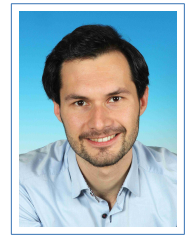# Michael Wallner

Curriculum Vitae

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I am currently an Erwin Schrödinger-Fellow and Postdoctoral researcher at the Laboratoire Bordelais de Recherche en Informatique at the Université de Bordeaux working with Mireille Bousquet-Mélou.

Education

11/2013 – 01/2017	**PhD in Mathematics**, *TU Wien*, Austria, Analytic combinatorics, discrete mathematics, lattice paths, compacted trees. Promotio sub auspiciis prasidentis rei publicae (Graduation with highest national distinction)
09/2011 – 09/2012	**Master of Science (MSc)**, *Brunel University London*, United Kingdom, Computational Mathematics with Modelling. Focus: FEM- and BEM-Methods for PDEs, Variational Calculus, Perturbation Theory, Integral Equations, Monte Carlo Methods for Asset Pricing Thesis Title: "Algebraic Multigrid Methods for Higher-Order Finite Element Discretization with Parallelization" supervised by Matthias Maischak Graduated with highest distinction
07/2011 – 10/2013	**Master of Science (Dipl.-Ing.)**, *TU Wien*, Austria, Technical Mathematics in the Computer Sciences. Focus: Discrete Mathematics, Calculus, Algebra, IT Security, Cryptography, Programming Thesis Title: "Lattice Path Combinatorics" supervised by Michael Drmota Graduated with highest distinction
10/2008 – 07/2011	**Bachelor of Science (BSc)**, *TU Wien*, Austria, Technical Mathematics in the Computer Sciences.
07/2007 – 01/2008	**Military service**, *Medic*, Austria.
09/2002 – 06/2007	**HTBL Pinkafeld – Höhere Lehranstalt für EDV und Organisation**, Austria. Austrian Matura passed with distinction

PhD thesis

Title	*Combinatorics of Lattice Paths and Tree-like Objects*
Supervisor	Bernhard Gittenberger, TU Wien
Description	The thesis is concerned with the enumerative and asymptotic analysis of directed lattice paths and tree-like structures. In the first part, several new models for lattice paths are introduced and some of their characterizing parameters, such as the number of returns to zero, or their average height and final altitude are analyzed. In the second part, enumerative and asymptotic results on compacted binary trees are solved. Such trees are a special class of directed acyclic graphs arising from a compressing method.

Work experience

02/2018 – present	**Postdoctoral position**, *Université de Bordeaux, Laboratoire Bordelais de Recherche en Informatique (LaBRI), Bordeaux*.
09/2017 – 12/2017	**Postdoctoral position**, *Université Paris 13, Laboratoire d'Informatique de Paris Nord (LIPN), Paris*.
05/2017 – 07/2017	**Postdoctoral position**, *Academia Sinica, Institute of Statistical Science, Taipei*.
02/2017 – 04/2017	**Postdoctoral position**, *TU Wien, Institute of Discrete Mathematics and Geometry*, SFB F50-03: Combinatorics of Tree-Like Structures and Enriched Trees.
09/2015 – 01/2017	**External lecturer (side job)**, *FH Campus Wien – University of Applied Sciences*. Small group tutoring in "Calculus 1" for electrical engineering students.
11/2013 – 04/2017	**Graduate teaching and research assistant**, *TU Wien, Institute of Discrete Mathematics and Geometry*. Performed independent research towards obtaining a PhD, disseminated research results, undertook various teaching and grading duties.
10/2012 – 01/2013	**Undergraduate teaching assistant**, *TU Wien, Institute of Discrete Mathematics and Geometry*. Small group tutoring in numerical mathematics.
2004 – 2011	**Internships**, (of 1–2 months).
2010/2011	AIT - Austrian Institute of Technologie, Donau-City-Str. 1, 1220 Wien.
2009	T-Systems Austria, Rennweg 97-99, 1030 Wien.
2008	Marriott Vacation Club International, 4700 Kinsale Road, Cork, Ireland.
2006	Telekom Austria AG, Lasallestr. 9, 1020 Wien.
2005	Kapsch Carrier.Com, Am Euro-Platz 5, 1120 Wien.
2004	Raiffeisen Bank International, Mooslackeng. 25, 1190 Wien.

Grants

02/2018 – 01/2021	Erwin Schrödinger-Fellowship of the FWF at the Université de Bordeaux and the TU Wien, *Funktionalgleichung für Gitterwege und Baumstrukturen*
12/2017 – 12/2019	Exzellenzstipendium für sub auspiciis Praesidentis Promovierende (Scholarship of excellence)
2012 – 2013	TUtheTOP Excellence program at TU Wien
2011 – 2012	Erasmus Scholarship Brunel University London
2011	Julius-Raab-Stipendium
2009 – 2013	Leistungstipendium der TU Wien (Excellence scholarship)

Teaching

All courses were taught in German and were exercise classes (German: Übung).

TU Wien

2015/2016	Discrete Methods (Diskrete Methoden)
	Analysis for Computer Science (Analysis für Informatik und Wirtschaftsinformatik)

2014/2015	Discrete Methods (Diskrete Methoden)
	Analysis for Computer Science (Analysis für Informatik und Wirtschaftsinformatik)
	Algebra and Discrete Mathematics (Algebra und Diskrete Mathematik für Informatik und Wirtschaftsinformatik)
2013/2014	Discrete Methods (Diskrete Methoden)
	Algebra and Discrete Mathematics (Algebra und Diskrete Mathematik für Informatik und Wirtschaftsinformatik)
2012/2013	Numerical Analysis (Numerische Mathematik)

FH Campus Wien – University of Applied Sciences

2016/2017	Analysis 1
2015/2016	Analysis 1

Lectures

2015	Invited course "An Invitation to Analytic Combinatorics and Lattice Path Counting", 3rd ALEA in Europe Young Researchers' Workshop, University of Bath, UK

Research areas

My main interest lies within (analytic) combinatorics, with an emphasis both on exact and asymptotic results for the enumeration of labeled and unlabeled structures and on probabilistic limit laws for combinatorial parameters. In line with this interest, my main focus areas are lattice path combinatorics and tree-like structures, but I am also interested in the application of methods from analytic combinatorics to number theory.

Lattice paths	Kernel method, new "unconventional" models (e.g. catastrophes, reflection, absorption, etc.), limit laws, applications
Trees	Compacted trees, directed acyclic graphs, Pólya trees, parameters
Number theory	Divisibility by prime numbers, applications of generating functions

Scientific activity

Publications	20 peer-reviewed publications, 4 additional scientific articles submitted; see Publications on page 5 for details
Talks	41 talks at international events; see Talks on page 7 for details
Reviews	Article reviewing for international journals and conferences:

- Journal of Integer Sequences
- Séminaire Lotharingien de Combinatoire
- Online Journal of Analytic Combinatorics
- Discrete Mathematics
- Annals of Combinatorics
- Discrete Mathematics and Theoretical Computer Science
- Proceedings of Formal Power Series and Algebraic Combinatorics (FPSAC)
- Proceedings of the International Meeting on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA)

- Proceedings of the International Conference on Lattice Path Combinatorics & Applications
- Reviewer for Birkäuser Science Lecture Notes in Applied and Numerical Harmonic Analysis series
- Reviewer for Mathematical Reviews

Computer skills

Programming	Java, C++, Fortran, Matlab, Maple
Database	Oracle, MySQL, SAP
Network	Cisco CCNA-Education
Publishing	Latex, Microsoft Office, LibreOffice, HTML

Languages

German	**Mother tongue**
English	**Proficiency (C2)**
Hungarian	**Independent user (B1)**
French	**Basic user (A2)**

Interests

Guitar	17 years of attending the music school Oberwart, member of different ensembles, participation at several concerts, ongoing member of the church ensemble Unterwart
Climbing	Member of Alpenverein Edelweiss (Austrian climbing society)
Other	Hiking, skiing, gym, board games, books

Organizational skills

2021	Member of organizing committee of the Lattice Path Conference, Luminy, France
2020	Member of organizing and scientific committee of the Ecole Jeunes Chercheurs en Informatique and Mathematique 2020 (EJCIM), Bordeaux, France
2017	Member of organizing committee of the ALEA in Europe Workshop, Vienna, Austria
2017	Member of organizing committee of the European Conference on Combinatorics, Graph Theory and Applications, Vienna, Austria
2016	Member of organizing committee of the 4th ALEA in Europe Young Researcher's Workshop, Vienna, Austria
2015	Member of organizing committee of AofA'15, Strobl, Austria.
2014 – present	Administrator of the website of the seminar of the Arbeitsgemeinschaft Diskrete Mathematik, TU Wien, Austria.
2013 – 2017	Teaching support at the Institute of Discrete Mathematics and Geometry, TU Wien, Austria.
2011 – 2012	Student representative of course "Computational Mathematics with Modelling" at Brunel University London

2007	Team leader during final year project "Vienna Online Diabetes Education" at HTBL Pinkafeld, First prize at school competition "Jugend Innovativ", category ICT
2007	Quality management technician after ISO 9001
2005	Driving license category B (Austria)

Popularization

12/2018	Talk at the 7. Weihnachtskolloquium: *Asymptotic Enumeration of Compacted Binary Trees*, TU Wien, Austria, December 2018.
08/2019	Pfade und Bäume in Bordeaux, *scilog – Magazin des Wissenschaftsfonds FWF*, August 2019.

Publications

submitted	*Compacted binary trees admit a stretched exponential* with Andrew Elvey Price, Wenjie Fang, 30 pages, preprint available at `arxiv.org/abs/1908.11181`.
submitted	*Periodic Pólya Urns, the Density Method, and Asymptotics of Young Tableaux* with Cyril Banderier, Philippe Marchal, 48 pages.
submitted	*Counting and sampling gene family evolutionary histories in the duplication-loss and duplication-loss-transfer models* with Cedric Chauve, Yann Ponty, 32 pages, preprint available at `arxiv.org/abs/1905.04971`.
submitted	*A half-normal distribution scheme for generating functions* 24 pages, preprint available at `arxiv.org/abs/1610.00541`.

Peer-reviewed Journals and Book Series

to appear	*Asymptotic Enumeration of Compacted Binary Trees of Bounded Right Height* with Antoine Genitrini, Bernhard Gittenberger, Manuel Kauers, Journal of Combinatorial Theory, Series A, 44 pages, preprint available at `arxiv.org/abs/1703.10031`.
2019	*A bijection of plane increasing trees with relaxed binary trees of right height at most one* Theoretical Computer Science,Volume 755, 10 January 2019, Pages 1-12, preprint available at `arxiv.org/abs/1706.07163`.
2019	*The Tu–Deng conjecture holds almost surely* with Lukas Spiegelhofer, Electronic Journal of Combinatorics, Volume.26 (2019), no. 1, Paper 1.28, 28 pp., preprint available at `arxiv.org/abs/1707.07945`.
2019	*Explicit formulas for enumeration of lattice paths: basketball and the kernel method* with Cyril Banderier, Christian Krattenthaler, Alan Krinik, Dmitry Kruchinin, Vladimir Kruchinin and David Nguyen, Lattice Path Combinatorics and Applications, G. E. Andrews, C. Krattenthaler and A. Krinik (eds.), Developments in Mathematics, Springer-Verlag, Cham, 2019, Pages 78-118, preprint available at `arxiv.org/abs/1609.06473`.

2019   *The kernel method for lattice paths below a line of rational slope*
       with Cyril Banderier, Lattice Path Combinatorics and Applications, G. E. Andrews,
       C. Krattenthaler and A. Krinik (eds.), Developments in Mathematics, Springer,
       Springer-Verlag, Cham, 2019, , Pages 119-154, preprint available at `arxiv.org/abs/1606.08412`.

2018   *On the shape of random Pólya structures*
       with Bernhard Gittenberger, Emma Yu Jin, Discrete Mathematics, Volume 341,
       Issue 4, April 2018, Pages 896–911, preprint available at `arxiv.org/abs/1707.02144`.

2018   *Divisibility of binomial coefficients by powers of two*
       with Lukas Spiegelhofer, Journal of Number Theory, Volume 192, November 2018,
       Pages 221-239, preprint available at `arxiv.org/abs/1710.10884`.

2017   *An explicit generating function arising in counting binomial coefficients divisible
       by powers of primes*
       with Lukas Spiegelhofer, Acta Arithmetica 181 (2017), 27-55, preprint available at
       `arxiv.org/abs/1604.07089`.

2017   *Lattice paths with catastrophes*
       with Cyril Banderier, Discrete Mathematics & Theoretical Computer Science,
       September 29, 2017, Vol 19 no. 1, preprint available at `arxiv.org/abs/1707.01931`.

Peer-reviewed Proceedings

2019   *Combinatorics of nondeterministic walks of the Dyck and Motzkin type*
       with Élie de Panafieu, Mohamed Lamine Lamali, in Proceedings of the Sixteenth
       Workshop on Analytic Algorithmics and Combinatorics, ANALCO 2019: 1-12, San
       Diego, 2019, preprint available at `arxiv.org/abs/1812.06650`.

2019   *De la probabilité de creuser un tunnel*
       with Élie de Panafieu, Mohamed Lamine Lamali, in Proceedings of AlgoTel 2019,
       Saint Laurent de la Cabrerisse, 2019, preprint available at HAL 02123269v1.

2018   *Periodic Pólya Urns and an Application to Young Tableaux*
       with Cyril Banderier, Philippe Marchal, LIPIcs, Vol. 110 - Aofa 2018, 11:1-11:13,
       2018, Uppsala, preprint available at `arxiv.org/abs/1806.03133`.

2018   *Rectangular Young tableaux with local decreases and the density method for uni-
       form random generation*
       with Cyril Banderier and Philippe Marchal, CEUR Workshop Proceedings 2113, GAS-
       Com 2018:60-68, Athens, 2018, preprint available at `arxiv.org/abs/1805.09017`.

2018   *Local time for lattice paths and the associated limit laws*
       with Cyril Banderier, CEUR Workshop Proceedings 2113, GASCom 2018:69-78,
       Athens, 2018, preprint available at `arxiv.org/abs/1805.09065`.

2017   *Lattice paths with catastrophes*
       with Cyril Banderier, Electronic Notes in Discrete Mathematics, 59:131-146, 2017.

2017 *A note on the scaling limits of random Pólya trees*
with Bernhard Gittenberger and Emma Yu Jin, 2017 Proceedings of the Fourteenth Workshop on Analytic Algorithmics and Combinatorics (ANALCO), 85-93, 2017, preprint available at `arxiv.org/abs/1606.08769`.

2016 *A half-normal distribution scheme for generating functions and the unexpected behavior of Motzkin paths*
in Proceedings of the 27th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (`http://www.aofa2016.meetings.pl/`), Krakow, pages 341-352, preprint available at `arxiv.org/abs/1605.03046`.

2016 *The reflection-absorption model for directed lattice paths*
with Cyril Banderier, in Proceedings of the Vienna Young Scientists Symposium (`http://vss.tuwien.ac.at/home/`), Vienna, pages 98-99.

2015 *Lattice paths of slope 2/5*
with Cyril Banderier, in Proceedings of the Twelfth Workshop on Analytic Algorithmics and Combinatorics (ANALCO), San-Diego, pages 105-113, preprint available at `arxiv.org/abs/1605.02967`.

2014 *Some reflections on directed lattice paths*
with Cyril Banderier, in Proceedings of the 25th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2014) (`http://www.aofa14.upmc.fr/`), Paris, pages 25-36, preprint available at `arxiv.org/abs/1605.01687`.

Theses

2017 *Combinatorics of lattice paths and tree-like structures*
PhD thesis, TU Wien, Vienna.

2013 *Lattice path combinatorics*
Master's thesis, TU Wien, Vienna.

2012 *Algebraic multigrid methods for higher-order finite element discretization with parallelization*
Master's thesis, Brunel University, London.

Talks

All events are links leading to the respective venues.

41 *Counting and Sampling Gene Families Evolutionary Histories*, 5th Algorithmic and Enumerative Combinatorics Summer School 2019, Hagenberg, Austria, July 2019.

40 *Periodic Pólya urns and an application to Young tableaux*, SIAM Algebraic Combinatorics Conference, Bern, Switzerland, July 2019.

39 *Asymptotic Enumeration of Compacted Binary Trees with Height Restrictions*, 30th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2019), CIRM, Marseille, France, July 2019.

38 *Counting and Sampling Gene Families Evolutionary Histories*, Seminar Combinatoire Énumérative et Algébrique, LaBRI, Bordeaux, France, April 2019.

37 *Periodic Pólya Urns and Asymptotics of Triangular Young tableaux*, Journées de combinatoire de Bordeaux, LaBRI, Bordeaux, France, February 2019.

36 *Periodic Pólya Urns and Asymptotics of Triangular Young tableaux*, Séminaires de Probabilités-Statistiques, Université de Versailles Saint-Quentin-en-Yvelines, Versailles, France, February 2019.

35 *Limit laws for lattice paths with catastrophes*, Joint Mathematics Meetings 2019, Baltimore, USA, January 2019.

34 *A bijection of plane increasing trees with bounded relaxed binary trees*, 4th Algorithmic and Enumerative Combinatorics Summer School 2018, Hagenberg, Austria, July 2018.

33 *Periodic Pólya urns and an application to Young tableaux*, 29th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2018), Uppsala, Sweden, June 2018.

32 *Periodic Pólya urns and an application to Young tableaux*, Seminar Combinatoire Énumérative et Algébrique, LaBRI, Bordeaux, France, June 2018.

31 *Asymptotic Enumeration of Compacted Binary Trees with Height Restrictions*, Computational Logic and Applications, Sorbonne University, Paris, France, May 2018.

30 *Periodic Pólya urns and an application to Young tableaux*, Journée MathStic - Combinatoire, probabilités, et physique, LIPN, Paris, France, May 2018.

29 *A bijection of plane increasing trees with bounded relaxed binary trees*, Journées ALEA, CIRM, Marseille, France, March 2018.

28 *Asymptotic Enumeration of Compacted Binary Trees with Height Restrictions*, Seminar of the Combinatoire Énumérative et Algébrique, LaBRI, Bordeaux, France, February 2018.

27 *Half-normal lattice paths*, PhD Seminars Mathematics, Ghent University, Belgium, December 2017.

26 *Asymptotic Enumeration of Compacted Binary Trees with Height Restrictions*, Seminar "Computations and Proofs", INRIA, France, December 2017.

25 *Lattice paths with catastrophes: limit laws and random generation*, Séminaire de Probabilités et Théorie Ergodique, Univeristé de Tours, France, November 2017.

24 *Limit laws for lattice paths with catastrophes*, séminaire de combinatoire, LIPN, Paris, France, September 2017.

23 *An introduction to lattice path counting (with catastrophes)*, PostDoc Seminar, Institute of Statistical Science, Academia Sinica, Taiwan, July 2017.

22 *Limit laws for lattice paths with catastrophes*, Seminar on Combinatorics, Institute of Mathematics, Academia Sinica, Taiwan, July 2017.

21 *The kernel method for lattice paths below a line of rational slope*, Algo@ISS-AS Seminar, Institute of Statistical Science, Academia Sinica, Taiwan, June 2017.

20 *A note on the scaling limits of random Pólya trees*, Analytic Algorithmics and Combinatorics (ANALCO), Barcelona, Spain, January 2017.

19   *Compacted binary trees*, SFB F50 Algorithmic and Enumerative Combinatorics status seminar, Strobl, Austria, November 2016.

18   *A note on the scaling limits of random Pólya trees*, Arbeitsgemeinschaft Diskrete Mathematik, Vienna University of Technology, Austria, November 2016.

17   *Lattice paths with catastrophes*, 77th Séminaire Lotharingien de combinatoire (SLC77), Strobl, Austria, September 2016.

16   *A half-normal distribution scheme for generating functions*, Asymptotic Analysis of Algorithms & Combinatorial Structures (A3CS), Paris, France, September 2016.

15   *A half-normal distribution scheme for generating functions and the unexpected behavior of Motzkin paths*, 27th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2016), Kraków, Poland, July 2016.

14   *Lattice paths below a line of rational slope*, Final conférence of the MADACA project, Domaine de Chalès, France, June 2016.

13   *A half-normal distribution scheme for generating functions*, Arbeitsgemeinschaft Diskrete Mathematik, Vienna University of Technology, Austria, June 2016.

12   *The reflection-absorption model for directed lattice paths*, VIENNA young SCIENTISTS SYMPOSIUM (VSS16), Vienna, Austria, June 2016.

11   *An Invitation to Analytic Combinatorics and Lattice Path Counting*, ALEA in Europe Young Researchers' Workshop, University of Bath, Bath, UK, December 2015.

10   *Counting compacted trees*, SFB F50 Algorithmic and Enumerative Combinatorics status seminar, Strobl, Austria, December 2015.

9   *Why and when does the half-normal distribution appear in combinatorics?*, Séminaire de combinatoire, LIPN, Paris, France, September 2015.

8   *A half-normal limit distribution scheme and applications to lattice paths*, 8th International Conference on Lattice Path Combinatorics & Applications, Cal Poly Pomona, USA, August 2015.

7   *The extension of a Rayleigh limiting distribution scheme*, SFB workshop on Lattice Walks, Hagenberg, Austria, May 2015.

6   *Lattice paths of slope 2/5*, Analytic Algorithmics and Combinatorics (ANALCO), San Diego, USA, January 2015.

5   *Lattice paths of slope 2/5*, SFB F50 Algorithmic and Enumerative Combinatorics status seminar, Strobl, Austria, December 2014.

4   *Lattice paths of slope 2/5 – Solving a problem of Knuth*, Arbeitsgemeinschaft Diskrete Mathematik, Vienna University of Technology, Austria, November 2014.

3   *Some (more) reflections on lattice paths*, Probability seminar of the Université Francois Rabelais, Tours, France, September 2014.

2   *Some reflections on lattice paths*, 25th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2014), Paris, France, June 2014.

1 *Some reflections on directed lattice paths*, Arbeitsgemeinschaft Diskrete Mathe-
matik, Vienna University of Technology, Austria, May 2014.

(Last updated: 3. September 2019)