# Christopher H. Cashen

Faculty of Mathematics – University of Vienna

Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria

christopher.cashen@univie.ac.at   •   orcid: 0000-0002-6340-469X

Research interests: Geometric Group Theory, Algebra, Low dimensional Geometry/Topology

## Positions

| | |
|---|---|
| **University of Vienna** | **Vienna, Austria** |
| Privatdozent/Project Leader | *2021–present* |
| **University of Arkansas** | **Fayetteville, USA** |
| Visiting Assistant Professor | *2020–2021* |
| **University of Vienna** | **Vienna, Austria** |
| Senior Postdoctoral Fellow/Project Leader | *2014–2020* |
| Postdoctoral Fellow | *2012–2014* |
| **Université de Caen Normandie** | **Caen, France** |
| Postdoctoral Fellow | *2011–2012* |
| **University of Utah** | **Salt Lake City, USA** |
| Postdoctoral Fellow | *2008–2011* |

## Education

| | |
|---|---|
| **University of Vienna** | **Vienna, Austria** |
| Habilitation, Mathematics | *2020* |
| **University of Illinois at Chicago** | **Chicago, USA** |
| PhD, Mathematics | *2007* |

## Grants

| | |
|---|---|
| **Austrian Science Fund (FWF): P 34214-N** | **~€400,000** |
| Project Leader *Hierarchies and graph products of elementary groups* | *2021–2024* |
| **Austrian Science Fund (FWF): P 30487-N35** | **~€240,000** |
| Project Leader *Generalizations of Hyperbolic Boundaries* | *2017–2020* |
| **Austrian Science Fund (FWF): M 1717-N25** | **~€140,000** |
| Project Leader *Geometric and Analytic Aspects of Free Group Automorphisms* | *2014–2016* |
| Lise Meitner Fellowship | |

## Supervision

| | |
|---|---|
| Zachary Wilcox, Bachelor "Introduction to Research" project | U. Utah, 2011 |
| *Introduction to topology via matrix groups* | |
| Alexandra Edletzberger, Master Thesis | U. Vienna, 2020 |
| *Residual finiteness in hyperbolic groups* | |
| Charlotte Hoffman, Master Thesis | U. Vienna, 2020 |
| *Generalisations of Small Cancellation: The RSym Algorithm On Hyperbolic One-Relator Groups* | |
| Alexandra Edletzberger, PhD | U. Vienna, in progress |
| Valentina Marie Dolin, Master Thesis | U. Vienna, in progress |

# Publications

## Peer-reviewed

1. *Quasi-isometries between tubular groups*, Groups, Geometry and Dynamics **4** (2010), no. 3, 473–516.

2. *Line patterns in free groups*, w/Macura, Geometry & Topology **15** (2011), no. 3, 1419–1475.

3. *Growth tight actions*, w/Arzhantseva and Tao, Pacific Journal of Mathematics **278** (2015), no. 1, 1–49.

4. *Virtual geometricity is rare*, w/Manning, LMS Journal of Computation and Mathematics **18** (2015), no. 1, 444–455.

5. *Quasi-isometries need not induce homeomorphisms of contracting boundaries with the Gromov product topology*, Analysis and Geometry in Metric Spaces **4** (2016), no. 1, 278–281.

6. *Splitting line patterns in free groups*, Algebraic & Geometric Topology **16** (2016), no. 2, 621–673.

7. *Mapping tori of free group automorphisms, and the Bieri-Neumann-Strebel invariant of graphs of groups*, w/Levitt, Journal of Group Theory **19** (2016), no. 2, 191–216.

8. *Growth tight actions of product groups*, w/Tao, Groups, Geometry and Dynamics **10** (2016), no. 2, 753–770.

9. *A geometric proof of the structure theorem for cyclic splittings of free groups*, Topology Proceedings **50** (2017), 335–349.

10. *Characterizations of Morse geodesics via superlinear divergence and sublinear contraction*, w/Arzhantseva, Gruber, and Hume, Documenta Mathematica **22** (2017), 1193–1224.

11. *Quasi-isometry classification for [right-angled Coxeter groups defined by suitable subdivisions of] complete graphs*, w/Dani and Thomas, Journal of Topology **10** (2017), no. 4, 1066–1106, appendix to *Bowditch's JSJ tree and the quasi-isometry classification of certain Coxeter groups* by Dani and Thomas.

12. *Quasi-isometries between groups with two-ended splittings*, w/Martin, Mathematical Proceedings of the Cambridge Philosopical Society **162** (2017), no. 2, 249–291.

13. *Negative curvature in graphical small cancellation groups*, w/Arzhantseva, Gruber, and Hume, Groups, Geometry and Dynamics **13** (2019), no. 2, 579–632.

14. *A metrizable topology on the contracting boundary of a group*, w/Mackay, Transactions of the American Mathematical Society **372** (2019), no. 3, 1555–1600.

15. *Morse subsets of CAT(0) spaces are strongly contracting*, Geometriae Dedicata **204** (2020), no. 1, 311–314.

16. *Cogrowth for group actions with strongly contracting elements*, w/Arzhantseva, Ergodic Theory and Dynamical Systems **40** (2020), no. 7, 1738–1754.

17. *Short, highly imprimitive words yield hyperbolic one-relator groups*, w/Hoffmann, Experimental Mathematics (in press).

## Submitted

18. *Asymptotic cones of snowflake groups and the strong shortcut property*, w/Hoda and Woodhouse, preprint (2022), `arXiv:2202.11626`.

## Theses

19. *Quasi-isometries among tubular groups*, Ph.D. thesis, University of Illinois at Chicago, (2007).

20. *Morse, contracting, and strongly contracting sets with applications to boundaries and growth of groups*, Habilitationsschrift, University of Vienna, (2019).

## Software

21. *virtuallygeometric*, w/Manning, (2014), python scripts for working with multiwords in free groups, including checking virtual geometricity, `github.com/cashenchris/virtuallygeometric`.

22. *orgcensus*, (2020), census of all 1-relator groups of rank $\leq 4$ and relator length $\leq 16$ and accompanying python scripts, `https://www.mat.univie.ac.at/~cashen/orgcensus/`.

# Professional Activities

Referee for various journals

Reviewer for Mathematical Reviews

Member: American Math. Soc. Austrian Math. Soc. European Math. Soc. Association for Women in Math.

Organizer: 'Max Dehn Seminar', U. Utah, 2008-2011

Organizer: 'Geometry and Analysis on Groups Seminar', U. Vienna, 2014-2020, 2021-

Organizer: conference GAGTA 2023