David Holmes

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Academic positions

2023≤ **Professor**, *University of Leiden*
2021 - 2023 **Associate Professor (UHD)**, *University of Leiden*
2014 - 2021 **Assistant Professor (UD)**, *University of Leiden*, (tenured since June 2017)
2012 - 2014 **Postdoc**, *University of Leiden*
4 - 8/2012 **Visiting researcher**, *University of Hamburg*
2008 - 2012 **PhD with Samir Siksek**, *University of Warwick*, awarded 10 Dec 2012
2007 - 2008 **Part III Mathematics**, *Christ's College Cambridge*, Distinction
2004 - 2007 **BSc Mathematics**, *University of Warwick*, 1st class Hons

Recent grants and awards

2025-2030 **ERC Consolidator grant**, *'Enumerative and Arithmetic Geometry of Logarithmic Curves'*, (2,000k€, individual research grant)
2021-2026 **NWO Vidi grant**, *'Degeneration of group structures in families of algebraic varieties'*, (800k€, individual research grant)
2022-2023 **Van Gogh Programme grant**, *'Spin double ramification cycles and applications'*, with Adrien Sauvaget
2019 **Foundation Composito Mathematica conference grant**, *to support a workshop organised with Lenny Taelman and Tim Dokchitser (postponed due to COVID)*
2019 **DIAMANT conference grant**, *to support a workshop organised with Lenny Taelman and Tim Dokchitser*
2019 **DIAMANT small grant**, *to support the Intercity Geometry Seminar, and the visit of Samouil Molcho*

PhDs and postdocs

Postdocs

2022-2024 **Leo Herr**, Leiden, funded by NWO Vidi
2021-2022 **Lawrence Barrott**, Leiden, funded by NWO Vidi
2021-2022 **Remy van Dobben de Bruyn**, Leiden

PhD students in progress

2023-2027 **Amira Tlemsani**, *Double ramification cycles for surfaces*, Leiden, funded by NWO Vidi

2022-2026 **George Politopoulos**, *Combinatorics and geometry of moduli of curves*, (cosupervised with Adrien Sauvaget), Leiden/l'Université de Cergy Pontoise, partly funded by NWO Vidi

PhD students graduated:

2020-2024 **Pim Spellier**, *Counting curves and their rational points*, Leiden, funded by NWO Vidi
Cum Laude, winner of the KWG PhD prize

2018-2023 **Rosa Schwarz**, *Logarithmic Approach to the Double Ramification Cycle*, Leiden, funded by NWO
Honourable Mention for the Christiaan Huygens PhD prize

2018-2022 **Ruihua Wang**, *Explicit computation of the height of a Gross-Schoen Cycle*, (cosupervised with R. de Jong), Leiden, funded by CRC scholarship

2016-2019 **Garnet Akeyr**, *Dual complexes of semistable varieties*, Leiden, funded by NSERC scholarship

2014-2017 **Raymond van Bommel**, *Models of curves: The Birch and Swinnerton-Dyer conjecture & ordinary reduction*, (cosupervised with F. Pazuki), Leiden/Copenhagen

2014-2017 **Giulio Orecchia**, *A monodromy criterion for existence of Néron models and a result on semi-factoriality*, (cosupervised with Q. Liu), Leiden/Bordeaux, funded by ALGANT consortium

Recent service

External

2021- **Managing editor for journal Compositio Mathematica**

2022, 2023 **Selection committee for NWO 'M' grants**

2020- **Member of Publications Committee of Platform Wiskunde Nederland**

Within Leiden MI

2024 **Strategy committee**

2023 - **Admissions committee bachelor mathematics**

2022 - **Diversity and Inclusion committee of the MI (founding member, vice-chair from 2024)**

2022 -2023 **Selection committee for full professor in Mathematics of Artificial Intelligence**

2021 -2024 **Institute Council**, *vice-chair from 2022*

2017-2022 **Study advisor**, *master's students in algebra, geometry and number theory*

2017-2022 **Mathematics Education Committee**, *member*

Selected recent seminars and conferences organised

2023- **Belgian-Dutch Algebraic Geometry Seminar** *(with B. Moonen, J. Nicaise, L. Taelman, N. Budur, M. Kool).*

2022 **Intercity Geometry Seminar on Condensed mathematics** *(with B. Moonen, L. Taelman, R. van Dobben de Bruyn).*

2021 **Dutch Algebraic Geometry Seminar** *(online, local organiser for Leiden)*.

2020-2021 **Differentials and b-Chow seminar** *(online, with J. Schmitt)*.

2019 **Intercity Geometry Seminar: The logarithmic Picard group and its tropicalization** *(national seminar, with C. Lazda, A. Sauvaget and A. Smeets)*.

2019 **DIAMANT meets GQT: Arithmetic and geometry** *(session of the NMC (Dutch Mathematical Congress), with M. Kool)*.

2018 **Intercity Geometry Seminar: Mirror Symmetry and moduli spaces of Higgs bundles** *(national seminar, with C. Lazda and A. Smeets)*.

Publications (peer reviewed international journals)

2025 **Logarithmic double ramification cycles** *(with S. Molcho, R. Pandharipande, A. Pixton, J. Schmitt)*,
arXiv:2207.06778, to appear in Inventiones Math.

2024 **Rings of Siegel-Jacobi forms of bounded relative index are not finitely generated** *(with A. M, Botero, J. I. Burgos Gil, R. de Jong)*,
arXiv:2203.14583, Duke Math. J. 173(12): 2315–2396.

2023 **Pixton's formula and Abel-Jacobi theory on the Picard stack** *(with Y. Bae, R. Pandharipande, J. Schmitt, and R. Schwarz)*,
arXiv:2004.08676, Acta Mathematica 230:2, 205–319 (2023).

2023 **Models of Jacobians of curves** *(with S. Molcho, G. Orecchia, T. Poiret)*,
arXiv:2007.10792, J. Reine Angew. Math. (Crelle's Journal), vol. 2023, no. 801, 2023, pp. 115-159.

2023 **Logarithmic moduli of roots of line bundles on curves** *(with G. Orecchia)*,
arXiv:2201.06869, Expo. Math. 41, No. 3, 577–602, special edition in memory of Bas Edixhoven.

2022 **Logarithmic intersections of double ramification cycles** *(with R. Schwarz)*,
arXiv:2104.11450, Algebraic Geometry 9 (5)(2022), doi: 10.14231/AG-2022-017.

2022 **Chern-Weil and Hilbert-Samuel formulae for singular hermitian line bundles** *(with A. M, Botero, J. I. Burgos Gil, R. de Jong)*,
arXiv:2112.09007, Doc. Math. 27, 2563–2623.

2022 **Improving estimations of life history parameters of small animals in mesocosm experiments: A case study on mosquitoes** *(with M. Dellar, S. P. Boerlijst)*,
https://doi.org/10.1111/2041-210X.13814, Methods in Ecology and Evolution.

2021 **A Néron model of the universal jacobian**,
arXiv:1412.2243, Ann. Henri Lebesgue 4, 1727–1766 (2021)

2021 **Infinitesimal structure of the pluricanonical double ramification locus** *(with Johannes Schmitt)*,
arXiv:1909.11981, Compositio Math., Vol. 157, No. 10 (2021), pp. 2280 - 2337.

2020 **Fine compactified moduli of enriched structures on stable curves** *(with Owen Biesel)*,
arXiv:1607.08835, Memoirs of the AMS vol. 1416.

2020 **Fields of definition of curves of a given degree** *(with Nick Rome)*, arXiv:1901.11294, Journal de Théorie des Nombres de Bordeaux, Vol. 32, No. 1 (2020), pp. 291-310.

2020 **The norm of the saturation of a binomial ideal, and applications to Markov bases**, arxiv:1907.10268, Algebraic Statistics, Vol. 11 (2020), No. 2, 169–187 DOI: 10.2140/astat.2020.11.169.

2019 **Extending the double ramification cycle by resolving the Abel-Jacobi map**, arXiv:1707.02261, , `https://doi.org/10.1017/S1474748019000252`, J. Inst. Math. Jussieu 20, No. 1, 331–359 (2021).

2019 **Multiplicativity of the double ramification cycle** *(with Aaron Pixton and Johannes Schmitt)*, arXiv:1711.10341, Doc. Math. 24, 545-562 (2019), DOI: 10.25537/dm.2019v24.545-562.

2019 **Empirical and dynamic approaches for modelling the yield and N content of European grasslands** *(with Martha Dellar, Kairsty Topp, Guillermo Pardo, Agustin del Prado, Nuala Fitton, Georgios Banos, Eileen Wall)*, `https://doi.org/10.1016/j.envsoft.2019.104562`, Environmental Modelling and Software.

2019 **Explicit arithmetic intersection theory and computation of Néron-Tate heights** *(with Steffen Muller and Raymond van Bommel)*, arXiv:1809.06791, Math. Comput. 89, No. 321, 395–410 (2020) `https://doi.org/10.1090/mcom/3441`.

2019 **Torsion points and height jumping in higher-dimensional families of abelian varieties**, arXiv:1604.04563, `https://doi.org/10.1142/S179304211950101X`, Int. J. Number Theory 15, No. 9, 1801–1826 (2019).

2019 **Néron models of jacobians over base schemes of dimension greater than 1**, arXiv:1402.0647 J. Reine Angew. Math. 747 (2019), 109–145. DOI 10.1515/crelle-2016-0014

2018 **Singularity of the biextension metric for families of abelian varieties** *(with J. Burgos Gil and R. de Jong)*, arXiv:1604.00686, Forum of Mathematics, Sigma, 6, E12. doi:10.1017/fms.2018.13.

2018 **Extending the Double Ramification Cycle using Jacobians** *(with J. Kass and N. Pagani)*, arXiv:1712.07098, Eur. J. Math. 4, No. 3, 1087–1099 (2018) `https://doi.org/10.1007/s40879-018-0256-7`.

2017 **Positivity of the height jump divisor** *(with J. Burgos Gil and R. de Jong)*, arXiv:1701.00370, International Mathematics Research Notices, Vol. 2019, Issue 7, Pages 2044–2068, `https://doi.org/10.1093/imrn/rnx169`.

2017 **Néron models and the height jump divisor** *(with O. Biesel and R. de Jong)*, arXiv:1412.8207, Trans. Amer. Math. Soc. 369 (2017), 8685-8723.

2016 **Quasi-compactness of Néron models, and an application to torsion points**, arXiv:1604.01155, Manuscripta Math doi:10.1007/s00229-016-0887-2.

2015 **The Brauer-Manin obstruction on Kummer varieties and ranks of twists of abelian varieties** *(with R. Pannekoek)*, Bull. London Math. Soc. **47**, arXiv:1404.3641.

2015 **Asymptotics of the Néron height pairing** *(with R. de Jong)*, arXiv:1304.4768, Math. Res. Lett. **22**, No. 5, 1337-1371.

2014 **An Arakelov-theoretic approach to naïve heights on hyperelliptic jacobians**, arXiv:1207.5948,New York J. Math. **20**, 927-957

2012 **Computing Néron-Tate heights of points on hyperelliptic jacobians**, arXiv:1004.4503J. Number Theory **132**, 1295-1305

Other publications

2022 **Steps towards openness and fairness in scientific publishing** *(with J. Briët and R.J. Kang)*, https://ir.cwi.nl/pub/31565, Nieuw Archief voor Wiskunde, 5(23), 53 - 55. ISSN 0028-9825.

2012 **Néron-Tate heights on the jacobians of high-genus hyperelliptic curves**, PhD thesis, University of Warwick

Preprints

2024 **Double ramification cycles within degeneracy loci via moduli of roots** *(with A. Chiodo)*, arXiv:2407.09086.

2023 **Logarithmic cohomological field theories** *(with P. Spelier)*, arXiv:2308.01099, submitted.

2022 **Points of non-linearity of functions generated by random neural networks**, arXiv:2304.09837.

2022 **A tale of two moduli spaces: logarithmic and multi-scale differentials** *(with D. Chen, S. Grushevsky, M. Möller, J.Schmitt)*, arXiv:2212.04704, submitted.

2021 **Divisorial and geometric gonality of higher-rank tropical curves** *(with J. van Dobben de Bruyn and D. van der Vorm)*, arXiv:2112.04205.

Recent international conference talks

2024 **Birational theory of double ramification cycles**, *Moduli Spaces and Modular Forms*, Schiermonikoog

2024 **The DR cycle and the parasite curve**, *Logs in Cam*, Cambridge, UK

2023 **Measuring when a line bundle on a curve is trivial**,
Global invariants of arithmetic varieties,
CIRM Luminy

2023 **Cohomological field theories for logarithmic curves**,
Curves: Algebraic, Tropical, and Logarithmic,
BIRS Banff

2023 **On the locus where a line bundle on a curve is trivial**,
Recent trends in algebraic geometry,
Oberwolfach

2023 **Coefficients of higher powers of r in Chiodo classes**,
Moduli spaces of curves workshop,
Les Diablerets

2023 **Detecting when a line bundle is (log) trivial**,
Workshop Logarithmic Geometry and Moduli Spaces,
Frankfurt

2022 **Double ramification cycles**,
Recent Advances on Moduli Spaces of Curves,
Leysin

2022 **Formulae for logarithmic double ramification cycles**,
Recent Advances on Moduli Spaces of Curves,
Leysin

2022 **Introduction to LogChow**,
Coding Intersection theory,
Les Diablerets

2021 **Piecewise polynomials on the moduli space of curves**,
Helvetic Algebraic Geometry workshop,
Geneva

Recent seminar and colloquium talks

2024 **Measuring when a line bundle on a curve is trivial**,
Algebraic and arithmetic geometry seminar,
Pisa

2024 **The locus where a line bundle is trivial**,
Algebraic Geometry Seminar,
Jussieu

2023 **The Double ramification Cycle via Riemann-Roch**,
Seminar,
Universiteit van Amsterdam

2022 **Introduction to adic spaces, after Huber**,
Intercity geometry seminar,
Universiteit van Amsterdam

2022 **Spin DR cycles**,
Tropical/algebraic geometry seminar,
Jussieu, Paris

2021 **The double-double ramification cycle**,
Algebraic geometry seminar (online),
HU Berlin

2021 **The double-double ramification cycle**,
Algebraic geometry seminar (online),
Padova

2020 **Geometry of the double ramification cycle**,
Algebraic geometry seminar (online),
Milano

2020 **Geometry of the double ramification cycle**,
Algebraic geometry seminar,
Cambridge University

2019 **The universal double ramification cycle**,
Algebraic geometry and moduli seminar,
ETH Zürich

Minicourses

2024 **Logarithmic and tropical intersection theory**,
GAEL,
Torino

2023 **Line bundles on logarithmic curves and the double ramification cycle**,
Moduli spaces of vector bundles,
Cergy-Pontoise

Teaching and supervising

Qualifications

2015 **Basis kwalificatie onderwijs**, *(basic Dutch university teaching qualification)*, Leiden

Master's students

2021 **Giorgio Spadaccini**, *Algebraic Statistics*, University of Leiden

2017 **Rosa Schwarz**, *Intersection theory on Picard stacks of genus-0 curves*, University of Leiden

2017 **Martin Heemskerk**, *Derived equivalence of singular varieties*, University of Leiden

2017 **Sergej Monavari**, *Line bundles on twisted curves*, University of Leiden

2016 **Arend de Jonge**, *Minimal desingularisations of aligned nodal curves*, University of Leiden

2014 **Raymond van Bommel**, *Almost all hyperelliptic jacobians have a bad semi-abelian prime*, University of Leiden

2014 **Erik Visse**, *Local computations on the Cassels-Tate pairing on an elliptic curve*, (with R. Newton), University of Leiden

2013 **Michele Serra**, *Smooth models of curves*, University of Leiden

Bachelor students supervised

2022 **Jorre The**, *Enriched categories as metric spaces*, University of Leiden

2020 **David van der Vorm**, *Gonalities of metric graphs*, University of Leiden

2018 **Wim Nijgh**, *Differential geometry via sheaves*, University of Leiden

2015 **Floris Ruijter**, *Homotopy types of non-Hausdorff manifolds*, University of Leiden

2014 **Anne Hommelberg**, *Compact non-Hausdorff manifolds*, University of Leiden

Interns

2016 **Noémie Gaveau**, *Origami and constructible numbers*, ENS Rennes

Recent courses taught

Autumn 2024 **Commutative Algebra**, *national graduate course*, (with Marta Pieropan)

Spring 2024 **Topics in Algebraic Geometry**, *graduate seminar course*

Autumn 2023 **Commutative Algebra**, *national graduate course*, (with Marta Pieropan)

Autumn 2023 **Wiskundige Structuren Werkgroep**

Spring 2023 **Topics in Algebraic Geometry**, *graduate seminar course*

Autumn 2022 **Commutative Algebra**, *national graduate course*, (with Marta Pieropan)

Spring 2022 **Topics in Algebraic Geometry**, *graduate seminar course*

Autumn 2021 **Algebraic Curves**, *bachelor/master's course*

Autumn 2021 **Commutative Algebra**, *national graduate course*, (with Simon Pepin Lehalleur)

Spring 2021 **Topics in Algebraic Geometry**, *graduate seminar course*