# Paul Vladimir Barajas Guzmán

paul.barajas@im.unam.mx
Cuernavaca, Morelos, Mexico

## Profile

Mathematician from Nayarit with research interests in commutative algebra and algebraic geometry. Ph.D. training at the Universidad Autónoma de Zacatecas under the supervision of Dr. Daniel Duarte. Currently working on Hasse–Schmidt derivations, higher-order differential modules, jet schemes, arc spaces, the Nash blow-up and higher-order Nash blowups, as well as blow-up modules.

## Academic Background

- **Ph.D. in Basic Sciences**, Universidad Autónoma de Zacatecas (2020–2024).
  Thesis: *Higher-order derivations of the Hasse-Schmidt algebra and blowups of jet schemes.*
  Advisor: Dr. Daniel Duarte.
- **Master's Degree in Mathematics**, Universidad Autónoma de Zacatecas (2017–2019).
  Thesis: *The higher-order Kähler differential module.*
  Advisor: Dr. Daniel Duarte.
- **Bachelor's Degree in Mathematics**, Universidad Autónoma de Nayarit (2008–2012).
  Thesis: *Approximations to the circle by means of Pythagorean Hodograph curves.*
  Advisor: Dra. Oyuki Hayde Hermosillo Reyes.

## Professional Experience

- **Postdoctoral Fellowship**, Instituto de Matemáticas, Unidad Cuernavaca – UNAM (2024–present).
  Supervisor: Dr. Ángel Cano.
- **Music Education Teacher**, Secretaría de Educación Pública del Estado de Nayarit (2011–2016).

## Research Stays

- **Université Paul Sabatier – Toulouse III** (France), April–May 2022.
  Joint work with Dr. Mark Spivakovsky.

## Scientific Production

### Published Articles

1. Barajas, P., & Duarte, D. (2023). *A Nobile-like theorem for jet schemes of hypersurfaces.* Osaka Journal of Mathematics, 60(3), 555–569.
2. Barajas, P., & Duarte, D. (2020). *On the module of differentials of order n of hypersurfaces.* Journal of Pure and Applied Algebra, 224(2), 536–550.
   doi:10.1016/j.jpaa.2019.05.020

### Preprints

- Barajas, P. & Chávez-Martínez, E. & Romano, A. (2025). *The blow-up of a singularity at the module of derivations.*
  arXiv.2510.07607 [math.AG].
- Barajas, P. (2023). *High-order derivations of the Hasse-Schmidt algebra.*
  arXiv:2305.04537 [math.AC]

## Talks at Conferences and Seminars

- **"Explorando singularidades a través de derivaciones y espacios de arcos"** – Research School in Geometry at Cuernavaca, Instituto de Matemáticas, UNAM, June 16–27, 2025.
- **"The Zariski-Lipman Conjecture"** – Spring School / Conference on Singularities in Algebraic Geometry, Université de Rennes (France), May 26 – June 13, 2025.
- **"Explotando derivaciones"** – Colloquium of the Instituto de Matemáticas, UNAM, May 20, 2025.
- **"Derivando Anillos"** – XVII Jornadas de Física, Matemáticas y Materiales, Instituto de Ingeniería y Tecnología, Universidad Autónoma de Ciudad Juárez, March 2025.
- **"Módulos de derivaciones orden superior y el álgebra Hasse-Schmidt"** – Seminario de Café y Álgebra, UAM-I (December 2024).
- **"De anillos a esquemas de jets"** – Seminario de Álgebra Conmutativa y Geometría Algebraica, CIMAT, November 2024.
- **"De anillos a esquemas de jets"** – Seminario AGATA, Unidad Cuernavaca del Instituto de Matemáticas, UNAM, October 2024.
- **"Módulos de derivaciones de orden superior y el álgebra Hasse-Schmidt"** – Special session on commutative algebra, Congreso Nacional de la Sociedad Matemática Mexicana, October 2024.
- **"Módulos de derivaciones y diferenciales de orden superior"** – Colloquium of the Unidad Cuernavaca del Instituto de Matemáticas, UNAM, September 2024.
- **"High-order derivations of the Hasse-Schmidt algebra"** – Resolution of Singularities, Valuation Theory and Related Topics, event in honor of Mark Spivakovsky's 63rd birthday, August 2024.
- **"Álgebra conmutativa, un puente en las matemáticas"** – 7º Congreso Internacional Matemáticas para Todos, November 2022.
- **"A Nobile-like theorem for jet schemes of hypersurfaces"** – 2nd International Meeting of Young Researchers in Singularity Theory and Related Fields, February 2022, Brazil.
- **"El módulo de diferenciales de orden superior y el álgebra Hasse-Schmidt"** – Congreso Nacional de la Sociedad Matemática Mexicana, October 2021, Mexico.
- **"Derivaciones de Kähler y derivaciones de orden superior"** – Seminario de Estudiantes, CIMAT, April 2019.
- **"El módulo de diferenciales de Kähler de orden superior"** – Congreso Nacional de la Sociedad Matemática Mexicana, October 2019, Mexico.
- **"Un teorema tipo Nobile para jets de singularidades"** – Encuentro de Singularidades, December 2021, Mexico.

- **"Aproximaciones al círculo por medio de curvas de Hodógrafo Pitagórico"** – Congreso Nacional de la Sociedad Matemática Mexicana, October 2017, Mexico.

## Event Organization

- **58th Congress of the Mexican Mathematical Society (SMM)** – Special Session on Commutative Algebra, coordinator (October 2025).
- **First National Meeting of Young Researchers in Commutative Algebra and Algebraic Geometry** – Instituto de Matemáticas, UNAM, Unidad Cuernavaca (June 30 – July 4, 2025).
- **Encuentro de saberes: Producción Editorial, Investigación Educativa, Divulgación e Inclusión** – Instituto de Matemáticas, UNAM, Unidad Cuernavaca (June 4–6, 2025).

## Teaching

- "Selected Topics in Commutative Algebra", IM–UNAM Cuernavaca, January–August 2025.
- Admission Workshop for the Mathematics Graduate Program at UNAM (Feb–Mar 2025).

## Outreach and Mentorship

- **"¿Y dónde están los primos?"**, public lecture delivered on November 7, 2022 at the *Centro de Bachillerato Tecnológico Agropecuario No. 246 (CBTA 246)*.
- **"Números primos"**, public lecture delivered on November 8, 2022 at the *Centro de Bachillerato Tecnológico Industrial y de Servicios No. 100 (CBTIS 100)*.
- Participant in the event **"Un docente investigador en mi clase"**, held on October 3, 2024 at the *Centro de Estudios Tecnológicos Industrial y de Servicios No. 12* (CETIS 12), Cuernavaca, Morelos.
- Evaluator at the event **"Simposio 2025: Las 8 ecuaciones que cambiaron el mundo"**, held on November 28, 2024 at the *Discovery School Junior High School*, Cuernavaca, Morelos.
- Evaluator at the **"XXXV Congreso de Investigación CUAM-ACMor"**, held on April 9–10, 2025 in Cuernavaca, Morelos.

## Skills

- Languages: Spanish (native), English (intermediate, 60%).
- Programming: basic knowledge of HTML, C++, Java.