Vítězslav Kala

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CONTACT
INFO

Vítězslav Kala
Charles University
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PERSONAL

Born August 8, 1985. Married, 2 daughters. Nationality Czech Republic.

RESEARCH
INTERESTS

Broadly interested in number theory (algebraic and analytic), algebra, and logic.
Specifically:
- Universal quadratic forms, arithmetic of number fields, distribution of class numbers, generalized continued fractions
- Langlands program, applications of model theory, simple semifields

WORK

Charles University, Prague, Czech Republic

Faculty of Mathematics and Physics, Department of Algebra

Associate Professor (tenured)	**01/2022 − present**
• Habilitation *'docent'* awarded 10/2021	
Assistant Professor	**01/2017 − 12/2021**
Postdoc	**09/2015 − 06/2016**

University of Göttingen, Germany

Postdoc	**01/2015 − 08/2017**
• Mentor: Valentin Blomer	
• Partly supported by V.B.'s ERC Starting Grant	

Max Planck Institute for Mathematics, Bonn, Germany

Postdoc	**09/2014 − 12/2014**

EDUCATION

Purdue University, West Lafayette, Indiana, USA

Ph.D., Mathematics	**2009 − 2014**
• Advisor: Freydoon Shahidi	
• Thesis: *Density of self-dual automorphic representations of $GL_n(\mathbb{A}_{\mathbb{Q}})$*	

Charles University, Prague, Czech Republic

Ph.D., Mathematics (in absentia)	**2009 − 2013**
• Advisor: Tomáš Kepka	
• Thesis: *Algebraic substructures in $\mathbb{C}^m$*	
Mgr. (Master's), Mathematics	**2007 − 2009**
Bc. (Bachelor's), Mathematics	**2004 − 2007**

| Grants, Awards | **Czech Science Foundation GAČR** | **2021 − 2025** |

- PI of *UFOCLAN: Universal quadratic forms and class numbers* grant
- Highly selective Junior Star project (success rate 9%)
- 8 postdocs supported, total budget 950 000 EUR

Primus Research Programme — **2020 − 2022**

- PI of research grant *Universal quadratic forms: geometry and analysis*
- 4 postdocs supported

Czech Science Foundation GAČR — **2017 − 2019**

- PI of Junior Grant *Quadratic forms and numeration systems over number fields*
- 3 postdocs supported
- Outcomes of the grant evaluated by the grant agency as excellent
- Nominated for GAČR President's award in physical sciences (the best project in mathematics; among top 3 out of approx. 100 projects overall)

Neuron Impulse — **2018 − 2019**

- PI of grant *Semifields in number theory and geometry*

Bolzano Award — **2019**

- Annual award of the Bernard Bolzano Endowment Fund for the best research in mathematics, for *Universal quadratic forms and families of number fields*

International Fulbright Science and Technology Award — **2009 − 2012**

- For international PhD students at prestigious universities in the USA
- Only 40 students worldwide selected each year

Mathematical Competitions

- 1st Prize – International Mathematical Competition 2006, 2008
- 1st Place – Vojtěch Jarník International Mathematical Competition 2009
- Bronze Medal – International Mathematical Olympiad 2004

ARTICLES

*Six of my best papers are highlighted in **bold**.*

[38] H. Řada, Š. Starosta, V. Kala, *Periodicity of general multidimensional continued fractions using repetend matrix form*, 28 pp., submitted

[37] V. Kala, M. Zindulka, *Partitions into powers of an algebraic number*, 8 pp., submitted

[36] V. Kala, T. Kepka, M. Korbelář, *Congruence-simple matrix semirings*, 11 pp., submitted

[35] V. Kala, E. Sgallová, M. Tinková, *Arithmetic of cubic number fields: Jacobi–Perron, Pythagoras, and indecomposables*, 40 pp. (+21 pp. of appendices), submitted

[34] V. Kala, P. Yatsyna, B. Żmija, ***Real quadratic fields with a universal form of given rank have density zero***, 18 pp., submitted

[33] V. Kala, L. Šíma, *On generators of commutative semifields*, 12 pp., submitted

[32] V. Kala, P. Miska, *On continued fraction partial quotients of square roots of primes*, J. Number Theory (to appear), 14 pp.

[31] G. Cherubini, A. Fazzari, A. Granville, V. Kala, P. Yatsyna, ***Consecutive real quadratic fields with large class numbers***, Int. Math. Res. Not. IMRN (2023), 12052 − 12063

[30] V. Kala, *Universal quadratic forms and indecomposables in number fields: A survey*, Commun. Math. 31 (2023), Special issue: Euclidean lattices: theory and applications, 81 − 114

[29] V. Kala, P. Yatsyna, ***On Kitaoka's conjecture and lifting problem for universal quadratic forms***, Bull. London Math. Soc. 55 (2023), 854 − 864

[28] V. Kala, *Number fields without universal quadratic forms of small rank exist in most degrees*, Math. Proc. Cambridge Philos. Soc. 174 (2023), 225 − 231

[27] V. Kala, M. Tinková, **_Universal quadratic forms, small norms and traces in families of number fields_**, Int. Math. Res. Not. IMRN (2023), 7541 – 7577

[26] T. Hejda, V. Kala, _Ternary quadratic forms representing a given arithmetic progression_, J. Number Theory 234 (2022), 140 – 152

[25] V. Kala, P. Yatsyna, **_Lifting problem for universal quadratic forms_**, Adv. Math. 377 (2021), 107497, 24 pp.

[24] V. Kala, P. Yatsyna, _Sums of squares in S-integers_, New York J. Math. 26 (2020), 1145 – 1154

[23] T. Hejda, V. Kala, _Additive structure of totally positive quadratic integers_, Manuscripta Math. 163 (2020), 263 – 278

[22] V. Kala, J. Svoboda, _Universal quadratic forms over multiquadratic fields_, Ramanujan J. 48 (2019), 151 – 157

[21] V. Kala, T. Vávra, _Periodic representations in algebraic bases_, Monatsh. Math. 188 (2019), 109 – 119

[20] V. Kala, M. Korbelář, _Idempotence of finitely generated commutative semifields_, Forum Math. 30 (2018), 1461 – 1474

[19] A. Dahl, V. Kala, _Distribution of class numbers in continued fraction families of real quadratic fields_, Proc. Edinb. Math. Soc. 61 (2018), 1193 – 1212

[18] V. Blomer, V. Kala, **_On the rank of universal quadratic forms over real quadratic fields_**, Doc. Math. 23 (2018), 15 – 34

[17] P. Glivický, V. Kala, _Fermat's Last Theorem and Catalan Conjecture in weak exponential arithmetics_, Math. Log. Quart. 63 (2017), 162 – 174

[16] V. Kala, _Semifields and a theorem of Abhyankar_, Comment. Math. Univ. Carolin. 58 (2017), 267 – 273

[15] V. Kala, _Lattice-ordered abelian groups finitely generated as semirings_, J. Commut. Algebra 9 (2017), 387 – 412

[14] V. Kala, _Norms of indecomposable integers in real quadratic fields_, J. Number Theory 166 (2016), 193 – 207

[13] V. Kala, _Universal quadratic forms and elements of small norm in real quadratic fields_, Bull. Aust. Math. Soc. 94 (2016), 7 – 14

[12] V. Blomer, V. Kala, _Number fields without universal n-ary quadratic forms_, Math. Proc. Cambridge Philos. Soc. 159 (2015), 239 – 252

[11] J. Berg, A. Castillo, R. Grizzard, V, Kala, R. Moy, C. Wang, _Congruences for Ramanujan's f and omega functions via generalized Borcherds products_, Ramanujan J. 35 (2014), 327 – 338

[10] J. Ježek, V. Kala, T. Kepka, _Finitely generated algebraic structures with various divisibility conditions_, Forum Math. 24 (2012), 379 – 397

[9] V. Kala, M. Korbelář, _Congruence simple subsemirings of_ $\mathbb{Q}+$, Semigroup Forum 81 (2010), 286 – 296

[8] A. Drápal, C. Hämäläinen, V. Kala, _Latin bitrades, dissections of equilateral triangles, and abelian groups_, J. Comb. Des. 18 (2010), 1 – 24

[7] V. Kala, T. Kepka, P. Němec, _Norms on semirings I._, Acta Univ. Carolin., Math. Et Phys. 51 (2010), 29 – 48

[6] V. Kala, T. Kepka, _Commutative parasemifields finitely generated as semirings_, Acta Univ. Carolin., Math. Et Phys. 51 (2010), 49 – 56

[5] V. Kala, T. Kepka, M. Korbelář, _Notes on commutative parasemifields_, Comment. Math. Univ. Carolin. 50 (2009), 521 – 533

[4] V. Kala, A. D. Keedwell, _Addendum to The existence of Buchsteiner and conjugacy-closed quasigroups_, Europ. J. Combin. 30 (2009), 1386

[3] V. Kala, T. Kepka, M. Korbelář, J. D. Phillips, _Various subsemirings of the field_ $\mathbb{Q}$ _of the rational numbers_, Acta Univ. Carolin., Math. Et Phys. 50 (2009), 29 – 59

[2] V. Kala, T. Kepka, *A note on finitely generated ideal-simple commutative semirings*, Comment. Math. Univ. Carolin. 49 (2008), 1 – 9

[1] V. Flaška, A. Jančařík, V. Kala, T. Kepka, *Trees in commutative nil-semi- groups of index two*, Acta Univ. Carolin., Math. Et Phys. 48 (2007), 81 – 101

TEACHING

Charles University, Czech Republic

♠: *Dean's teaching award for all my courses in a given year (total 1 times)*

♡: *Dean's teaching award for an individual course (total 4 times)*

2nd year Bachelor's lectures
- Algebra, Spring 2021, 2024
- Number theory, Spring 2009, 2018, 2019, 2020 ♡, 2022 ♠, 2023

3rd year Bachelor's lectures
- Introduction to commutative algebra, Fall 2017 ♡, 2018, 2019 ♡, 2022
- Introduction to group theory, Fall 2021 ♠

Master's lectures
- Algebraic number theory, Spring 2018, 2019, 2021
- Quadratic forms and class fields, Fall 2015, 2018 ♡, Spring 2011, 2016, 2019
- Modular forms and L-functions, Fall 2017, 2019, Spring 2018

8 recitation classes (on number theory and algebra), 2006 – 2009

University of Göttingen, Germany
- Analytic Number Theory I (assistant), Winter 2016

Purdue University, USA
- Introductory Analysis I (business calculus course), Spring 2013, 2014

SERVICE

- Chair of the evaluation panel *Mathematics and Computer Science*, Czech Science Foundation, from 2023 (previously vice chair 2021 – 2023)
- Member of the *Committee of programs for the support of science at Charles University* (evaluating grant proposals), from 2023
- Member of the *Cooperatio* advisory board for mathematics, Charles University, from 2022
- Member of the *Academic Senate* of the Faculty of Mathematics and Physics, Charles University, 2020 – 2023
- Editorial board member of *Commentationes Mathematicae Universitatis Carolinae*, from 2021
- Founder and Organizer of the *Number Theory Seminar* (from 2015) and *Algebra Colloquium* (from 2021) at Charles University
- Referee for >30 articles, e.g., for *Adv. Math., Comment. Math. Helvet., Intern. Math. Res. Not. IMRN, Math. Z., Trans. Amer. Math. Soc.*
- External Ph.D. thesis referee for *University of Salerno* (Italy) and *Harish–Chandra Research Institute* (India)
- External grant reviewer for *National Science Centre Poland*
- Reviewer for *Mathematical Reviews*
- Editorial board member of *Pokroky matematiky, fyziky a astronomie* (Advances in mathematics, physics, and astronomy), Czech journal for popularization of math and physics, from 2019
- *Graduate Representative* in the Department of Mathematics at Purdue University, 2012 – 2013
- Founder and Organizer of the *Student Colloquium* in the Department of Mathematics at Purdue University, 2011 – 2012
- Vice president and Mentor of the *Purdue Fulbright Association*, 2011, 2012
- Organizer of math competitions (correspondence seminars) and camps for middle- and high-school students, 2001 – 2009

POSTDOCS
- Nicolas Daans, 01/2023 – 11/2023
- Stevan Gajovic, 03/2023 – 08/2025
- Siu Hang Man, 09/2022 – 08/2025
- Mentzelos Melistas, 01/2023 – 08/2025

- Matteo Bordignon, 01/2022 – 01/2023
  next job: postdoc at KTH Stockholm
- Giacomo Cherubini, 09/2020 – 10/2022
  next job: permanent position at Sapienza University of Rome
- Alessandro Fazzari, 09/2021 – 12/2021
  next job: postdoc at American Institute of Mathematics
- Daniel Gil Muñoz, 08/2021 – 06/2023
  next job: postdoc at University of Barcelona
- Tomáš Hejda, 01/2017 – 12/2019
  next job: work for Overleaf
- Eric Stucky, 08/2021 – 08/2022
  next job: adjunct faculty member at Champlain College
- Tomáš Vávra, 01/2017 – 12/2019, 05/2020 – 08/2020
  next job: postdoc at University of Waterloo
- Pavlo Yatsyna, 01/2020 – 08/2022
  next job: postdoc at Aalto University
- Ezra Waxman, 08/2018 – 07/2019
  next job: postdoc at Dresden University with Minerva Fellowship
- Błażej Żmija, 10/2021 – 06/2023
  next job: postdoc at Polish Academy of Sciences

STUDENTS

Ph.D.
- Ester Sgallová, *n-universal quadratic forms over number fields* (from 2021)
- Mikuláš Zindulka, *Arithmetics of number fields: partitions, norms, and quadratic forms* (from 2021)
- Jakub Krásenský, *Universal quadratic forms over orders in number fields* (2018 – 2023)
  next job: tenure-track faculty at Czech Technical University, Prague
- Magdaléna Tinková, *Arithmetics of number fields and generalized continued fractions* (2017 – 2021)
  Josef Hlávka Award
  next jobs: tenure-track faculty at Czech Technical University, Prague; and postdoc at TU Graz supported by Czech Science Foundation grant

Master's
- Martin Raška (from 2021)
- Martin Kuděj, *Semilattices and indecomposable elements* (from 2021)
- Bára Tížková, *Adeles and class fields* (2023)
- Sára Vyhnalová, *Ideal lattices in cryptography* (co-advised by P. Yatsyna, 2021)
- Kristína Mišlanová, *Quaternion algebras and units* (2021)
- Lucien Šíma, *Finitely generated semirings and semifields* (2021)
- Ester Sgallová, *Periodicity of Jacobi-Perron algorithm* (co-advised by M. Tinková, 2021)
  2nd place in SVOČ research competition
- Pavel Surý, *Local-global principle for quadratic forms* (2020)
- Martin Čech, *Pretentious approaches in analytic number theory* (2018)
- Kristýna Zemková, *Composition of quadratic forms over number fields* (2018)
  Dean's prize for best thesis; 3rd place in SVOČ research competition
- Dominik Lachman, *Bruhat-Tits buildings* (2017)
  Dean's prize for best thesis; 1st place in SVOČ research competition

- Jakub Hlavnička, *Products of primes in arithmetic sequences and prime number theorem*, Czech Technical University, Master's project (2015) and thesis (2016)
- Maroš Hrnčiar, *Solving diophantine equations by factorization in number fields* (2015)

Bachelor's
- Tomáš Sklenář, *Proving combinatorial identities via formal power series* (co-advised by S. H. Man, from 2022)
- František Couf, *Fourier transform on polytopes and tiling with rectangles* (co-advised by M. Zindulka, 2023)
- Simona Hlavinková, *The structure of generalized Pythagorean triples* (2023)
- Veronika Jarrahová, *Cyclotomic extensions and the Kronecker–Weber theorem* (2023)
- Filip Kucka, *RSA in number fields and on lattices* (2023)
- David Stern, *Partitions of totally positive elements in real quadratic fields* (co-advised by M. Zindulka, 2023)
- Matěj Doležálek, *Subfields of number field extensions and quadratic forms* (2022)
    3rd place in SVOČ research competition
- Daniela Lněničková, *Geometric solution of quadratic diophantine equations* (2022)
- Martin Raška, *Sums of squares in number fields* (2021)
    Dean's prize for best thesis; Honor. mention in SVOČ research compet.
- Bára Tížková, *Universal quadratic forms and estimates of traces of algebraic integers* (2021)
- Ondrej Bínovský, *Imaginary quadratic fields with class number 1* (2021)
- Matěj Doležálek, *Quaternions and universal quadratic forms over number fields* (2021, unofficial research project)
    Award of The Learned Society of the Czech Republic
    1st place in SVOČ research competition
- Alexandr Beneš, *Counting extensions of imaginary quadratic fields* (2020)
    Dean's prize for best thesis
- Veronika Hájková, *Pythagoras numbers of orders in number fields* (2020)
- Martin Kuděj, *Continued fractions with prescribed period* (2020)
- Kateřina Bžatková, *Visibly irreducible polynomials* (2019)
- Kristína Mišlanová, *Matrix of Legendre symbols* (2019)
- Sára Vyhnalová, *Solovay-Strassen primality test* (2019)
- Anh Dung Le, *Bernoulli numbers and ideal class groups* (2017)
- Martin Čech, *Algebraic proofs of Dirichlet's theorem on arithmetic progressions* (2016)
- Josef Svoboda, *Universal quadratic forms over number fields* (2016)

High School
- Matěj Doležálek, *Quaternions and generalizations of 4-square theorem* (2019)
    České hlavičky award; 1st place in SOČ research competition
- Matěj Doležálek, *The congruent number problem* (2018)

TALKS   **Invited conference and seminar talks**
- *Consecutive real quadratic fields with large class number*; International Conference on Class Groups of Number Fields and Related Topics, KSoM, India; November 22, 2022
- *Lifting problem for universal quadratic forms*; Number Theory Seminar; Krakow, Poland (online talk); November 3, 2022
- *Universal quadratic forms and indecomposables in number fields* (6 hours of lectures); XXIII International Workshop for Young Mathematicians, Krakow, Poland; September 11 – 17, 2022
- *Universal quadratic forms over number fields*; International Conference on Class Groups of Number Fields and Related Topics, KSoM, India (online talk); October 24, 2021

- *Universal quadratic forms over number fields*; Number Theory Lunch Seminar, MPIM Bonn, Germany; March 3, 2020
- *Introduction to L-functions and Langlands program* (two plenary lectures); 57th SSAOS, Czechia; September 5 and 6, 2019
- *Universal quadratic forms over number fields*; Prague–Dresden Number Theory Meeting, Dresden, Germany; March 8, 2019
- *The rank of universal quadratic forms over number fields*; Conference on the Arithmetic Theory of Quadratic Forms, Seoul National University, Korea; January 7, 2019
- *Universal quadratic forms and class numbers of real quadratic fields*; Mathematical Colloquium, Göttingen, Germany; October 26, 2016
- *Universal quadratic forms over number fields*; Rényi Institute, Hungary; May 24, 2016
- *Universal quadratic forms and indecomposable integers in* $\mathbb{Q}(\sqrt{D})$; Oberseminar Analytic Number Theory, Göttingen, Germany; April 11, 2016
- *Universal quadratic forms and continued fractions*; Mathematical Colloquium, Masaryk University, Brno, Czechia; November 6, 2015
- *Number fields without universal n-ary quadratic forms*; Göttingen–Hannover Number Theory Workshop, Germany; April 24, 2015
- *Provability of Fermat's Last Theorem in arithmetics with weak exponential*; Automorphic Forms and Representation Theory Seminar, Purdue University, USA; December 9, 2014
- *Number of self-dual automorphic representations of GL(N) and depth preservation*; Families of Automorphic Forms and the Trace Formula; BIRS, Canada; December 3, 2014
- *Number of self-dual automorphic representations of GL(N) and depth preservation*; Oberseminar Analytic Number Theory, Göttingen, Germany; November 10, 2014
- *Counting (self-dual) automorphic representations*; Texas–Oklahoma Representations and Automorphic Forms VI; March 8, 2014

Contributed conference talks (selected)
- *A density result for universal quadratic forms over number fields*; Leuca 2022, Italy; May 16, 2022
- *Lifting problem for universal quadratic forms*; 31st Journées Arithmétiques, Turkey; July 4, 2019
- *Classifications of finitely generated semifields and lattice-ordered groups*; 98th AAA, Dresden, Germany; June 21, 2019
- *Classifications of finitely generated semifields and lattice-ordered groups*; 56th SSAOS, Czechia; September 6, 2018
- *Universal quadratic forms over number fields*; Quadratic forms in Chile, Talca; January 12, 2018
- *Universal quadratic forms over number fields*; 30th Journées Arithmétiques, France; July 7, 2017
- *Additively indecomposable integers in number fields*; ALaNT 4, Czech Republic; June 16, 2016
- *Universal quadratic forms over number fields*; 22nd Czech and Slovak International Conference on Number Theory; August 31, 2015
- *Langlands program: an area of pure mathematics* (poster); International Fulbright Science and Technology Conference, Washington, DC; June 12, 2012

Frequent local seminar talks are not listed.