Bartosz Naskręcki

Personal Data

Date of Birth:	11 May 1986
Place of Birth:	Poznań, Poland
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Employment

since Dec 2022	Post-doctoral researcher at Institute of Mathematics, Polish Academy of Sciences
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 divisiblity 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

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

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 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 [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.