Bartosz Naskręcki

PERSONAL DATA

Date of Birth:	11 May 1986
Place of Birth:	Poznań, Poland
E-mail:	nasqret@gmail.com
Address:	Collegium Mathematicum, Building B
	Uniwersytetu Poznańskiego 4, 61-614 Poznań
Nationality:	Polish

Employment

2022-2024	Visiting Assistant Professor at the Dioscuri Centre in Topological Data Analysis, Instutute
	of Mathematics of Polish Academy of Sciences, Warsaw
since Oct 2014	Assistant professor at Adam Mickiewicz University Poznań
2016 - 2017	Research Associate at University of Bristol
2014 - 2016	Postdoctoral Research Fellow at Universität Bayreuth

Education

2010-2014	Ph. D. student at Adam Mickiewicz University (AMU), Faculty of Mathematics and Computer
	Science (Scholarship Funded by EU)
Jun 2010	M. Sc., Faculty of Mathematics and Computer Science, AMU
2005-2010	M. Sc. Programme in Mathematics at AMU
2002 - 2005	VIII Secondary School in Poznań, mathematical and computer science profile

RESEARCH EXPERIENCE

since 2024	IDUB 140/04/POB4/0009 research grant, "AI-Driven Insights: Deep Learning and Generative
	Techniques in Mathematical Research"
2013 - 2015	National Science Centre research grant PRELUDIUM "Formy modularne i rangi krzywych
	eliptycznych.", 2012/05/N/ST1/02871
2010 - 2014	Ranks in families of elliptic curves and modular forms, Ph.D. Thesis
	Advisor: Professor Wojciech Gajda
2009 - 2010	On a certain diophantine equation, M.Sc. Thesis
	Advisor: Professor Wojciech Gajda

PRIZES AND AWARDS

2022,23	Diamenty Krystalografii, PAN Award in category "Teoria, metodyka i dydaktyka krystalo-
	grafii"
2017	STEM Bronze Award for Mathematical Sciences, UK Parliament, London
2014	Young Mathematicians Prize of Polish Mathematical Society
2010	J. Marcinkiewicz Award for the Outstanding Undergraduate Mathematical Paper (Distinction)
2007	Third Prize, International Mathematics Competition, Blagoevgrad, Bulgaria

EXPERIENCE

2022	Teaching grant (55k PLN) - Jupyter Notebook based full course materials on Introduction
	to Mathematics for Computer Science Students

- 2021 Rectors Fund Grant for developing crystallographic methods (20k PLN)
- 2021 Editing Jupyter Notebooks for AITECH Project (Adam Mickiewicz University), approx. 2000 A4 PDF pages generated with automated process and unique conversion procedure
- 2016 Contributions to L-functions Modular Forms Database project, mod ℓ modular forms section (joint work with Samuele Anni and Anna Medvedovsky).

PUBLICATIONS

1. Second moments and the bias conjecture for the family of cubic pencils, (with Matija Kazalicki), accepted in Mathematische Zeitschrift, preprint+code

2. *Periodic arrangements of closely packed spheres*, (with Zbigniew Dauter and Mariusz Jaskolski), ChemTexts 11, 2 (2025). 1-17.

3. Growth functions of periodic space tessellations, (with Jakub Malinowski, Zbigniew Dauter, Mariusz Jaskolski), Acta Crystallogr., Sect. A: Found. Adv. (2025), Vol. 81, No. 1, 64-81

4. Common valuations of division polynomials, (with Matteo Verzobio), Proc. A. R. Soc. Edinb. Published online 2024 pp. 1-15

5. Geometry of the del Pezzo surface $y^2 = x^3 + Am^6 + Bn^6$, (with Julie Desjardins), Ann. Inst. Fourier. Ann. Inst. Fourier 74 no.5 2231-2274

6. The Euler characteristic as a basis for teaching topology concepts to crystallographers, (with Zbigniew Dauter and Mariusz Jaskólski), Journal of Applied Crystallography, (2022), Vol. 55, 154-167

7. Diophantine triples and K3 surfaces, (with Matija Kazalicki), Journal of Number Theory (2022), Vol. 236, 41-70

8. A topological proof of the modified Euler characteristic based on the orbifold concept, (with Zbigniew Dauter and Mariusz Jaskólski), Acta Crystallographica Section A: Foundations and Advances (2021), Vol.7, No. 4, 317-326

9. Arithmetic proof of the multiplicity-weighted Euler characteristic for symmetrically arranged space-filling polyhedra, (with Zbigniew Dauter and Mariusz Jaskólski), Acta Crystallographica Section A: Foundations and Advances (2021), Vol.7, No. 2, 126-129

10. Arithmetic and geometry of a K3 surface emerging from virtual corrections to Drell-Yan scattering, (with Marco Besier, Dino Festi and Michael Harrison), Communications in Number Theory and Physics (2020), Vol. 14, No. 4, 863-911

11. Primitive divisors of elliptic divisibility sequences over function fields with constant *j*-invariant, (with Marco Streng), Journal of Number Theory (2020), Vol.213, 152-186

12. The generalized Fermat equation with exponents 2, 3, n (with Nuno Freitas and Michael Stoll), Compositio Mathematica, Vol. 156 (1) (2020), 77-113

13. On higher congruences between cusp forms and Eisenstein series II, Notes from the International Autumn School on Computational Number Theory: Izmir Institute of Technology 2017, Birkhäuser (2019), 331–353

14. Divisibility sequences of polynomials and heights estimates, New York J. Math. 22 (2016) 989–1020.

15. Distribution of Mordell-Weil ranks of families of elliptic curves, Banach Center Publications 108 (2016), 201–229.

16. On higher congruences between cusp forms and Eisenstein series, in volume Computations with Modular Forms, Springer, Contributions in Mathematical and Computational Sciences, 6 (2014) 257–277.

17. Mordell-Weil ranks of families of elliptic curves associated to Pythagorean triples, Acta Arithmetica, 160, No. 2 (2013), 159–183.

18. Infinite family of elliptic curves of rank at least 4, Involve, 3, No. 3 (2010), 297–316.

Preprints

19. On the geography of log-surfaces, (with Piotr Pokora), submitted

20. Divisibility sequences related to abelian varieties isogenous to a power of an elliptic curve, (with Stefan Barańczuk and Matteo Verzobio), submitted

21. Explicit equations of 800 conics on a Barth-Bauer quartic, submitted

22. On a certain hypergeometric motive of weight 2 and rank 3, submitted

23. Mordell-Weil ranks of families of elliptic curves parametrized by binary quadratic forms, submitted

TEACHING EXPERIENCE

Teaching at Adam Mickiewicz University:

2017-... Introduction to Mathematics, Logic and Set Theory, Computer Algebra Systems, Cryptography with Elements of Algebra, Cryptanalysis, Topological Data Analysis, Protection of Intellectual Property, Mathematical Foundations of Machine Learning and Cybersecurity
2011-2015 Computer assisted mathematics, Introduction to algebra and number theory, Introduction to mathematics, Linear algebra, Galois theory

Teaching at University of Bristol:

Fall/Winter 2016–2017 | Maths Single Honours Tutorial (Analysis and Foundations and Proof)

Selected Talks

$\mathrm{Sep}\ 2024$	Common valuations of division polynomials, Algebra, geometry and number theory seminar,
	Leiden, Netherlands
Dec 2023	Higher moments of elliptic curves, Algebraic Geometry and Number Theory Seminar, ISTA,
	Vienna
Sep 2023	Higher moments of elliptic curves, Spanish+Polish Mathematical Meeting, Łódź, Poland
Apr 2023	Growth functions of periodic space tessellations, PORMETALOMICS session, IMDEA Madrid,
	Spain
Oct 2022	Higher moments of elliptic curves, Representation Theory XVII, Inter-University Centre,
	Dubrovnik, Croatia
Jul 2022	Topological and combinatorial methods in crystallography, Applied Topology 2022, Będlewo,
	Poland
Jun 2022	Higher moments of elliptic curves, Algebraic Geometry Group Seminar, Milan, Italy
Dec 2019	Applications of Shioda-Inose structures in arithmetic, December Workshop, Padova, Italy
Jun 2019	Hypergeometric differential equations and hypergeometric motives, Representation Theory
_	XVI, Inter-University Centre, Dubrovnik, Croatia
Jun 2019	Discussion panel on higher congruences Eisenstein ideal and Iwasawa theory, Morningside
	Center of Mathematics, Beijing, China
Jun 2018	Elliptic surfaces, Lectures on computational aspects of algebraic geometry, Zagreb, Croatia
Apr 2018	Elliptic and hyperelliptic realisations of low degree hypergeometric motives, Periods in Number
	Theory, Algebraic Geometry and Physics, Bonn, Germany
Jul 2017	Hypergeometric motives of low degrees, Workshop on Algorithms in Number Theory and
NT 0015	Arithmetic Geometry, Leiden, Netherlands
Nov 2015	Zeta functions, Weil conjectures and how to apply them, Workshop on Modern Applied
G oot (Mathematics PK 2015, Kraków, Poland
Sep 2014	Mordell-Weil ranks in families of elliptic curves parametrized by binary quadratic forms,
T 1 0010	DMV-PTM Joint Meeting, Poznań, Poland
Jul 2013	Mordell-Weil ranks of families of elliptic curves associated to Pythagorean triples, Journees
1 0010	Arithmetiques 2013, Grenoble, France
Jun 2013	On higher congruences between cusp forms and Eisenstein series, Workshop on Galois
M 0010	representations modulo prime powers, Luxembourg
May 2013	Mordell-Weil ranks of families of elliptic curves associated to Pythagorean triples, Heilbronn
Mar 2012	Seminar, Bristol, UN
mar 2013	On night congruences between cusp jorms and Eisenstein series, "Explicit Methods for
	Modular Forms", Warwick, UK

RESEARCH STATEMENT

My research focuses mainly on the arithmetic aspects of algebraic geometry. This is a varied field with many applications, even outside of mathematics. The most important work in my list is [12]. We prove in this paper the generalized Fermat theorem for three different exponents 2, 3, n with n = 11 and some partial information about higher n. This work is only the second known case of application of the modularity method to the equation of type $x^p + y^q + z^r = 0$ with three different exponents (p, q, r).

Papers [11], [14] and [20] address the question of existence of a uniform Zgimondy bound on the elliptic

divisibility sequences. The topic of divisibility sequences is well-known and full of interesting results about Fibonacci and Lucas sequences. In my work I address the classic questions in the function field context. The first paper [14] proves the first known uniform bound which works for most elliptic curves with a fixed point. This is a breakthrough which allows to completely characterise the Zsigmondy bound in practice.

Our paper [11] address the search of optimal Zsigmondy bounds (least possible) in the constant j-invariant case. Paper [4] proves some useful formulas for the cancellation in divisibility sequeces. Papers [15], [17], [18], [23] and [5] study Mordell-Weil groups of various elliptic curves over function fields. I provide in each paper a different application of the general theory of Mordell-Weil lattices. The strongest application comes in the paper [5] which explains how to detect new examples of del Pezzo surfaces of degree 1 with a Zariski dense set of rational points.

Papers [10], [19] and [21] are related to the study of geometry of K3 surfaces. Our paper [10] addresses a very difficult question of non-rationality of a certain master integral related to the Drell-Yan scattering in quantum physics. We study deeply all the geometric and arithmetic properties of the surface and speculate about further physical applications of these.

In the paper [22] we construct realizations of the so-called hypergeometric motives. This is a difficult and rather technical construction which allows one to prove some interesting identities over finite fields. Papers [13] and [16] are dedicated to the study of congruences between certain modular forms. Apart from some theoretical results I have constructed an extensive database of such congruences which allowed other researchers to verify some auxiliary claims.

Papers [1] and [7] focus on the motivic aspects of the moment sums attached to families of elliptic curves. This is a topic related to the geometry of Kuga-Satake varieties and contains strong arithmetic results linked to curves of higher genera and modular forms.

In papers [2], [3], [6], [8] and [9] are a study of certain new numerical invariants of crystallographic lattices. These papers are on the boundary between mathematics and crystallography and have strong potential for applications in crystallography and chemistry.