Alexander Mieczyslaw Kasprzyk

PERSONAL INFORMATION

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EMPLOYMENT

Associate Professor (Reader) in Geometry
University of Nottingham, UK — Aug 2015–present

Secondment to the Heilbronn Institute
Heilbronn Institute for Mathematical Research, UK — Sep 2017–Aug 2019

Research Fellow
Imperial College London, UK — Dec 2014–Jul 2015

Postdoctoral Research Associate
Imperial College London, UK — Jan 2011–Nov 2014

Research Fellow
University of Sydney, Australia — Nov 2009–Dec 2010

Postdoctoral Research Associate
University of Kent, UK — Oct 2008–Oct 2009

Postdoctoral Research Fellow
University of New Brunswick, Canada — Sep 2006–Sep 2008

CONSULTANCY

Centre for Emerging Technology and Security, UK — Jun 2023–Jan 2024

Heilbronn Institute for Mathematical Research, UK — Sep 2019–present

EDUCATION

University of Bath, UK — 2002–2006
Ph.D. in Mathematics

University of Oxford, UK — 1998–2002
MMath in Mathematics

REFEREED PUBLICATIONS

Where relevant, the number of citations is included in [red] (data collected from Google Scholar). As of Dec 2023 my work (including preprints omitted here) has been cited over 1500 times.

(39) The Rapid Rise of Generative AI: Assessing risks to safety and security.
A. Janjeva, A. Harris, S. Mercer, A. Kasprzyk, A. Gausen, *Centre for Emerging Technology and Security* Research Report (2023).

(38) Machine learning detects terminal singularities. [1]
T. Coates, A. Kasprzyk, S. Veneziale, *Neural Information Processing Systems (NeurIPS)* (2023).

(37) Machine learning the dimension of a Fano variety. [2]
T. Coates, A. Kasprzyk, S. Veneziale, *Nature Communications* **14**:5526 (2023).

(36) Computation and data in the classification of Fano varieties.
G. Brown, T. Coates, A. Corti, T. Ducat, L. Heuberger, A. Kasprzyk, *Nankai Symposium on Mathematical Dialogues*, Springer, 2023.

(35) Toric Sarkisov links of toric Fano varieties.
G. Brown, J. Buczyński, A. Kasprzyk, *Birational Geometry, Kähler–Einstein Metrics and Degenerations*, Springer, 2023, 129–144.

(34) Machine learning the dimension of a polytope. [2]
T. Coates, J. Hofscheier, A. Kasprzyk, *Machine Learning in Pure Mathematics and Theoretical Physics*, World Scientific, 2023, 85–104.

(33) Singularity content. [39]
M. Akhtar, A. Kasprzyk, To appear in *Kyoto J. Math.* (2023).

(32) Databases of quantum periods for Fano manifolds. [3]
T. Coates, A. Kasprzyk, *Nature Sci. Data* **9**:163 (2022).

(31) On the maximum dual volume of a canonical Fano polytope. [10]
G. Balletti, A. Kasprzyk, B. Nill, *Forum of Math., Sigma* **10** (2022), e109.

(30) On the Fine interior of three-dimensional canonical Fano polytopes. [10]
V. Batyrev, A. Kasprzyk, K. Schaller, *Interactions with Lattice Polytopes*, Springer, 2022, 11–47.

(29) Gorenstein formats, canonical and Calabi–Yau threefolds. [22]
G. Brown, A. Kasprzyk, L. Zhu, *Exp. Math.* **31**(1) (2022), 146–164.

(28) Laurent polynomials in mirror symmetry: why and how?
A. Kasprzyk, V. Przyjalkowski, *Proyecciones J. Math.* **41**(2) (2022), 481–515.

(27) Hilbert series, machine learning, and applications to physics. [18]
J. Bao, Y.-H. He, E. Hirst, J. Hofscheier, A. Kasprzyk, S. Majumder, *Phys. Lett. B* **827**:136966 (2022).

(26) Maximally mutable Laurent polynomials. [27]
T. Coates, A. Kasprzyk, G. Pitton, K. Tveiten, *Proceedings of the Royal Society A* **477**:20210584 (2021).

(25) Quantum periods for certain four-dimensional Fano manifolds. [16]
T. Coates, S. Galkin, A. Kasprzyk, A. Strangeway, *Exp. Math.* **29**(2) (2020), 183–221.

(24) Laurent inversion. [31]
T. Coates, A. Kasprzyk, T. Prince, *Pure Appl. Math. Q.* **15**(4) (2019), 1135–1179.

(23) *Appendix to* Four dimensional Fano quiver flag zero loci. [18]
T. Coates, E. Kalashnikov, A. Kasprzyk, *Proceedings of the Royal Society A* **475**:20180791 (2019).

(22) Ehrhart polynomial roots of reflexive polytopes. [14]
G. Hegedüs, A. Higashitani, A. Kasprzyk, *Electron. J. Combin.* **26**(1) (2019), P1.38.

(21) Fano 3-folds in $\mathbb{P}^2 \times \mathbb{P}^2$ format, Tom and Jerry. [16]
G. Brown, A. Kasprzyk, M. Qureshi, *Eur. J. Math.* **4**(1) (2018), 57–72.

(20) Minimality and mutation-equivalence of polygons. [38]
A. Kasprzyk, B. Nill, T. Prince, *Forum of Math., Sigma* **5** (2017), e18.

(19) Mutations of fake weighted projective planes. [24]
M. Akhtar, A. Kasprzyk, *Proc. Edinburgh Math. Soc. (2)* **59**(2) (2016), 271–285.

(18) Quantum periods for 3-dimensional Fano manifolds. [119]
T. Coates, A. Corti, S. Galkin, A. Kasprzyk, *Geom. Topol.* **20**(1) (2016), 103–256.

(17) Mirror symmetry and the classification of orbifold del Pezzo surfaces. [78]
M. Akhtar, T. Coates, A. Corti, L. Heuberger, A. Kasprzyk, A. Oneto, A. Petracci, T. Prince, K. Tveiten, *Proc. Amer. Math. Soc.* **144** (2016), 513–527.

(16) Four-dimensional projective orbifold hypersurfaces. [28]
G. Brown, A. Kasprzyk, *Exp. Math.* **25**(2) (2016), 176–193.

(15) Four-dimensional Fano toric complete intersections. [38]
T. Coates, A. Kasprzyk, T. Prince, *Proceedings of the Royal Society A* **471**:20140704 (2015).

(14) Mutations of fake weighted projective spaces. [1]
T. Coates, S. Gonshaw, A. Kasprzyk, N. Nabijou, *Electron. J. Combin.* **21**(4) (2014), P4.14.

(13) Mirror symmetry and Fano manifolds. [135]
T. Coates, A. Corti, S. Galkin, V. Golyshev, A. Kasprzyk, *Proceedings of the 6th European Congress of Mathematics*, European Mathematical Society, 2013, 285–300.

(12) Seven new champion linear codes. [19]
G. Brown, A. Kasprzyk, *LMS J. Comput. Math.* **16** (2013), 109–117.

(11) Small polygons and toric codes. [19]
G. Brown, A. Kasprzyk, *J. Symbolic Comput.* **51** (2013), 55–62.

(10) Fano polytopes. [41]
A. Kasprzyk, B. Nill, *Strings, Gauge Fields, and the Geometry Behind – The Legacy of Maximilian Kreuzer*, World Scientific, 2012, 349–364.

(9) Minkowski polynomials and mutations. [114]
M. Akhtar, T. Coates, S. Galkin, A. Kasprzyk, *SIGMA Symmetry Integrability Geom. Methods Appl.* **8** (2012), 094, pp. 707.

(8) Reflexive polytopes of higher index and the number 12. [20]
A. Kasprzyk, B. Nill, *Electron. J. Combin.* **19**(3) (2012), P9.

(7) The boundary volume of a lattice polytope. [10]
G. Hegedüs, A. Kasprzyk, *Bull. Aust. Math. Soc.* **85** (2012), 84–104.

(6) Roots of Ehrhart polynomials of smooth Fano polytopes. [10]
G. Hegedüs, A. Kasprzyk, *Discrete Comput. Geom.* **46**(3) (2011), 488–499.

(5) Canonical toric Fano threefolds. [100]
A. Kasprzyk, *Canad. J. Math.* **62**(6) (2010), 1293–1309.

(4) On the combinatorial classification of toric log del Pezzo surfaces. [42]
A. Kasprzyk, M. Kreuzer, B. Nill, *LMS J. Comput. Math.* **13** (2010), 33–46.

(3) Bounds on fake weighted projective space. [62]
A. Kasprzyk, *Kodai Math. J.* **32** (2009), 197–208.

(2) A note on palindromic δ-vectors for certain rational polytopes. [36]
M. Fiset, A. Kasprzyk, *Electron. J. Combin.* **15**(1) (2008), N18.

(1) Toric Fano three-folds with terminal singularities. [77]
A. Kasprzyk, *Tohoku Math. J.* **58**(1) (2006), 101–121.

Scientific Software & Databases

(7) The Fano 3-fold database. [6] doi:10.5281/zenodo.5820338
G. Brown, A. Kasprzyk, *Zenodo* (2022).

(6) Quantum periods for four-dimensional Fano manifolds. doi:10.5281/zenodo.5708307
T. Coates, A. Kasprzyk, *Zenodo* (2021).

(5) PCAS: A Parallel Computational Algebra System. https://www.pcas.xyz
T. Coates, A. Kasprzyk, 2017–present.

(4) The classification of toric canonical Fano 3-folds. [3] doi:10.5281/zenodo.5866330
A. Kasprzyk, (2010).

(3) Convex polytopes and polyhedra. [3] https://tinyurl.com/2p9cmuk9
G. Brown, A. Kasprzyk, (2009).

(2) Toric geometry. https://tinyurl.com/bdww76mc
G. Brown, J. Buczyński, A. Kasprzyk, (2009).

(1) Graded Ring Database. [138] http://www.grdb.co.uk
G. Brown, A. Kasprzyk, 2007–present.

Edited Volumes

(3) Angles of Geometry: Proceedings of the Nottingham Geometry Seminar.
L. Campo, J. Hofscheier, and A. Kasprzyk (eds), World Scientific, 2024.

(2) Recent developments in Algebraic Geometry.
H. Abban, G. Brown, A. Kasprzyk, and S. Mori (eds), London Mathematical Society Lecture Note Series, **478**, Cambridge University Press, 2022.

(1) Interactions with lattice polytopes.
A. Kasprzyk and B. Nill (eds), Springer Proceedings in Mathematics & Statistics, **386**, Springer, 2022.

Journal Editor-in-Chief

Experimental Mathematics 2023–present
Publishes formal results in pure mathematics inspired by experimentation, conjectures suggested by experiments, and data supporting significant hypotheses.

Journal Editorial Board Member

Fundamental Journal of Mathematics and Applications 2023–present
Publishes original research articles, review articles, and survey articles with a focus on number theory, geometry, and topology.

International Journal of Data Science in the Mathematical Sciences 2022–present
A highly interdisciplinary journal aimed at experimental mathematicians, both pure and applied, physicists, and data scientists, with a focus on machine learning.

Enumerative Combinatorics and Applications 2021–present
Covers research in enumerative combinatorics, focussing on research resulting from the rich interplay between mathematics and theoretical physics.

Experimental Results 2021–2023
An open access, open peer review journal providing a venue to publish all valid experimental findings, from all disciplines across STEM.

Policy Advice

Generative AI and National Security Dec 2023
Centre for Emerging Technology and Security

Global AI Safety Summit pre-Summit Royal Society Workshop Oct 2023
Science x AI Safety: Horizon-scanning AI safety risks across scientific disciplines

Global AI Safety Summit AI for Innovation Oct 2023
Department for Science, Innovation and Technology

Selected Grants

Since 2016 I have been awarded over £1M in external funding. With the exception of the grant indicated by ⋆ below, all are externally funded.

Project title	Role	Funder	Dates	Value
Computational Algebraic Geometry INI Network Grant	Co-I	INI	Apr 2023– Mar 2025	£15K
DANGER: Data, Numbers & Geometry INI Network Grant	PI	INI	Jan 2023– Dec 2024	£30K
PhD Sponsorship Four-year PhD studentship	PI	GCHQ	Oct 2020– Aug 2024	£45K
Constructing a Periodic Table for Geometry Tübingen–Nottingham seedcorn⋆	PI	Tübingen & Nottingham	Sep 2021– Sep 2023	€24K
Turing Network Development Award ATI Network Funding	Co-I	ATI	Feb– Sep 2022	£40K
The Combinatorics of Mirror Symmetry EPSRC Fellowship EP/N022513/1	PI	EPSRC	Jun 2016– Mar 2022	£551K
Algorithmic Methods in Algebraic Geometry Nottingham–Magma collaboration	PI	University of Sydney	Apr 2018– Mar 2021	£240K
Secondment Secondment to HIMR	PI	GCHQ	Oct 2017– Sep 2019	£53K
Computing toric Fano varieties Atlantic Excellence Network Fellowship	PI	ACEnet	Oct 2007– Sep 2009	$80K

Postdoc Supervision

Name	Dates
Johannes Hofscheier Progressed to Assistant Professor in Geometry at the University of Nottingham.	2020–2022
Livia Campo Progressed to a postdoc at the University of Birmingham with M. Mazzocco. Currently Research Fellow at the Korea Institute for Advanced Study (KIAS), Korea.	2020–2021
Giuseppe Pitton Progressed to a data science position at Deutsche Bank.	2018–2021
Michael Harrison Progressed to a software engineering position in industry.	2018–2021

Andrea Petracci 2017–2019
Progressed to a postdoc at Freie Universität Berlin with K. Altmann.
Currently Assistant Professor at the Università di Bologna, Italy.

PhD Supervision

Name	Role	Dates
Charles Yallup *Toric degenerations, mutations, and the associated cluster varieties*	Supervisor	2023–present
Heath Pearson *Mirror symmetry for spherical Fano varieties*	Supervisor	2023–present
Sara Veneziale *Machine learning Fano varieties from the quantum period* Progressed to a Chapman–Schmidt Fellowship in AI for Science, Imperial College.	Supervisor	2021–2023
Girtrude Hamm *Mirror symmetry for terminal Fano threefolds* Part-funded by a HIMR studentship (£45K).	Supervisor	2020–present
Thomas Hall *Four dimensional Fano varieties in the mirror* Part-funded by a JSPS pre-doctoral research bursary (£42K).	Supervisor	2019–present
Christopher Hall *Investigations into local class field theory over general fields* Progressed to an LMS Postdoctoral Fellowship.	Second Supervisor	2019–2023
Daniel Cavey *Mirror symmetry for orbifold del Pezzo surfaces* Progressed to a postdoc at the University of Lancaster with J. Evans.	Supervisor	2016–2019
Paolo Dolce *Low dimensional Adelic geometry* Progressed to a postdoc at the University of Udine, Italy.	Second Supervisor	2015–2018
Mohammad Akhtar *Mutations of Laurent polynomials and lattice polytopes* Progressed to a Hodge Fellowship at the IHÉS, France, with M. Kontsevich.	Supervisor	2011–2015

Invited Summer Schools & Lecture Series

University of Oxford, UK 3–7 Jul 2023
LMS Research School: Machine Learning in Mathematics and Theoretical Physics

Fraunhofer Institute for Industrial Mathematics, Germany 28 Nov–1 Dec 2022
Computational Geometry

Kyoto University, Japan 10–14 Dec 2018
Mirror Symmetry for Fano Manifolds and Related Topics

International Centre for Theoretical Physics (ICTP), Trieste, Italy 1–12 Aug 2016
Advanced school on Moduli Spaces, Mirror Symmetry, and Enumerative Geometry

University of Catania, Italy 16 Sep–4 Oct 2013
Pragmatic 2013*: Summer School on Mirror Symmetry and Fano Manifolds*

Organisation of Seminars & Conferences Since 2017

ICMS 2024: Machine Learning within Computer Algebra Systems 22–25 Jul 2024
Durham University, UK

Computational Geometry 23–28 Jun 2024
Banff international Research Station (BIRS), Canada

DANGER 3: Data, Numbers, & Geometry 24–25 Aug 2023
London Institute for Mathematical Sciences, UK

Computational Algebraic Geometry Workshop 27–31 Mar 2023
University of Warwick, UK

Online Machine Learning Seminar Feb 2023–present
Online

Computational Geometry 29 Aug–2 Sep 2022
University of Nottingham, UK

DANGER 2: Data, Numbers, & Geometry 25–26 Aug 2022

DANGER: Data, Numbers, & Geometry — 25–26 Aug 2021
Online

Fano varieties and Birational Geometry — 23–26 Feb 2021
Online

Sanya Workshop on Machine Learning in Geometry and Physics — 26–28 Jan 2021
Tsinghua Sanya International Mathematics Forum, Shanghai

COW/EmSG/GLEN Joint Summer School — 7–11 Sep 2020
Online

ICMS 2020: Databases in Mathematics — 13–16 Jul 2020
Braunschweig, Germany

Machine Learning in Algebraic Geometry — Jun 2020
University of Nottingham, UK

Online Algebraic Geometry Seminar — Apr 2020–present
Online

Lucia Geometrica: A Celebration of Geometry — 9–13 Dec 2019
Stockholm University, Sweden

Lattice polytopes, with a view towards Geometry and Applications — 18–20 Sep 2019
ICMS, Edinburgh, UK

Mutations: Mirror Symmetry, Deformations, and Combinatorics — 11–16 Aug 2019
Banff international Research Station (BIRS), Canada

Cluster algebras and algebraic geometry — 11–14 Jul 2018
University of Nottingham, UK

Interactions with Lattice Polytopes — 14–16 Sep 2017
Otto-von-Guericke-Universität Magdeburg, Germany

Experimental Classification of Fano Varieties — 16–18 Aug 2017
Universität Tübingen, Germany

Workshop on Computational Algebra — 18–21 Apr 2017
King's College, University of Cambridge, UK

Selected Invited Talks Since 2010

Universität Tübingen, Germany — Oct 2024
Workshop to celebrate Hausen's 60th birthday

Będlewo, Poland — Jul 2024
Fano and uniruled varieties

Institution for Engineering and Technology, London — Apr 2024
Centre for Emerging Technology and Security (CETaS) 2024 Showcase

TU Berlin, Germany — Jan 2024
Discrete and Convex Geometry Seminar

New Orleans, USA — Dec 2023
Conference on Neural Information Processing Systems (NeurIPS)

Schloss Dagstuhl, Germany — Oct 2023
Automated mathematics: integrating proofs, algorithms and data

International Centre for Theoretical Physics (ICTP), Trieste, Italy — Sep 2023
Workshop on Deformation Theory II

Technische Universität Berlin, Germany — Nov 2022
MOM workshop on MaRDI, OSCAR and MATHREPO

San Diego, USA — Sep 2022
SIAM Conference on Mathematics of Data Science

Boston University, USA — May 2022
Big Data in Pure Mathematics

University of Connecticut, USA — Mar 2022
Department Colloquium

Texas, USA — Aug 2021
SIAM Conference on Algebraic Geometry

Chern Institute of Mathematics, China — Aug 2021
Nankai Symposium on Mathematical Dialogues

Steklov Mathematical Institute, Russia — May 2020
Iskovskikh Seminar Series

University of Torino, Italy — Feb 2020
Algebraic Geometry – Torino 2020

Chicheley Hall, UK — Sep 2019
3CinG Workshop

University of Warwick, UK — Oct 2018
Classification, Computation, and Construction, New Methods in Geometry

Banach Center, Warsaw, Poland — Sep 2017
Periods and Ricci flat manifolds

Museum of Science and Industry, Manchester, UK — Sep 2017
Second Conference of Research Software Engineers

Universität Tübingen, Germany — Aug 2017
Experimental Classification of Fano Varieties

Johannes Gutenberg-Universität Mainz, Germany — Mar 2017
Cluster Algebras in Mathematical Physics

Freie Universität Berlin, Germany — Dec 2016
Einstein workshop on Lattice Polytopes

Banff International Research Station, Canada — Mar 2016
Homological Mirror Geometry

Hannover University, Germany — May 2015
Experimental Methods in Computational Algebra

University of Ulm, Germany — Feb 2015
Department Colloquium

Simons Center for Geometry and Physics, Stony Brook University, USA — Nov 2014
Wall Crossing, Quantum Integrable Systems, and TQFT

Max Planck Institute for Mathematics, Bonn, Germany — Sep 2014
Motivic Structures on Quantum Cohomology & Pencils of CY Motives

KTH Royal Institute of Technology, Stockholm, Sweden — Aug 2014
Algebra & Geometry Seminar

Freie Universität Berlin, Germany — Jul 2014
Combinatorics and Geometry Seminar

University of Vienna, Austria — Jun 2014
Geometry and Mathematical Physics Seminar

Miami University, USA — Jan 2014
Homological Mirror Symmetry

Colorado State University, USA — Aug 2013
SIAM Conference on Applied Algebraic Geometry

TU Berlin, Germany — Aug 2012
21st International Symposium on Mathematical Programming

Kyoto University, Japan — Jul 2012
Convex Polytopes

British Mathematical Colloquium, UK — Apr 2012
British Mathematical Colloquium: Number Theory and Algebraic Geometry

University of Sydney, Australia — Jan 2012
Department Colloquium

Freie Universität Berlin, Germany — Dec 2011
Extremal Laurent Polynomials and Fano Varieties

RICAM, Austrian Academy of Sciences, Linz, Austria — Apr 2011
Colloquium

University of Sydney, Australia — Oct 2010
Computational Algebra Seminar

Freie Universität Berlin, Germany — Jun 2010
Combinatorics and Geometry Seminar

External Leadership Responsibilities

EPSRC Strategic Advisory Team (SAT) Jan 2022–present

One of 16 elected members of the EPSRC's Mathematical Sciences SAT, developing future EPSRC strategy and shaping the research and training portfolios.

Convenor for the LMS Continuing Professional Development Panel Sessions for Early Career Researchers Aug 2023–present

ATI Topology and Geometry of Data Interest Group Member Jan 2023–present

Member of the Alan Turing Institute group focusing on applications of topology and geometry to the analysis of noisy data.

External Examiner, University of East Anglia Oct 2022–present

External Examiner, University of Bath Oct 2021–present

EPSRC Prosperity Partnerships Interview Panel Jul 2023

EPSRC Programme Grant Outline Panel Jun 2023

EPSRC Fellowship Interview Panel Jul 2022

EPSRC New Horizons Outline Panel Mar 2022

EPSRC Mathematics Prioritisation Panel Sep 2016, Nov 2020

Mentor for the Society of Research Software Engineering Oct 2021–present

German Research Foundation (DFG) Review Panel Mar 2021

Athena SWAN Assessment Panel Jan 2021

University Leadership Responsibilities

Researcher Academy Faculty Lead for Science Jan 2024–present

Head of Pure Mathematics Aug 2020–present

I lead a section of approximately 20 academic staff and PDRAs. Responsibilities include: curriculum review; allocation of teaching duties; research growth and grant applications; REF submission; PhD recruitment; staff hiring, promotions, evaluation, and performance management.

School Leadership Board Aug 2020–present

Equality, Diversity, and Inclusion (EDI) Committee Aug 2018–present

Outreach & Public Engagement

New Scientist Oct 2023

AI is helping mathematicians build a periodic table of shapes: "Mathematicians attempting to build a 'periodic table' of shapes have turned to artificial intelligence for help…"

Popular Mechanics Oct 2023

Mathematicians are close to building the perfect periodic table of shapes: "Just as molecules can be broken down into atoms, so too can mathematical shapes be broken down into more basic components…"

Pint of Science May 2022

Helped organise Nottingham's contribution to the global Pint of Science festival.

A periodic table of shapes 2012–2015

Collaborated with artist-in-residence Gemma Anderson-Tempini interpreting the mathematics of Fano varieties through print-making and sculpture.

Physics World Mar 2011

Nature's building blocks brought to life: "The scientists are looking for shapes, known as 'Fano varieties', which are basic building blocks and cannot be broken down into simpler shapes…"

New Scientist Feb 2011

Atoms ripple in the periodic table of shapes: "This rippling structure may look like a piece of origami, or an intricate scarf. In fact, it is geometry's answer to the atom…"

Science Feb 2011

Elementary mathematics: "An international group of mathematicians hopes to do for math what Dmitri Mendeleev's periodic table did for chemistry…"