

Maciej Dołęga

Associate Professor

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Research interests

Algebraic, asymptotic, and enumerative combinatorics in the context of representation theory, enumerative geometry, probability and mathematical physics.

Degrees

2022 **Habilitation (mathematics)**, *Institute of Mathematics, Polish Academy of Sciences (IMPAN)*

title: *Combinatorial structure of Jack and Macdonald symmetric functions through enumeration of graphs*

2013 **Ph.D. (mathematics)**, *Uniwersytet Wrocławski, Summa cum laude*

thesis: *Combinatorics of asymptotic representation theory of symmetric groups*

advisor: Prof. Piotr Śniady

2010 **M.Sc. (mathematics)**, *Uniwersytet Wrocławski*

thesis: *Structure of Kerov polynomials*

advisor: Prof. Piotr Śniady

Employment

III 2022–now **Associate Professor**, *Institute of Mathematics, Polish Academy of Sciences (IMPAN)*

X 2018–II 2022 **Assistant Professor**, *Institute of Mathematics, Polish Academy of Sciences (IMPAN)*

X 2015–IX 2018 **NCN Postdoctoral Fellow**, *Adam Mickiewicz University*

XI 2013–X 2015 **CartaPlus Postdoctoral Fellow**, *Université Paris Diderot*

Grants (as PI)

III 2022 – **PI in grant** *One-parameter deformations in symmetric functions theory*,
– III 2026 *2021/42/E/ST1/00162*, SONATA BIS, National Science Center

X 2018 – **PI in grant** *Combinatorics of symmetric functions*, *2017/26/D/ST1/00186*,
– III 2022 SONATA, National Science Center

XI 2015 – **PI in grant** *Combinatorics of maps*, *2015/16/S/ST1/00420*, FUGA, National
– IX 2018 Science Center

IX 2012 – **PI in grant** *Asymptotic representation theory*, *2011/03/N/ST1/00117*, PRE-
– III 2014 LUDIUM, National Science Center

Awards and Honors

2023 **Fulbright STEM Impact Award**

2023 **Wacław Sierpiński Prize** for scientific achievements in the field of mathematics awarded by the *Faculty of Sciences and Earth Sciences of the PAS*

2018–2021 **Outstanding Young Scientist Fellowship** of the *Polish Minister of Science and Higher Education*

2016 **The Science Award** of the magazine “*Polityka*” in the category of Physical Sciences

2016 The **START** award of the *Foundation for Polish Science*

- 2014 Nomination for **The International Stefan Banach Prize** for a doctoral dissertation (*Polish Mathematical Society*)
- 2012–2013 **Hugo Steinhaus Memorial Fellowship** (*Wrocławskie Centrum Akademickie*)
- 2010 First award in the **Marcinkiewicz Memorial Contest**, (*Polish Mathematical Society*)
- 2008–2010 **Scholarship of the Polish Minister of Science and Higher Education**

Selected Invited Talks

- IV 2023 *Jack-deformed (weighted) Hurwitz numbers and their combinatorial interpretation*, **Invitation to Recursion, Resurgence and Combinatorics**, Okinawa Institute of Science and Technology, Japan
- XII 2022 *b-Hurwitz numbers and enumeration of maps*, **Enumerative Combinatorics**, MFO Oberwolfach, Germany
- V 2022 *b-deformed weighted Hurwitz numbers*, **Combinatorial and Algebraic Enumeration**, University of Waterloo, Canada
- I 2022 *Bijections for maps on non-oriented surfaces*, **Random Geometry**, CIRM, Luminy, France
- IX 2021 *Signed reflection functions – positive definiteness and applications*, **Combinatorics and Representation Theory in Lausanne**, EPFL, Switzerland
- II 2020 *Random Young diagrams and the approximate factorization property*, **Asymptotic Algebraic Combinatorics**, UCLA, USA
- III 2019 *Jack-deformed random Young diagrams*, **Asymptotic Algebraic Combinatorics**, BIRS Banff, Canada
- VI 2018 *Enumeration of maps and Jack polynomials*, **Poznań–Berlin–Hamburg combinatorial meeting 2018**, Freie Universität Berlin, Germany
- II 2017 *Gaussian fluctuations of Jack-deformed random Young diagrams*, **Workshop on Asymptotic Representation Theory**, IHP, Paris, France
- VI 2015 *When orientability makes a difference?*, **Séminaire Philippe Flajolet**, IHP, Paris, France
- III 2015 *A bijection for rooted maps on general surfaces*, **Journées ALEA 2015**, CIRM, Luminy, France
- VI 2014 *A bijection for rooted maps on non-orientable surfaces*, **2014 SIAM Conference on Discrete Mathematics**, Minneapolis, USA
- VI 2014 *Dual combinatorics of Jack polynomials via maps*, **Journées Cartes**, LPMA, Université Paris 6, France
- II 2014 *Central limit theorem for random Young diagrams with respect to Jack measure*, **Journées de combinatoire de Bordeaux 2014**, Université de Bordeaux, France
- II 2011 *Colorings of bipartite graphs and polynomial functions on the set of Young diagrams*, **Bialgebras in Free Probability**, Erwin Schrödinger Institute, Vienna, Austria
- XII 2010 *Polynomial functions on the set of Young diagrams and coloring of bipartite graphs*, **Workshop on Free Probability and Random Combinatorial Structures**, Universität Bielefeld, Germany

Research Visits and Internships

- IV 2023 **research visit**, *The University of Tokyo*, work with Kento Osuga, one week
- II 2022–III 2022 **research visit**, *Harvard University*, work with Cesar Cuenca, two weeks
- II 2020 **research visit**, *Université Paris VII*, work with Guillaume Chapuy, one week
- VI 2019 **research visit**, *UCSD*, work with Jonathan Novak, one week
- II 2018 **research visit**, *Université Paris VII*, work with Guillaume Chapuy, one week
- XI 2014 **research visit**, *Universität Zürich*, work with Valentin Féray, one week

- X 2011–XI 2011 **research visit**, *Université de Bordeaux*, work with Valentin Féray, two weeks
X 2010–II 2011 **PhD internship**, *Adam Mickiewicz University*
II 2009–VI 2009 **Erasmus internship**, *University of Copenhagen*

Memberships and Institutional Responsibilities

- 2023–2026 Member of the **Scientific Council of the Institute of Mathematics of the Polish Academy of Sciences**
2023–now Member of the **Polish Mathematical Society**
2021–2024 Jury member of the **Kazimierz Kuratowski Award**
2018, 2019 Member of two hiring committees for one postdoc and two PhD positions at the *Institute of Mathematics, Polish Academy of Sciences*

Supervision

- 2023–now **Hans Höngesberg**, *Postdoc at IMPAN, starting Fall 2023*
2023–now **Victor Nador**, *Postdoc at IMPAN, starting Fall 2023*
2018–now **Maciej Kowalski**, *PhD student at IMPAN*
2015–2018 **Adam Burchardt**, *PhD at the Adam Mickiewicz University*, secondary supervisor
Principal supervisor: Piotr Śniady,
Thesis title: *Structure constants of Jack characters*

Organization of Scientific Meetings and Seminars

- VIII 2023 Organizer of the **Summer School in Algebraic, Asymptotic and Enumerative Combinatorics**, *Mathematical Conference Center in Będlewo*
VI 2022 Organizer of the **Summer School in Algebraic Combinatorics**, *Jagiellonian University*
2019–now Organizer of the **Kraków Combinatorics Seminar** (cooperation of *IMPAN, Jagiellonian University & AGH*)
Fall 2019 Organizer of the Working Group on **Combinatorial Representation Theory** at *IMPAN*
Spring 2019 Organizer of the Working Group on **Symmetric Functions** at the *Jagiellonian University*
2014–2015 Organizer of the **Seminar on Enumerative and Algebraic Combinatorics** in *LIAFA* at the *Université Paris Diderot*

Teaching and Outreach

- December 2022 **Series of lectures**, *University of Wrocław*, Polish Children's Funds
Fall 2022 **Combinatorics of symmetric functions**, *advanced course*, *IMPAN*
2016–2017 **Series of lectures**, “*Math Festival*”, the “*Mathematical Meetings*” and the “*Power of Mathematics*”, *events aimed to exceptional high-school students interested in mathematics*, *Poznań Mathematical Foundation*
Fall semesters in **Combinatorics**, *course*, *University of Wrocław*
2011–2013
2008–2013 **Mathematics faculty**, *Stefan Żeromski High School (for exceptional high-school students interested in mathematics)*, *Jelenia Góra*
2005–2010 **Series of lectures**, *Mathematical camps aimed to exceptional high-school students interested in mathematics*, *Wrocław Mathematical Foundation*

Refereeing service

- 2023 **Reviewer**, *PhD. thesis of Mikołaj Marciniak*, *Nicolaus Copernicus University in Toruń*
2022 **Editor**, *Newsletter of the Institute of Mathematics, Polish Academy of Sciences*

- 2020–now **Reviewer**, *Zentralblatt MATH*
- 2020 **Reviewer of a grant proposal**, *National Fund for Scientific and Technological Research*
- 2014–now **Reviewer**, *MathSciNet*
- 2018–2022 **Reviewer**, *FPSAC Conferences*

Referee for journals, “*Advances in Mathematics*”, “*Algebraic Combinatorics*”, “*Annales de l’Institut Henri Poincaré D*”, “*Annals of Combinatorics*”, “*Annals of Probability*”, “*Discrete Mathematics*”, “*Duke Mathematical Journal*”, “*Electronic Journal of Combinatorics*”, “*European Journal of Combinatorics*”, “*Fundamenta Mathematicae*”, “*International Journal of Algebra and Computation*”, “*International Mathematics Research Notices*”, “*Journal of Combinatorial Theory, Series A*”, “*Pacific Journal of Mathematics*”, “*Random Structures and Algorithms*”, “*Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales. Serie A. Matemáticas*”, “*Symmetry, Integrability and Geometry: Methods and Applications*”, “*Selecta Mathematica*”, “*Transactions of the American Mathematical Society*”

Journal papers and preprints

- 2024 K. Nitin Chidambaram, Maciej Dołęga, and Kento Osuga. “ b -Hurwitz numbers from Whittaker vectors for \mathcal{W} -algebras”. Preprint arXiv:2401.12814. arXiv: 2401.12814.
- 2023 Houcine Ben Dali and Maciej Dołęga. “Positive formula for Jack polynomials, Jack characters and proof of Lassalle’s conjecture”. Preprint arXiv:22305.07966. arXiv: 2305.07966.
- 2023 Valentin Bonzom, Guillaume Chapuy, and Maciej Dołęga. “ b -monotone Hurwitz numbers: Virasoro constraints, BKP hierarchy, and $O(N)$ -BGW integral”. In: *Int. Math. Res. Not. IMRN* 14, pp. 12172–12230.
- 2023 Marek Bożejko, Maciej Dołęga, Wiktor Ejsmont, and Światosław R. Gal. “Reflection length with two parameters in the asymptotic representation theory of type B/C and applications”. In: *J. Funct. Anal.* 284.5, Paper No. 109797.
- 2023 Cesar Cuenca, Maciej Dołęga, and Alexander Moll. “Universality of global asymptotics of Jack-deformed random Young diagrams at varying temperatures”. Preprint arXiv:2304.04089. arXiv: 2304.04089.
- 2022 Valentin Bonzom, Guillaume Chapuy, and Maciej Dołęga. “Enumeration of non-oriented maps via integrability”. In: *Algebr. Comb.* 5.6, pp. 1363–1390.
- 2022 Guillaume Chapuy and Maciej Dołęga. “Non-orientable branched coverings, b -Hurwitz numbers, and positivity for multiparametric Jack expansions”. In: *Adv. Math.* 409.part A, Paper No. 108645, 72.
- 2022 Maciej Dołęga and Maciej Kowalski. “LLT Cumulants and Graph Coloring”. In: *Electron. J. Combin.* 29.4, Paper No. 4.5–.
- 2022 Maciej Dołęga and Mathias Lepoutre. “Blossoming bijection for bipartite pointed maps and parametric rationality of general maps of any surface”. In: *Adv. in Appl. Math.* 141, Paper No. 102408.
- 2022 Maciej Dołęga and Jonathan Novak. “Procesi’s Conjecture on the Formanek-Weingarten Function is False”. In: *C. R. Math. Acad. Sci. Paris* 360, pp. 1169–1172.
- 2020 Maciej Dołęga, Thomas Gerber, and Jacinta Torres. “A positive combinatorial formula for symplectic Kostka-Foulkes polynomials I: Rows”. In: *J. Algebra* 560, pp. 1253–1296.
- 2019 Maciej Dołęga. “Macdonald cumulants, G -inversion polynomials and G -parking functions”. In: *European J. Combin.* 75, pp. 172–194.
- 2019 Maciej Dołęga and Piotr Śniady. “Gaussian fluctuations of Jack-deformed random Young diagrams”. In: *Probab. Theory Related Fields* 174.1-2, pp. 133–176.

- 2017 Guillaume Chapuy and Maciej Dołęga. “A bijection for rooted maps on general surfaces”. In: *J. Combin. Theory Ser. A* 145, pp. 252–307.
- 2017 Maciej Dołęga. “Strong factorization property of Macdonald polynomials and higher-order Macdonald’s positivity conjecture”. In: *J. Algebraic Combin.* 46.1, pp. 135–163.
- 2017 Maciej Dołęga. “Top degree part in b -conjecture for unicellular bipartite maps”. In: *Electron. J. Combin.* 24.3, Paper No. 3.24, 39.
- 2017 Maciej Dołęga and Valentin Féray. “Cumulants of Jack symmetric functions and the b -conjecture”. In: *Trans. Amer. Math. Soc.* 369.12, pp. 9015–9039.
- 2016 Maciej Dołęga and Valentin Féray. “Gaussian fluctuations of Young diagrams and structure constants of Jack characters”. In: *Duke Math. J.* 165.7, pp. 1193–1282.
- 2014 Maciej Dołęga, Valentin Féray, and Piotr Śniady. “Jack polynomials and orientability generating series of maps”. In: *Sém. Lothar. Combin.* 70, Art. B70j, 50.
- 2012 Maciej Dołęga and Piotr Śniady. “Asymptotics of characters of symmetric groups: structure of Kerov character polynomials”. In: *J. Combin. Theory Ser. A* 119.6, pp. 1174–1193.
- 2010 Maciej Dołęga, Valentin Féray, and Piotr Śniady. “Explicit combinatorial interpretation of Kerov character polynomials as numbers of permutation factorizations”. In: *Adv. Math.* 225.1, pp. 81–120.

Conference papers

- 2023 Houcine Ben Dali and Maciej Dołęga. “Jack characters as generating series of bipartite maps and proof of Lassalle’s conjecture”. In: *Sém. Lothar. Combin.* 89B, Art. 34, 12.
- 2022 Maciej Dołęga. *b-Hurwitz numbers and enumeration of maps*. Oberwolfach Rep. 57/2022.
- 2021 Guillaume Chapuy and Maciej Dołęga. “Non-orientable branched coverings, b -Hurwitz numbers, and positivity for multiparametric Jack expansions (extended abstract)”. In: *Sém. Lothar. Combin.* 85B, Art. 32, 13.
- 2020 Maciej Dołęga, Thomas Gerber, and Jacinta Torres. “A positive combinatorial formula for symplectic Kostka-Foulkes polynomials I: Rows”. In: *Sém. Lothar. Combin.* 84B, Art. 42, 12 pp.–11.
- 2018 Maciej Dołęga. “A combinatorial formula for Macdonald cumulants”. In: *Sém. Lothar. Combin.* 80B, Art. 41, 12.
- 2016 Maciej Dołęga and Valentin Féray. “Cumulants of Jack symmetric functions and b -conjecture (extended abstract)”. In: *28th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2016)*. Discrete Math. Theor. Comput. Sci. Proc., BC. Assoc. Discrete Math. Theor. Comput. Sci., Nancy, pp. 395–406.
- 2015 Guillaume Chapuy and Maciej Dołęga. “A bijection for rooted maps on general surfaces (extended abstract)”. In: *27th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2015)*. Discrete Math. Theor. Comput. Sci. Proc., FPSAC’15. Assoc. Discrete Math. Theor. Comput. Sci., Nancy, pp. 181–192.
- 2013 Maciej Dołęga and Valentin Féray. “On Kerov polynomials for Jack characters.” In: *25th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2013)*. Discrete Math. Theor. Comput. Sci. Proc., AS. Assoc. Discrete Math. Theor. Comput. Sci., Nancy, pp. 539–550.
- 2011 Maciej Dołęga and Piotr Śniady. “Polynomial functions on Young diagrams arising from bipartite graphs”. In: *23rd International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2011)*. Discrete Math. Theor. Comput. Sci. Proc., AO. Assoc. Discrete Math. Theor. Comput. Sci., Nancy, pp. 257–268.

- 2009 Maciej Dołęga, Valentin Féray, and Piotr Śniady. “Characters of symmetric groups in terms of free cumulants and Frobenius coordinates”. In: *21st International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2009)*. Discrete Math. Theor. Comput. Sci. Proc., AK. Assoc. Discrete Math. Theor. Comput. Sci., Nancy, pp. 337–348.