

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

since Oct 2014 | Assistant professor at Adam Mickiewicz University
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

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

PUBLICATIONS

1. *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
 2. *Diophantine triples and $K3$ surfaces*, (with Matija Kazalicki), [Journal of Number Theory](#) (2022), Vol. 236, 41-70
 3. *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
 4. *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
 5. *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
 6. *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
 7. *The generalized Fermat equation with exponents 2, 3, n* (with Nuno Freitas and Michael Stoll), [Compositio Mathematica](#), Vol. 156 (1) (2020), 77-113
 8. *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
 9. *Divisibility sequences of polynomials and heights estimates*, [New York J. Math.](#) 22 (2016) 989–1020.
 10. *Distribution of Mordell-Weil ranks of families of elliptic curves*, [Banach Center Publications](#) 108 (2016), 201–229.
 11. *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.
 12. *Mordell-Weil ranks of families of elliptic curves associated to Pythagorean triples*, [Acta Arithmetica](#), 160, No. 2 (2013), 159–183.
 13. *Infinite family of elliptic curves of rank at least 4*, [Involve](#), 3, No. 3 (2010), 297–316.
- Preprints
14. *Common valuations of division polynomials*, (with Matteo Verzobio), submitted
 15. *Explicit equations of 800 conics on a Barth-Bauer quartic*, submitted
 16. *Second moments and the bias conjecture for the family of cubic pencils*, (with Matija Kazalicki), submitted
 17. *Geometry of the del Pezzo surface $y^2 = x^3 + Am^6 + Bn^6$* , with Julie Desjardins, submitted
 18. *On a certain hypergeometric motive of weight 2 and rank 3*, submitted
 19. *Mordell-Weil ranks of families of elliptic curves parametrized by binary quadratic forms*, submitted

PRIZES AND AWARDS

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| 2022 | Diamenty Krystalografii, PAN Award in category “Teoria, metodyka i dydaktyka krystalografii” |
| 2017 | STEM Bronze Award for Mathematical Sciences, UK Parliament, London |
| 2014 | <i>Young Mathematicians Prize of Polish Mathematical Society</i> |
| 2013 | Scholarship of <i>Adam Mickiewicz University Foundation</i> |
| 2010 | <i>J. Marcinkiewicz Award for the Outstanding Undergraduate Mathematical Paper (Distinction)</i> |
| 2010 | Medal for Outstanding Graduates "Sapere Aude", Adam Mickiewicz University |
| 2009 | Scholarship of Kulczyk Family Fund, Adam Mickiewicz University |
| 2009 | Ministry of Science and Higher Education Award (scholarship) for scientific achievements |
| 2008 | <i>Honourable Mention, International Mathematics Competition</i> , Blagoevgrad, Bulgaria |
| 2008 | Ministry of Science and Higher Education Award (scholarship) for scientific achievements |
| 2007 | <i>Third Prize, International Mathematics Competition</i> , Blagoevgrad, Bulgaria |
| 2007 | Ministry of Science and Higher Education Award (scholarship) for scientific achievements |

SELECTED TALKS

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| Jul 2022 | <i>Topological and combinatorial methods in crystallography</i> , Applied Topology 2022, Będlewo, Poland |
| Jun 2022 | <i>Higher moments of elliptic curves</i> , Algebraic Geometry Group Seminar, Milan, Italy |
| May 2022 | <i>Higher moments of elliptic curves</i> , Heilbronn Seminar, Bristol, UK |
| Dec 2019 | <i>Applications of Shioda-Inose structures in arithmetic</i> , December Workshop, Padova, Italy |
| Sep 2019 | <i>Hypergeometric differential equations and hypergeometric motives</i> , Jubileuszowy Zjazd Matematyków Polskich w 100-lecie PTM, Kraków, Poland |
| Jun 2019 | <i>Hypergeometric differential equations and hypergeometric motives</i> , Representation Theory XVI, Inter-University Centre, Dubrovnik, Croatia |
| Jun 2019 | <i>Discussion panel on higher congruences Eisenstein ideal and Iwasawa theory</i> , Morningside Center of Mathematics, Beijing, China |
| Jun 2018 | <i>Point counts on elliptic surfaces inspired by the theory of motives</i> , ALANT 5, Będlewo, Poland |
| Jun 2018 | <i>Elliptic surfaces</i> , Lectures on computational aspects of algebraic geometry, Zagreb, Croatia |
| May 2018 | <i>Motivic decomposition of K3 surfaces with high Picard rank</i> , Research Group: Motives of Calabi-Yau manifolds, Kraków, Poland |
| Apr 2018 | <i>Elliptic and hyperelliptic realisations of low degree hypergeometric motives</i> , Periods in Number Theory, Algebraic Geometry and Physics, Bonn, Germany |
| Sep 2017 | <i>Introduction to Computer Algebra System</i> , Izmir Autumn School on Computational Number Theory, Izmir, Turkey |
| Oct 2016 | <i>Generalized Fermat's equation of type $(2,3,n)$</i> , Linfoot seminar, University of Bristol, UK |

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| Nov 2015 | <i>Zeta functions, Weil conjectures and how to apply them</i> , Workshop on Modern Applied Mathematics PK 2015, Kraków, Poland |
| Oct 2015 | <i>Generalized Fermat equations $x^2+y^3=zp$ – a progress report</i> , Jahrestagung SPP 1489, Osnabrück, Germany |
| Sept 2014 | <i>Mordell-Weil ranks in families of elliptic curves parametrized by binary quadratic forms</i> , DMV-PTM Joint Meeting, Poznań, Poland |
| Jun 2014 | <i>Mordell-Weil ranks in families of elliptic curves parametrized by binary quadratic forms</i> , ALANT 2014, Będlewo, Poland |
| Jul 2013 | <i>Mordell-Weil ranks of families of elliptic curves associated to Pythagorean triples</i> , Journées Arithmétiques 2013, Grenoble, France |
| Jun 2013 | <i>On higher congruences between cusp forms and Eisenstein series</i> , Workshop on Galois representations modulo prime powers, Luxembourg |
| May 2013 | <i>Mordell-Weil ranks of families of elliptic curves associated to Pythagorean triples</i> , Heilbronn seminar, Bristol, UK |
| Mar 2013 | <i>On higher congruences between cusp forms and Eisenstein series</i> , “Explicit Methods for Modular Forms”, Warwick, UK |
| Jun 2012 | <i>Mordell-Weil ranks of families of elliptic curves associated to Pythagorean triples</i> , Algebraic and Arithmetic Geometry, Kraków, Poland |
| Jul 2011 | <i>Sphere packings and codes</i> , 14th International Workshop for Young Mathematicians “Algebra”, Kraków, Poland |
| Sep 2010 | <i>A computer can do more than the mathematician?</i> , 13th International Workshop for Young Mathematicians “Logic and Foundations of Mathematics”, Kraków, Poland |
| Nov 2009 | <i>Infinite family of elliptic curves</i> , Workshop on Ranks, Faculty of Mathematics and Computer Science, AMU, Poznań |
| Sep 2009 | <i>Enchained in Markov Chains</i> , 12th International Workshop for Young Mathematicians “Probability Theory and Statistics”, Kraków, Poland |
| Sep 2008 | <i>Elliptic curves cryptography</i> , 11th International Workshop for Young Mathematicians “Number Theory”, Kraków, Poland |

WORKSHOPS AND CONFERENCES

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| May 2017 | <i>Modular forms are everywhere</i> , Bonn, Germany |
| Mar 2017 | <i>New Trends in Arithmetic and Geometry of Algebraic Surfaces</i> , Banff, Canada |
| Sep 2016 | <i>Recent Developments on Elliptic Curves</i> , Oxford, UK |
| Jun 2016 | <i>Arithmetic statistics and the Cohen-Lenstra heuristics</i> Warwick, UK |
| May 2016 | <i>LMFDB Workshop</i> , San Jose, California, USA |
| Apr 2016 | <i>Explicit Methods in Number Theory: Conference in Honour of John Cremona’s 60th Birthday</i> , Warwick, UK |
| Mar 2016 | <i>British Mathematical Colloquium</i> , Bristol, UK |
| Nov 2015 | <i>Workshop on Modern Applied Mathematics PK 2015</i> , Kraków, Poland |
| Nov 2014 | <i>Workshop on Galois representations</i> , Luxembourg |
| Sept 2014 | <i>DMV-PTM Joint Meeting</i> , Poznań, Poland |
| Jun 2014 | <i>Alant 2014</i> , Będlewo, Poland |
| Oct 2013 | <i>Kosmos Summer School: MZV in Mathematics and Physics</i> , Berlin, Germany |
| Jul 2013 | <i>Sage Days: Algorithms in Arithmetic Geometry</i> , Leiden, Netherlands |
| Jul 2013 | <i>Journées Arithmétiques 2013</i> , Grenoble, France |
| Jun 2013 | <i>Workshop on Galois representations modulo prime powers</i> , Luxembourg |
| Mar 2013 | <i>Explicit Methods for Modular Forms</i> , Warwick, UK |
| Jun 2012 | <i>6th European Congress of Mathematics</i> , Kraków, Poland |
| Feb 2012 | <i>Winter School on Galois Theory</i> , University of Luxembourg, Luxembourg |
| Aug 2011 | <i>Summer School and Conference "Computations with Modular Forms 2011"</i> , University of Heidelberg, Heidelberg, Germany |
| Jun 2011 | <i>Abelian Varieties & Galois Actions</i> , Adam Mickiewicz University, Poznań, Poland |
| Mar 2011 | <i>Spring School on higher dimensional class field theory</i> , University of Mainz, Mainz, Germany |

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| Mar 2011 | <i>School and Conference on Modular Forms and Mock Modular Forms and their Applications in Arithmetic, Geometry and Physics</i> , ICTP, Trieste, Italy |
| Feb 2011 | <i>MSRI Arithmetic Statistics: Introductory Workshop</i> , MSRI, Berkeley, California, USA |
| Jan 2011 | <i>MSRI Arithmetic Statistics: Connections for Women</i> , MSRI, Berkeley, California, USA |
| Jun 2010 | <i>Advanced Courses on Modularity</i> , Universitat Autònoma de Barcelona, Barcelona, Spain |
| Feb 2010 | <i>Advanced Course on Arithmetic Geometry for Function Fields of Positive Characteristic</i> , Universitat Autònoma de Barcelona, Barcelona, Spain |
| Oct 2009 | <i>Advanced Course on Shimura Varieties and L-functions</i> , Universitat Autònoma de Barcelona, Barcelona, Spain |
| Jun 2009 | <i>Clay Institute Summer School 2009 "Galois representations"</i> , Honolulu, Hawaii, USA |

EXPERIENCE

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| 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). |
| 2008 | Coauthor of interactive presentation module for Calculus courses (Computer Science programme) created in Mathematica system: Module 1 (pl) , Module 2 (pl) |
| Wolfram Demonstration Project applets: | <ol style="list-style-type: none"> <i>Motion of a Simple Pendulum with Damping</i> from The Wolfram Demonstrations Project <i>Work in an Attractive Inverse-Square Field</i> from The Wolfram Demonstrations Project <i>Driven Damped Oscillator with Resonance Effect</i> from The Wolfram Demonstrations Project <i>Numerical Integration using Rectangles, the Trapezoidal Rule, or Simpson's Rule</i> from The Wolfram Demonstrations Project |

TEACHING EXPERIENCE

Teaching at Adam Mickiewicz University:

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| 2017–... | <i>Introduction to Mathematics, Logic and Set Theory, Computer Algebra Systems, Cryptography with Elements of Algebra, Protection of Intellectual Property, Mathematical Foundations of Machine Learning and Cybersecurity</i> |
| 2011-2015 | <i>Computer assisted mathematics, Introduction to algebra and number theory, Introduction to mathematics, Linear algebra, Galois theory</i> |

Teaching at University of Bristol:

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| Fall/Winter 2016–2017 | <i>Maths Single Honours Tutorial</i> (Analysis and Foundations and Proof) |
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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 [7]. 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 [6] and [9] address the question of existence of a uniform Zsigmondy 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 [5] 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 [6] address the search of optimal Zsigmondy bounds (least possible) in the constant j -invariant case.

Papers [10], [12], [13],[17] and [19] 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 [19] which explains how to detect new examples of del Pezzo surfaces of degree 1 with a Zariski dense set of rational points.

Papers [2], [5] and [18] are related by the use of the Shioda-Inose structures of K3 surfaces . Our paper [5] 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 [18] 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 [8] and [11] 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.

In papers [1], [3] and [4] 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.