# Curriculum Vitæ
## Jean-Philippe Labbé
(January 4, 2021)

Arbeitsgruppe Diskrete Geometrie
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## Area of Specialization

My research is at the intersection of combinatorics, discrete geometry and group theory. My speciality is combining geometric, combinatorial and computational approaches to study properties of algebraic and topological structures. In particular, my research merges abstract modelizations and computational experimentations to tackle open problems related to Coxeter groups, polytopes (in particular permutahedra, associahedra, and their applications to quantum physics), triangulations, and simplicial complexes.

**MSC2010 keywords:**

05 Combinatorics: Groups and algebras, Reflection and Coxeter groups (05E15, 20F55, 20B40)

52 Discrete Geometry: Combinatorial and computational aspects of polytopes, Special polytopes (52B05, 52B12, 52B55)

## Work Experience

| | | |
|---|---|---|
| 11/2020 – | **Privatdozent** | |
| | Freie Universität Berlin, Germany | |
| 10/2016 – 09/2020 | **Research Fellow**, *SFB Transregio* "Discretization in Geometry and Dynamics" | |
| | Freie Universität Berlin, Germany | |
| 10/2014 – 09/2016 | **Research Fellow**, *Israel Science Foundation Grant* of Prof. Eran Nevo | |
| | Hebrew University of Jerusalem, Israel | |
| 02/2015 – 10/2015 | **Research Fellow**, Fonds de recherche Nature et Technologies (Québec) | |
| | Universitad de Cantabria, Santander, Spain | |
| 07/2013 – 06/2014 | **Research Fellow**, *SFB Transregio* "Discretization in Geometry and Dynamics" | |
| | Freie Universität Berlin, Germany | |

## Teaching Experience

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|---|---|
| 2017 – | **University courses** |
| | Bachelor courses: *Wahrscheinlichkeit & Statistik*, *Seminar zur Geometrie* |
| | Master courses: *Discrete Mathematics I*, *Seminar Discrete Mathematics I* |
| 2016 – | **Programming** |
| | Sagemath: SageDays 79 (Teaching `python` and `Sagemath`), Friday Coding Sprints |
| 2008 – 2010 | **Teaching Assistant** |
| | *Algèbre Matricielle*, *Combinatoire*, *Algèbre II* |

## Education

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|---|---|
| 07/2020 | **Habilitation**, Mathematics / Freie Universität Berlin |
| | Title: *Convex Geometry of Subword Complexes of Coxeter Groups* |
| | Habilitation Presentation: *Jones Unknotting Conjecture* |
| 10/2010 – 07/2013 | **Dr. rer. nat.**, Mathematics / Freie Universität Berlin |
| | Title: *Polyhedral Combinatorics of Coxeter Groups* |
| | Advisor: Prof. Günter M. Ziegler |
| 05/2008 – 08/2010 | **Maîtrise ès Sciences**, Mathématiques / Université du Québec à Montréal |
| | Title: *Approche combinatoire des amas par les éléments triés des groupes de Coxeter* |
| | Advisor: Prof. Christophe Hohlweg |
| 09/2005 – 04/2008 | **Bachelier ès Sciences**, Mathématiques / Université Laval, Québec City |
| 09/2007 – 12/2007 | **Math in Moscow** / Independent University of Moscow |
| 09/2006 – 12/2006 | **Budapest Semesters in Mathematics** / Eötvös University |

## Articles in Preparation

[1]   Christian Schilling, Federico Castillo, and Jean-Philippe Labbé, *Comprehensive foundation of one-matrix functional theory for excited states*, in preparation (2020) 20 pp.

[2]   Winfried Bruns, Vincent Delecroix, Matthias Köppe, and Jean-Philippe Labbé, *Algebraic polyhedra in Sagemath with Normaliz*, in preparation (2020) 21 pp.

[3]   Federico Castillo, Jean-Philippe Labbé, and Christian Schilling, *Paulitopes*, in preparation (2020) 15 pp.

## Preprints

[4]   Michael Cuntz, Sophia Elia, and Jean-Philippe Labbé, *Congruence normality of simplicial hyperplane arrangements via oriented matroids*, arXiv:2009.14152 (2020) 39 pp.

[5]   Jean-Philippe Labbé, *Combinatorial foundations for geometric realizations of subword complexes of Coxeter groups*, arXiv:2003.02753 (2020) 34 pp.

## Book Chapters

[6]   Ana Maria Botero, Jean-Philippe Labbé, and Lauren Williams. *Introduction to total positivity and cluster algebras*. In: *ECCO – Lectures Notes*. (Book in preparation). Cambridge University Press, 2019, 32 pp.

## Publications

[7]   Joseph Doolittle, Jean-Philippe Labbé, Carsten Lange, Rainer Sinn, Jonathan Spreer, and Günter M. Ziegler, *Combinatorial inscribability obstructions for higher-dimensional polytopes*, Mathematika **66** (2020) no. 4, 927–953.

[8]   Jean-Philippe Labbé and Carsten Lange, *Cambrian acyclic domains: counting c-singletons*, Order **37** (2020) no. 3, 571–603.

[9]   Jean-Philippe Labbé, Günter Rote, and Günter M. Ziegler, *Area difference bounds for dissections of a square into an odd number of triangles*, Exp. Math. **29** (2020) no. 3, 253–275.

[10]  Sarah B. Brodsky, Cesar Ceballos, and Jean-Philippe Labbé, *Cluster algebras of type $D_4$, tropical planes, and the positive tropical Grassmannian*, Beitr. Algebra Geom. **58** (2017) no. 1, 25–46.

[11]  Hao Chen and Jean-Philippe Labbé, *Limit directions for Lorentzian Coxeter systems*, Groups Geom. Dyn. **11** (2017) no. 2, 469–498.

[12]  Jean-Philippe Labbé, *Brocoli: Sagemath package dealing with LImit ROots of COxeter groups*, https://github.com/jplab/brocoli (2017) version 1.0.0 3500 lines.

[13]  Jean-Philippe Labbé, Thibault Manneville, and Francisco Santos, *Hirsch polytopes with exponentially long combinatorial segments*, Math. Program. **165** (2017) no. 2, Ser. A, 663–688.

[14]  Jean-Philippe Labbé and Eran Nevo, *Bounds for entries of $\gamma$-vectors of flag homology spheres*, SIAM J. Discrete Math. **31** (2017) no. 3, 2064–2078.

[15]  Christophe Hohlweg and Jean-Philippe Labbé, *On inversion sets and the weak order in Coxeter groups*, European J. Combin. **55** (2016) 1–19.

[16]  Nantel Bergeron, Cesar Ceballos, and Jean-Philippe Labbé, *Fan realizations of type A subword complexes and multi-associahedra of rank 3*, Discrete Comput. Geom. **54** (2015) no. 1, 195–231.

[17]  Hao Chen and Jean-Philippe Labbé, *Lorentzian Coxeter systems and Boyd-Maxwell ball packings*, Geom. Dedicata **174** (2015) 43–73.

[18]  Cesar Ceballos, Jean-Philippe Labbé, and Christian Stump, *Subword complexes, cluster complexes, and generalized multi-associahedra*, J. Algebraic Combin. **39** (2014) no. 1, 17–51.

[19]  Christophe Hohlweg, Jean-Philippe Labbé, and Vivien Ripoll, *Asymptotical behaviour of roots of infinite Coxeter groups*, Canad. J. Math. **66** (2014) no. 2, 323–353.

[20]  Srečko Brlek, Jean-Philippe Labbé, and Michel Mendès France, *Combinatorial variations on Cantor's diagonal*, J. Combin. Theory Ser. A **119** (2012) no. 3, 655–667.

## Conference Proceedings

[21]  Jean-Philippe Labbé. *Universal Oriented Matroids for Subword Complexes of Coxeter Groups*. In: *FPSAC 2020*. 2020, pp. 12.

[22] Nantel Bergeron, Cesar Ceballos, and Jean-Philippe Labbé. *Fan realizations of type A subword complexes and multi-associahedra of rank 3*. In: *Proceedings of FPSAC 2015*. DMTCS Proc. Assoc. DMTCS, Nancy, 2015, 429–440.

[23] Hao Chen and Jean-Philippe Labbé. *Lorentzian Coxeter groups and Boyd-Maxwell ball packings*. In: *26th FPSAC*. DMTCS Proc. Assoc. DMTCS, Nancy, 2014, 103–111.

[24] Cesar Ceballos, Jean-Philippe Labbé, and Christian Stump. *Multi-cluster complexes*. In: *24th FPSAC*. DMTCS Proc. Assoc. DMTCS, Nancy, 2012, 1–8.

[25] Christophe Hohlweg, Jean-Philippe Labbé, and Vivien Ripoll. *Asymptotical behaviour of roots of infinite Coxeter groups I*. In: *24th FPSAC*. DMTCS Proc. Assoc. DMTCS, Nancy, 2012, 851–862.

## Honors, Awards and Grants

| | |
|---|---|
| 2011 – | Ambassador, Centre d'étude Collégial, Lac-Mégantic (Québec) |
| 2016 | *Deux frères dans les hautes sphères des mathématiques internationales*<br>News article, Ronald Martel, *La Tribune*, appeared 14 March 2016 |
| 01/2015 – 12/2016 | Postdoctoral Research Fellowship – **by Competition**<br>*Fonds de recherche Nature et Technologies (Québec)*, (70 000\$CAD) |
| 10/2013 | Phase II – Certificate of Distinction<br>*Berlin Mathematical School* |
| 02/2013 | Public Prize for Best Talk<br>*Math Slam (Sandwich Theory)* – Berlin Mathematical School Conference |
| 09/2010 – 08/2013 | Doctoral Research Fellowship – **by Competition**<br>*Fonds de recherche Nature et Technologies (Québec)*, (60 000\$CAD) |
| 08/2010 | Mention d'Honneur – Top Score Thesis<br>*Faculté des Sciences, Université du Québec à Montréal* |
| 09/2008 – 08/2010 | Master Research Fellowship – **by Competition**<br>*Fonds de recherche Nature et Technologies (Québec)*, (30 000\$CAD) |
| 05/2008 – 08/2008 | Summer Research Grant<br>*LaCIM-UQAM*, (5 000\$CAD) |
| 05/2007 | Math in Moscow Scholarship – **by National Competition**<br>*CMS and NSERC Scholarship (Canada)*, 3 Prizes/Year, (9 000\$CAD) |
| 05/2007 – 08/2007 | Summer Research Grant – **by Competition**<br>*NSERC*, (6250\$CAD) |
| 05/2006 – 08/2006 | Summer Research Grant – **by Competition**<br>*NSERC*, (6250\$CAD) |
| 08/2005 – 04/2006 | Tableau d'Honneur – Perfect Grade Point Average (4.3/4.3)<br>*Département de Mathématiques et Statistique, Université Laval* |

## Selected Scientific Invitations

FPSAC International Conferences (acceptance: ≈5% talk, ≈15% poster)
Tel Aviv Israel (Poster, 2020), Daejeon South Korea (Poster, 2015), Chicago USA (Poster, 2014), Nagoya Japan (2 Talks, 2012)

Research invitations
Oberwolfach *Discrete Geometry* (09/2020), Oberwolfach *Algorithms in Polyhedral Geometry* (Research in Pairs, 04/2019), Institute for Mathematics and its Applications – Minneapolis (Research in Pairs, 04/2018), Oberwolfach *Algebraic and Geometric Combinatorics* (02/2015), Centre International de Rencontres Mathématiques (05/2010)

Invited Talks
AMS Sectional Meeting *Geometric and Topological Combinatorics* (11/2019), Institute for Mathematics and its Applications (08/2017), Encuentro Colombiano de Combinatoria (06/2016)

Combinatorics & Geometry Seminars
Max Planck Institute Leipzig (03/2020), UCLA (11/2019), University of Southern California (11/2019), University of Washington (11/2019), University of Miami (11/2019), Institut Henri-Poincaré (03/2019), LaBRI Bordeaux (11/2017)

## Professional Services

Referee

Transactions of the AMS, Annales Henri Lebesgue, Experimental Mathematics, Israel Journal of Mathematics, Journal of Algebra, Algebraic Combinatorics, Discrete & Computational Geometry, New York Journal of Mathematics, Beiträge zur Algebra und Geometrie, Journal of Combinatorial Theory A, European Journal of Combinatorics, Electronic Journal of Combinatorics, Séminaire Lotharingien de Combinatoire, Discrete Mathematics, Australasian Journal of Combinatorics, Publicationes Mathematicae Debrecen

Organizer
- 2× Chair of organization committee (Sage Days 79, 1st BMS Student Conference)
- 5× Member of international organization committee (ECCO 2020, 1st and 2nd BMS–BGSMath Joint Junior Meeting, Sage Days 84, Coxeter Groups meet Convex Geometry 2012)
- 2× Member of organization committee of research seminars at the Freie Universität Berlin (Discrete Geometry group seminar, Polyhedral Combinatorics research seminar)

Thesis Advisorship
- Doctoral student:               1 on-going
- Master students:      3 completed
- Bachelor students:    3 completed,    1 on-going

Past and present committees
- Examination: 5 bachelor theses, 1 master thesis, 3 PhD Qualifying Exams, 3 PhD Defenses
- Hiring: 2 post-doctoral positions
- Representation: elected student representative (3×), appointed postdoctoral faculty spokesperson (2×), board member (Berlin Mathematical School, *Facets of Complexity* Graduate School), Early Career Representative for the Berlin Excellence Strategy University Alliance

## References

**Günter M. Ziegler (PhD Advisor)**
Freie Universität Berlin, Germany

**Eran Nevo**
Hebrew University Jerusalem, Israel

**Victor Reiner**
University of Minnesota, USA

**Francisco Santos**
Universidad de Cantabria, Spain

**Matthias Beck (Habil. Vorsitzender)**
San Francisco State University, USA

**Volkmar Welker**
Philipps-Universität Marburg, Germany

## Interests

Languages

| French: | Native speaker | English: | Fluent | German: | Fluent |
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| Russian: | Pushkin State Institute, Moscow McGill University (Advanced 2) | Spanish: | Upper Intermediate | Italian: | Beginner |
| Hungarian: | Budapest Semesters (Beginner) | Hebrew: | Beginner | | |

Cycling

- Constructed three single-speed bikes
- Cyclo-camping: Québec City – Îles-de-la-Madeleine (1200km in 7 days)
- Race: Vélothon Berlin 2012 (60km in 1h38min12sec)

Other

| Colonial History of the Americas | Ultimate frisbee | Sustainable gardening |
|---|---|---|
| Theater of the Absurd | French poetry | Fine Woodworking |