Yairon Cid-Ruiz

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CONTACT INFORMATION

Professional Address: Department of Mathematics, SAS Hall 4214, North Carolina State University, Box 8205 Raleigh, NC 27695 USA.

WORK EXPERIENCE

01/2024 –	**Assistant Professor**, North Carolina State University.
02/2024 – 03/2024	**Research Member**, SLMath (MSRI).
08/2022 – 12/2023	**Postdoctoral researcher**, KU Leuven.
10/2020 – 07/2022	**Postdoctoral researcher**, Ghent University.
09/2019 – 09/2020	**Postdoctoral researcher**, Max Planck Institute for Mathematics in the Sciences.
09/2016 – 08/2019	**Early stage researcher**, Universitat de Barcelona. PhD candidate under a Marie Skłodowska-Curie grant.
09/2014 – 07/2015	**Graduate Teaching Assistant**, Universidad Central "Marta Abreu" de las Villas.

EDUCATION

09/2016 – 08/2019	**Ph.D. in Mathematics**, *summa cum laude.* Center: Universitat de Barcelona. Advisor: Carlos D'Andrea.
09/2015 – 08/2016	**Postgraduate Diploma Programme in Mathematics**, *top student prize.* Center: Abdus Salam International Centre for Theoretical Physics (ICTP). Advisor: Lothar Göttsche.
09/2009 – 07/2014	**Bachelor in Computer Science**, *summa cum laude.* Center: Universidad Central "Marta Abreu" de las Villas (UCLV).

PUBLICATIONS & PREPRINTS

1. *"Bounding the degrees of a minimal μ-basis for a rational surface parametrization"*, Journal of Symbolic Computation 95 (2019), 134-150, arXiv:1611.07506.
2. *"A D-module approach on the equations of the Rees algebra"*, Journal of Commutative Algebra Vol 14 (2022), No. 2, 155-176, arXiv:1706.06215.
3. *"Regularity and Gröbner bases of the Rees algebra of edge ideals of bipartite graphs"*, Le Matematiche Vol 73 No 2 (2018), pp. 279–296, arXiv:1801.06731.
4. (with Sepehr Jafari, Beatrice Picone and Navid Nemati), *"Regularity of bicyclic graphs and their powers"*, Journal of Algebra and Its Applications Vol. 19, No. 03, 2050057 (2020), arXiv:1802.07202.
5. (with Laurent Busé and Carlos D'Andrea), *"Degree and birationality of multi-graded rational maps"*, Proceedings of the London Mathematical Society (3) 121 (2020) 743–787, arXiv:1805.05180.
6. "Multiplicity of the saturated special fiber ring of height two perfect ideals", Proceedings of the American Mathematical Society 148 (2020), no. 1, 59–70, arXiv:1807.03189.
7. (with Aron Simis), *"Degree of rational maps via specialization"*, International Mathematics Research Notices, Volume 2022, Issue 6, March 2022, Pages 4451–4502, arXiv:1901.06599.

8. *"Noetherian operators, primary submodules and symbolic powers"*, Collectanea Mathematica 72, p. 175–202 (2021),
arXiv:1909.07253.

9. (with Vivek Mukundan), *"Multiplicity of the saturated special fiber ring of height three Gorenstein ideals"*, Acta Mathematica Vietnamica 46, pp. 663–674 (2021),
arXiv:1909.13633.

10. *"Mixed multiplicities and projective degrees of rational maps"*, Journal of Algebra 566 (2021), 136–162,
arXiv:2001.00547.

11. (with Roser Homs and Bernd Sturmfels), *"Primary ideals and their differential equations"*, Foundations of Computational Mathematics 21, pp. 1363–1399 (2021),
arXiv:2001.04700.

12. (with Marc Chardin and Aron Simis), *"Generic freeness of local cohomology and graded specialization"*, Transactions of the American Mathematical Society 375 (2022), no. 1, 87–109,
arXiv:2002.12053.

13. (with Federico Castillo, Binglin Li, Jonathan Montaño and Naizhen Zhang), *"When are multidegrees positive?"*, Advances in Mathematics 374 (2020), 107382,
arXiv:2005.07808.

14. (with Federico Castillo, Binglin Li, Jonathan Montaño and Naizhen Zhang), *"When are multidegrees positive?"*, FPSAC 2021 Proceedings, Séminaire Lotharingien de Combinatoire 85B (2021), Art. 46, 12 pp.

15. (with Jonathan Montaño), *"Convex bodies and graded families of monomial ideals"*, Revista Matemática Iberoamericana 38 (2022), no. 6, 2033–2056,
arXiv:2010.07918.

16. (with Jonathan Montaño), *"Mixed multiplicities of graded families of ideals"*, Journal of Algebra 590 (2022) 394–412,
arXiv:2010.11862.

17. *"Equations and multidegrees for inverse symmetric matrix pairs"*, Le Matematiche Vol. LXXVI (2021) - Issue II, pp. 369–381,
arXiv:2011.04616.

18. (with Justin Chen, Marc Härkönen, Robert Krone and Anton Leykin), *"Noetherian Operators in Macaulay2"*, Journal of Software for Algebra and Geometry, Vol. 12 (2022), 33–41.
arXiv:2101.01002.

19. (with Bernd Sturmfels), *"Primary decomposition with differential operators"*, International Mathematics Research Notices, rnac178, 2022,
arXiv:2101.03643.

20. (with Justin Chen), *"Primary decomposition of modules: a computational differential approach"*, Journal of Pure and Applied Algebra, 226, 2022,
arXiv:2104.03385.

21. (with Fatemeh Mohammadi and Leonid Monin), *"Multigraded algebras and multigraded linear series"*, Journal of the London Mathematical Society, Volume 109, Issue 3, 2024,
arXiv:2104.05397.

22. *"Fiber-full modules and a local freeness criterion for local cohomology modules"*, Mathematische Zeitschrift 303, 30 (2023),
arXiv:2106.07777.

23. (with Ritvik Ramkumar), *"The fiber-full scheme"*, to appear in Journal of Pure and Applied Algebra,
arXiv:2108.13986.

24. (with Federico Castillo, Fatemeh Mohammadi and Jonathan Montaño), *"Double Schubert polynomials do have saturated Newton polytopes"*, Forum of Mathematics, Sigma Vol. 11:e100 1–9,
arXiv:2109.10299.

25. (with Oliver Clarke and Fatemeh Mohammadi), *"A study of nonlinear multiview varieties"*, Journal of Algebra 620 (2023) 363–391,
arXiv:2112.06216.

26. (with Ritvik Ramkumar), *"A local study of the fiber-full scheme"*, Journal of Algebra 636 (2023) 248–278,
arXiv:2202.06652.
27. (with Claudia Polini and Bernd Ulrich), *"Generalized Jouanolou duality, weakly Gorenstein rings, and applications to blowup algebras"*, to appear in Journal für die reine und angewandte Mathematik (Crelle's journal),
arXiv:2205.03837.
28. (with Alessio Caminata and Aldo Conca), *"Multidegrees, prime ideals, and non-standard gradings"*, Advances in Mathematics 435 (2023) 109361,
arXiv:2208.07238.
29. (with Federico Castillo, Fatemeh Mohammadi and Jonathan Montaño), *"K-polynomials of multiplicity-free varieties"*,
arXiv:2212.13091.
30. (with Ilya Smirnov), *"Effective generic freeness and applications to local cohomology"*, Journal of the London Mathematical Society, Volume110, Issue 4, October 2024,
arXiv:2302.08196.
31. *"Relative mixed multiplicities and mixed Buchsbaum-Rim multiplicities"*,
arXiv:2311.15105.
32. *"Polar multiplicities and integral dependence"*, International Mathematics Research Notices 2024, 00(0), 1–18,
arXiv:2401.10198.
33. (with Jack Jeffries), *"Uniformity in nonreduced rings via Noetherian operators"*, to appear in International Mathematics Research Notices,
arXiv:2404.02057.
34. (with Claudia Polini and Bernd Ulrich), *"Multidegrees, families, and integral dependence"*,
arXiv:2405.07000.
35. (with Yupeng Li and Jacob P. Matherne), *"Log-concavity of polynomials arising from equivariant cohomology"*,
arXiv:2411.17572.
36. (with Yupeng Li and Jacob P. Matherne), *"Log-concavity of polynomials arising from equivariant cohomology"*, FPSAC 2025 Proceedings, Séminaire Lotharingien de Combinatoire 93B (2025) Art. 68, 12 pp.
37. *"Mixed Segre zeta functions and their log-concavity"*,
arXiv:2507.06424.
38. (with Jacob P. Matherne and Anna Shapiro), *"Syzygies of polymatroidal ideals"*,
arXiv:2507.13153.

AWARDS, GRANTS & FELLOWSHIPS

- 09/2025–08/2027: NSF Grant DMS #2502321, *"Multigraded structures in Algebra, Geometry, and Combinatorics"*, ($119,093).
- 09/2025–08/2030: Simons Foundation, *Travel Support for Mathematicians*, ($37,635).
- 06/02/2025–06/06/2025: Participation in a *Collaborate@ICERM* Group, Institute for Computational and Experimental Research in Mathematics, Brown University, Providence.
- 03/2023: Awarded the *Heisenberg Programme* from the Deutsche Forschungsgemeinschaft (DFG). Declined in favor of an Assistant Professor position at North Carolina State University.
- 11/2022 – 12/2022: *Oberwolfach Research Fellow*, MFO, Oberwolfach Research Institute for Mathematics.
- 06/2022 – 07/2022: *Professore Visitatore in Italia (Visiting Professor)*, supported by Istituto Nazionale di Alta Matematica "Francesco Severi" – Gruppo Nazionale per le Strutture Algebriche, Geometriche e le loro Applicazioni (INdAM-GNSAGA), University of Genova.
- 10/2021 – 09/2024: *Postdoctoral Fellowship Research Foundation Flanders (FWO)*, Ghent University & KU Leuven, Belgium.
- 09/2016 – 08/2019: *Marie Skłodowska-Curie Fellowship*, Universitat de Barcelona, Barcelona, Spain.

- 09/2015 – 08/2016: Awarded a *fully funded scholarship to pursue the Postgraduate Diploma in Mathematics at ICTP*, Trieste, Italy.
- Extraordinary Doctorate Award, Universitat de Barcelona, 2019.
- Winner of the top student prize in Mathematics in International Centre for Theoretical Physics, 2016.
- One of the 10 selected students in the Postgraduate Diploma Programme in Mathematics in International Centre for Theoretical Physics, 2015.
- Best graduate student in 2014 in the Universidad Central "Marta Abreu" de Las Villas, 2014.
- SILVER MEDAL in the XV Iberoamerican Mathematical Olympiad, 2012.
- BRONZE MEDAL in the XIII Iberoamerican Mathematical Olympiad, 2010.
- BRONZE MEDAL in the Caribbean Regional Final of the Latin American programming ACM-ICPC, 2012.

RESEARCH VISITS

- Basque Center for Applied Mathematics, 2 weeks, 16/10/2023 – 27/10/2023, host: Ilya Smirnov.
- Basque Center for Applied Mathematics, 1 week, 10/10/2022 – 15/10/2022, host: Ilya Smirnov.
- University of Notre Dame & Purdue University, 1 month, 03/2022, hosts: Claudia Polini & Bernd Ulrich.
- University of Genova, 1 month, 07/2022, host: Aldo Conca.
- Universidad de Sevilla, 1 week, 22/04/2019 – 26/04/2019, host: Francisco Jesús Castro Jiménez.
- International Centre for Theoretical Physics, 1 week, 11/02/2019 – 15/02/2019, host: Tarig Abdelgadir.
- Polictenico di Torino, 1 week, 05/11/2018 – 09/11/2018, host: Aron Simis.
- Johannes Kepler University Linz, 2 months, 10/2018 – 11/2018, host: Josef Schicho.
- INRIA Sophia Antipolis, 6 months, 10/2017 – 03/2018, host: Lurent Busé.

INVITED TALKS

- *"Matroid Schubert varieties"*, Arbeitsgemeinschaft "Combinatorial Hodge Theory", Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany, October 2025.
- *"Noetherian operators in Commutative Algebra"*, 50th Annual Spring Lecture Series, University of Arkansas, Fayetteville, May, 2025.
- *"Log-concavity of polynomials arising from equivariant cohomology"*, Commutative Algebra in The South, Conference in Georgia State University, Atlanta, April 2025.
- *"Log-concavity of polynomials arising from equivariant cohomology"*, Special Year Seminar, Institute for Advanced Study, Princeton, March 2025.
- *"Multiplicities and integral dependence"*, Algebra and Combinatorics seminar, North Carolina State University, September 2024.
- *"Numerical criteria for integral dependence and their behavior in families"*, Seminar on Commutative Algebra and Algebraic Geometry, UC Berkeley, March 2024.
- *"Duality and blow-up algebras"*, Algebra and Combinatorics seminar, North Carolina State University, January 2024.
- *"Multidegrees, polymatroids and Schubert polynomials"*, Complex Geometry Seminar, Institut de Mathématiques de Toulouse Université Paul Sabatier, November 2023.
- *"Some lectures on multidegrees"*, 28th National School on Algebra Interactions between Algebra and Geometry, Bucharest, Romania, June 2023.
- *"Duality and blow-up algebras"*, Foundations of Computational Mathematics, Sorbonne Université, June 2023.
- *"Duality and blow-up algebras"*, Algebra Seminar, Institute of Mathematics, Osnabrück University, April 2023.
- *"Multidegrees at the crossroads of Algebra, Geometry, and Combinatorics"*, Colloquium, Department of Mathematics, Auburn University, January 2023.

- *"Multidegrees at the crossroads of Algebra, Geometry, and Combinatorics"*, Colloquium (online), Department of Mathematics, New Mexico State University, January 2023.
- *"Multidegrees at the crossroads of Algebra, Geometry, and Combinatorics"*, Colloquium, Department of Mathematics, North Carolina State University, January 2023.
- *"K-polynomials of multiplicity-free varieties"*, Conference: "Written Geometry: Commutative Algebra", CIRM, Luminy, France, January 2023.
- *"Double Schubert polynomials do have saturated Newton polytopes"*, Geometry meets Combinatorics in Bielefeld, Germany, September 2022.
- *"The fiber-full scheme and applications"*, Algebra & Geometry Seminar, University of Genova, Italy, July 2022.
- *"Describing non-reduced schemes with differential operators"*, Workshop on Differential Algebra, MPI Leipzig, Germany, June 2022.
- *"Double Schubert polynomials do have saturated Newton polytopes"*, AMS 2022 Spring Western Virtual Sectional Meeting (online), May 2022.
- *"A local study of the fiber-full scheme"*, AMS Spring Central Virtual Sectional Meeting, Purdue University, USA, March 2022.
- *"Differential primary decomposition of modules"*, Congreso Bienal de la Real Sociedad Matemática Española 2022, Universidad de Castilla - La Mancha, Ciudad Real, Spain, January 2022.
- *"Double Schubert polynomials do have saturated Newton polytopes"*, Congreso Bienal de la Real Sociedad Matemática Española 2022, Universidad de Castilla - La Mancha, Ciudad Real, Spain, January 2022.
- *"An invitation to the fiber-full scheme"*, Seminar Number Theory and Algebraic Geometry, KU Leuven, Leuven, Belgium, November 2021.
- *"An invitation to the fiber-full scheme"*, Jornada de Jóvenes Doctores en Geometría Algebraica, Universitat de Barcelona, Barcelona, Spain, November 2021.
- *"The fiber-full scheme"*, Fellowship of the Ring seminar (online), October 2021.
- *"Convex bodies and graded families of ideals"*, Society for Industrial and Applied Mathematics, Applied Algebraic Geometry Conference (online), August 2021.
- *"Primary decomposition with differential operators"*, ICERM conference (online): D-modules, Group Actions, and Frobenius: Computing on Singularities, August 2021.
- *"Primary decomposition with differential operators"*, Simon Fraser University Number Theory and Algebraic Geometry Seminar (online), July 2021.
- *"Primary decomposition with differential operators"*, Mathematical Congress of the Americas (online), July 2021.
- *"Convex bodies and graded families of monomial ideals"*, IIT Bombay Virtual Commutative Algebra Seminar (online), July 2021.
- *"Multigraded algebras and multigraded linear series"*, Technische Universität Berlin (online), June 2021.
- *"Equations and multidegrees for inverse symmetric matrix pairs"*, Effective Methods in Algebraic Geometry MEGA 2021 (online), May 2021.
- *"Primary decomposition with differential operators"*, Seminari de Geometria Algebraica de Barcelona (online), April 2021.
- *"Primary ideals and differential operators"*, The MAX computer algebra seminar (online), February 2021.
- *"When are multidegrees positive?"*, Ghent Algebra and Geometry Seminars Weekly Research Seminars, Ghent, Belgium, November 2020.
- *"Ehrenpreis-Palamodov theorem in commutative algebra"*, Differential Operators in Commutative Algebra Seminar (online), July 2020.
- *"Specialization of graded modules and generic freeness of local cohomology"*, Nonlinear Algebra Seminar Online, March 2020.
- *"Noetherian operators, primary submodules and symbolic powers"*, V congreso de jóvenes investigadores RSME, Castellón, Spain, January 2020.

- *"Noetherian operators, primary submodules and symbolic powers"*, Algebra Seminar, Osnabrück, Germany, November 2019.
- *"Rational maps, syzygies and specialization"*, Seminar on Nonlinear Algebra, Leipzig, Germany, September 2019.
- *"Ehrenpreis – Palamodov Theorem"*, Second edition of the conference: Computing with D-modules, Leipzig, Germany, September 2019.
- *"Specialization of rational maps"*, Society for Industrial and Applied Mathematics, Applied Algebraic Geometry Conference, Bern, Switzerland, July 2019.
- *"Rational maps and syzygies"*, Seminario de Álgebra de la Universidad de Sevilla, Sevilla, Spain, April 2019.
- *"Saturated special fiber ring and rational maps"*, Seminari de Geometria Algebraica de Barcelona, Barcelona, Spain, March 2019.
- *"Saturated special fiber ring and rational maps"*, Mathematics Seminar, International Centre for Theoretical Physics, Italy, February 2019.
- *"Rational maps and the saturated special fiber ring"*, Joint Meeting of the Czech, Slovenian, Austrian, Slovak and Catalan Mathematical Societies, Bratislava, Slovakia, September 2018.
- *"Degree and birationality of multi-graded rational maps"*, ARCADES Doctoral School II and ESR Days in Barcelona, Barcelona, Spain, September 2018.
- *"Regularity and Gröbner bases of the Rees algebra of edge ideals of bipartite graphs"*, XVI Encuentro de Álgebra Computacional y Aplicaciones (EACA), Zaragoza, Spain, July 2018.
- *"Regularity of bicyclic graphs and their powers"*, IPPI Workshop 2018 (post-Pragmatic 2017 event), Turin, Italy, March 2018.
- *"Regularity and Gröbner bases of the Rees algebra of edge ideals of bipartite graphs"*, Journées Nationales de Calcul Formel, CIRM, Luminy, France, January 2018.
- *"A D-module approach on the equations of the Rees algebra"*, Séminaire d'algèbre, topologie et géométrie, University of Nice, France, November 2017.
- *"Bounding the degrees of a minimal μ-basis for a rational surface parametrization"*, Society for Industrial and Applied Mathematics, Applied Algebraic Geometry Conference, Atlanta, United States, August 2017.
- *"Bounding the degrees of a minimal μ-basis for a rational surface parametrization"*, Effective Methods in Algebraic Geometry MEGA 2017, Nice, France, June 2017.
- *"Bounding the degrees of a minimal μ-basis for a rational surface parametrization"*, Seminari de Geometria Algebraica de Barcelona, Barcelona, Spain, March 2017.

CONFERENCES & WORKSHOPS

- Arbeitsgemeinschaft "Combinatorial Hodge Theory", Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany, October 2025.
- Conference: "Written Geometry: Commutative Algebra", CIRM, Luminy, France, January 2023.
- Workshop on Differential Algebra, MPI Leipzig, Germany, June 2022.
- Mathematical Congress of the Americas 2021 (online), July 2021.
- Summer School on Randomness and Learning in Non-Linear Algebra, Leipzig, Germany, July 2019.
- Thematic Program in Commutative Algebra and its Interaction with Algebraic Geometry. In Honor of Bernd Ulrich. Notre Dame University, United States, June 2019.
- Learning Week III in ARCADES, Nice, France, March 2019.
- Second ARCADES Software & Industrial Workshop, Cambridge, UK, January 2019.
- Frobenius Action in Commutative Algebra: Recent Developments, Barcelona, Spain, January 2019.
- Macaulay2 Workshop, Leipzig, Germany, June 2018.
- Learning Week II in ARCADES, Nice, France, March 2018.
- Workshop on Commutative Algebra, Syzygies and Singularities, Nice, France, December 2017.
- First Software & Industrial Workshop, and Midterm Review ARCADES, Athens, Greece, November 2017.

- Research school in Algebraic Geometry and Commutative Algebra, Pragmatic 2017, Catania, Italy, June 2017.
- Learning Week I in Algebraic Representations in Computer-Aided Design for complEx Shapes (ARCADES), Nice, France, March 2017.
- 1st Doctoral School ARCADES, Oslo, Norway, December 2016.
- Workshop in Algebra, Algebraic Geometry, Algebraic Topology and Applications sponsored by Centro de Investigaciones en Matemáticas(CIMAT, Guanajato, México) in Ciego de Avila, Cuba, 2014.

ORGANIZATIONAL ACTIVITIES

- Program Committee of the conference *"Computer Algebra in Scientific Computing 2024"*, Rennes, France, September 2024.
- Member of the Organizing Committee of the minisymposia *"Differential Equations in Algebraic Geometry and Beyond"*, 2021 SIAM Conference on Applied Algebraic Geometry (online), August 2021.
- Member of the Organizing Committee of the minisymposia *"Syzygies and applications to Geometry"*, 2019 SIAM Conference on Applied Algebraic Geometry, Bern, Switzerland, July 2019.

TEACHING EXPERIENCE

North Carolina State University	01/2024 –
Introduction to Toric Varieties	Fall 2025
Computer Algebra II	Spring 2025
Computer Algebra I	Fall 2024
KU Leuven	08/2022 – 12/2023
Supervisor of three Bachelor Projects in Pure Mathematics	Fall 2022
Ghent University	10/2020 – 07/2022
Calculus	Spring 2021
Universidad Central "Marta Abreu" de las Villas	09/2014 – 07/2015
Differential Geometry of Curves and Surfaces	Spring 2015
Topology	Fall 2014

LANGUAGES

Spanish: Mother tongue.
English: Fluent.
Dutch: Intermediate (level B1).

COMPUTER SKILLS

C/C++, JAVA, LaTeX, Linux, Wolfram Mathematica, MACAULAY2, SINGULAR.