papers & Preprints

1. **J. Carvajal-Rojas**, Zs. Patakfalvi, *Varieties with ample Frobenius-trace kernel*, ArXiv e-prints, 2021. `arXiv2110.15035`.
2. **J. Carvajal-Rojas**, T. Yasuda, *On the behavior of stringy motives under Galois quasi-étale covers*, ArXiv e-prints, 2021. `arXiv2105.05214`.
3. **J. Carvajal-Rojas**, A. Stäbler, J. Kollár, *On the local étale fundamental group of KLT threefold singularities*, ArXiv e-prints, 2020. `arXiv2004.07628`.

## Teaching activities

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|---|---|---|
| Fall | 2022 | **Instructor**, Advanced Reading Course in Mathematics, KU Leuven |
| Spring | 2022 | **Instructor**, MATH-679 Group Schemes, EPFL |
| Fall | 2020 | Teaching Assistant, MATH-510 Modern Algebraic Geometry, EPFL |
| Spring | 2020 | Teaching Assistant, MATH-105(b) Analyse avancée II, EPFL |
| Fall | 2018 | Teaching Assistant, MATH-333 Chapitre choisi de géométrie: surfaces minimales, EPFL |
| Summer | 2018 | **Instructor**, MATH 2270 Linear Algebra, University of Utah |
| Spring | 2018 | **Instructor**, MATH 2270 Linear Algebra, University of Utah |
| Spring | 2017 | Teaching Assistant, MATH 1210 Calculus I, University of Utah |
| Fall | 2016 | **Instructor**, MATH 1210 Calculus, University of Utah |
| Fall | 2015 | **Instructor**, MATH 1090 Business Algebra, University of Utah |
| Spring | 2015 | **Instructor**, MATH 1030 Intro. to Quantitative Reasoning, University of Utah |
| Fall | 2014 | Teaching Assistant, MATH 1210 Calculus I, University of Utah |
| Spring | 2014 | Teaching Assistant, MATH 1310 Engineering Calculus II, University of Utah |
| Fall | 2013 | Teaching Assistant, MATH 1310 Engineering Calculus I, University of Utah |
| I Ciclo | 2013 | **Instructor**, MA1004-Álgebra Lineal (two sections), Universidad de Costa Rica |

**Master theses directed:**

1. Arnaud Vilpert, *Singularities of determinantal pairs*, Fall 2021, EPFL. (Preprint in preparation)
2. Anne Fayolle, *Centers of $F$-purity and their behavior under finite covers*, Spring 2022, EPFL. (Preprint in preparation)
3. Maxime Matthey, *$F$-splitting numbers of Segre pure pairs*, Spring 2022, EPFL.

TEACHING ACTIVITIES (CONTINUED)

**Master projects supervised:**

1. Anne Fayolle, *The test ideal and other measures of singularities in positive characteristic*, Fall 2020, EPFL.
2. Arnaud Vilpert, *The Frobenius endomorphism and singularities in positive characteristic*, Fall 2020, EPFL.

**Bachelor projects supervised:**

1. Emre Özavci, *Local Cohomology*, Spring 2022, EPFL.
2. Marco Cavaleri, *Ring completions and the Cohen's structure theorem*, Spring 2020, EPFL.

**Summer in the Lab Program:**

1. Emre Özavci, *On the positivity of the Frobenius-trace kernel on toric and Hibi varieties*, Summer 2022, EPFL.

TALKS

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| 55 Congreso Nacional de la SMM, Universidad de Guadalajara: *Centros de $F$-pureza y extensiones finitas.* | October 2022 |
| Commutative Algebra Seminar, University of Michigan: *F-singularities of determinantal pairs.* | April 2022 |
| Algebraic Geometry Seminar, Princeton University: *Varieties with ample Frobenius-trace kernel: in the search of a Frobenius-theoretic characterization of projective spaces.* Recording | January 2022 |
| 11-th Swiss-French workshop in Algebraic Geometry, Charmey Switzerland: *Varieties with ample Frobenius-trace kernel: in the search of a Frobenius-theoretic characterization of projective spaces.* | January 2022 |
| Groups, Arithmetic & Algebraic Geometry Seminar, EPFL: *On the behavior of stringy motives under Galois quasi-étale covers.* | May 2021 |
| Online Algebraic Geometry Seminar, Yale University: *On the fundamental group of KLT threefold singularities in positive characteristic.* | May 2020 |
| Algebra and Representation Theory Seminar (ARTS), University of Oklahoma (via ZOOM): *Fundamental groups of KLT singularities.* | May 2020 |

TALKS (CONTINUED)

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| Conference "Singularities and Arithmetics," Tohoku University: *Étale fundamental groups of rational KLT threefold singularities in positive characteristic.* | February 2020 |
| FACARD 2019 Workshop, Institut de Matemàtica Universitat de Barcelona: *Tame fundamental groups of purely $F$-regular pairs.* | January 2019 |
| SFB/TRR45 Kolloquium, Johannes Gutenberg-Universität Mainz: *The USTP property and diagonal $F$-regularity.* | December 2018 |
| Intercity BeNeFri Seminar, Université de Neuchâtel: *The USTP property and diagonal $F$-regularity.* | November 2018 |
| Basel-Dijon-EPFL Joint Seminar, Institut de Mathématiques de Bourgogne-Dijon: *Towards a purity-for-torsors theorem for $F$-regular singularities.* | October 2018 |
| Groups, Arithmetic & Algebraic Geometry Seminar, EPFL: *Arithmetic aspects of strong $F$-regularity.* | October 2018 |
| Grupo de Trabajo en Geometría y Topología, Universidad de Costa Rica: *Aspectos aritméticos de la $F$-regularidad fuerte.* | August 2018 |
| Commutative Algebra Seminar, University of Michigan: *Finite torsors over strongly $F$-regular singularities.* | October 2017 |
| Algebra Seminar, Universität Osnabrück: *Finite torsors over strongly $F$-regular singularities.* | October 2017 |
| SFB/TRR45 Colloquium, Johannes Gutenberg-Universität Mainz: *Finite torsors over strongly $F$-regular singularities.* | September 2017 |
| FRAGMENT Seminar, Colorado State University: *Fundamental groups of $F$-regular schemes and singularities.* | April 2017 |
| Algebraic Geometry Seminar, University of Illinois at Chicago: *Fundamental groups of $F$-regular schemes and singularities.* | March 2017 |
| Commutative Algebra Seminar, University of Utah: *Fundamental groups of strongly $F$-regular singularities via $F$-signature.* | September 2016 |

## Talks (continued)

Departmental Colloquium, Universidad de Costa Rica: June 2016
*$F$-singularidades y grupos fundamentales locales.*

## Conference Posters

1. *Finite torsors over strongly $F$-regular singularities* (PDF), presented at:
   - Western Algebraic Geometry Symposium, University of California at Los Angeles, October 2017.
   - Local Cohomology in Commutative Algebra and Algebraic Geometry Conference in honor of Gennady Lyubeznik's 60th birthday, University of Minnesota, August 2017.
2. *Fundamental groups of strongly $F$-regular singularities via $F$-signature* (PDF), presented at:
   - Western Algebraic Geometry Symposium, Colorado State University, October 2016.
   - KUMUNU Conference, University of Kansas, October 2016.
   - Summer School and Conference in Higher Dimensional Algebraic Geometry, University of Utah, July 2016.
   - Commutative Algebra Conference in honor of Craig Huneke's 65th birthday, University of Michigan, July 2016.

## Refereeing Service

Proceedings of the 2015 AMS Summer Institute, Nagoya Mathematical Journal, IMRN.

## Prizes and fellowships

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| August | 2012 | *Diploma de Excelencia Académica*—awarded to the student with the best grades in the section. |
| March | 2012 | *Beca de excelencia académica*—awarded to students with an average above 9/10, waives tuition for the academic year. |
| August | 2011 | *Diploma de Excelencia Académica* |
| March | 2011 | *Beca de excelencia académica* |
| March | 2010 | *Beca de excelencia académica* |
| March | 2009 | *Beca de excelencia académica* |