Robert Kropholler

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Research Interests: Hyperbolic groups and their subgroups, finiteness properties, filling functions, small cancellation theory.

Employment History

Mathematics Münster Cluster of Excellence, University of Münster	**Münster, Germany**
Postdoctoral Research Assistant	*2020 – Present*
Tufts University	**Medford, MA, USA**
Norbert Wiener Assistant Professor	*2017 – 2020*
Mathematical Sciences Research Institute	**Berkeley, CA, USA**
Postdoctoral Researcher	*2016*

Education

St Edmund Hall, University of Oxford	**Oxford, UK**
DPhil. in Mathematics	*2012 – 2016*
Advisor: Martin Bridson	
University of Nottingham	**Nottingham, UK**
MMath, First Class	*2008 – 2012*

Publication List

Published Papers

1. Robert Kropholler and Vladimir Vankov. Finitely generated groups acting uniformly properly on hyperbolic space, 2020. To appear in Groups Geom. Dyn.

2. Robert Kropholler. Hyperbolic groups with almost finitely presented subgroups, 2020. To appear in Groups Geom. Dyn.

3. Robert Kropholler and Genevieve Walsh. Incoherence and fibering of many free-by-free groups, 2020. To appear in Ann. Inst. Fourier.

4. Assaf Bar-Natan, Moon Duchin, and Robert Kropholler. Conjugation curvature for cayley graphs, 2020. To appear in J. Topol. Anal.

5. Michael Ben-Zvi and Robert Kropholler. Right-angled artin group boundaries, 2020. To appear in Proc. Am. Math. Soc.

6. Robert Kropholler, Ian J Leary, and Ignat Soroko. Uncountably many quasi-isometry classes of groups of type FP. *Amer. J. Math.*, 142(6):1931–1944, 2020.

7. Robert Kropholler and Davide Spriano. Closure properties in the class of multiple context-free groups. *Groups Complex. Cryptol.*, 11(1):1–15, 2019.

8. Robert H. Gilman, Robert Kropholler, and Saul Schleimer. Groups whose word problems are not semilinear. *Groups Complex. Cryptol.*, 10(2):53–62, 2018.

9. Robert Kropholler. Special cube complexes. In *Geometric and cohomological group theory*, volume 444 of *London Math. Soc. Lecture Note Ser.*, pages 46–66. Cambridge Univ. Press, Cambridge, 2018.

10. Robert Kropholler and Gareth Wilkes. Profinite properties of RAAGs and special groups. *Bull. Lond. Math. Soc.*, 48(6):1001–1007, 2016.

11. Jack O. Button and Robert Kropholler. Nonhyperbolic free-by-cyclic and one-relator groups. *New York J. Math.*, 22:755–774, 2016.

Papers under review...

12. Robert Kropholler, Rylee Alanza Lyman, and Thomas Ng. Extensions of hyperbolic groups have locally uniform exponential growth, 2020. arXiv:2012.14880.

13. Noel Brady, Robert Kropholler, and Ignat Soroko. Homological filling functions of groups of type FP_2, 2020. arXiv:2012.00730.

14. Robert Kropholler Michael Ben-Zvi and Rylee Lyman. Folding-like techniques for CAT(0) cube complexess, 2020. arXiv:2011.05374.

15. Robert Kropholler and Mark Pengitore. A coarse embedding theorem for homological filling functions, 2020. arXiv:2008.11090.

16. Robert Kropholler, Stefano Vidussi, and Genevieve Walsh. Incoherence of free-by-free and surface-by-free groups, 2020. arXiv:2005.01202.

17. Robert Kropholler and Brendan Mallery. Medium-scale curvature at larger radii in finitely generated groups, 2020. arXiv:2004.10801.

18. Dawid Kielak, Robert Kropholler, and Gareth Wilkes. ℓ^2 betti numbers and coherence of random groups, 2020. arXiv:2003.06354.

19. Robert Kropholler and Chris O'Donnell. Groups with arbitrary cubical dimension gap, 2019. arXiv:1912.05055.

20. Robert Kropholler. Hyperbolic groups with finitely presented subgroups not of type F_3, 2018. arXiv:1808.09505.

21. Robert Kropholler and Federico Vigolo. A new construction of CAT(0) cube complexes, 2018. arXiv:1802.01885.

22. Robert Kropholler. Almost hyperbolic groups with almost finitely presented subgroups, 2018. arXiv:1802.01658.

Papers in preparation..

23. Robert Kropholler. Groups of type FP_2 over fields but not over $\mathbb{Z}$, 2020. In preparation.

24. Robert Kropholler and Claudio Llosa Isenrich. Dehn functions for coabelian subdirect products of free groups, 2020. In preparation.

Teaching Experience

Tufts University **Medford, MA, USA**
- Spring 2017: Lecturer for Calculus I and Algebraic Topology. *2017 - 2020*

- Fall 2017: Lecturer for Grad Algebra I and Recitation Leader for Calculus 1.
- Spring 2018: Lecturer for Grad Algebra II and Algebraic Topology.
- Fall 2018: Lecturer for 2 courses of Abstract Algebra I.
- Spring 2019: Lecturer for Calculus II, Abstract Algebra II and Special topics in Topology.
- Fall 2019: Lecturer for Algebraic Topology.
- Spring 2020: Lecturer for Algebraic Topology II.
- Set qualifying exams for Algebra and Algebraic Topology.
- Project supervision: two summer projects and two senior honors thesis.
- Examiner: five PhD candidates and one masters thesis.

○ **University of Oxford**   **Oxford, UK**
Stipendiary Lecturer   *2012 - 2016*

    Tutor for first year courses: Groups and Group Actions, Complex Numbers, Linear Algebra, Introduction to University Mathematics, and Optimization.

Tutor for second year courses: Algebra I: Linear Algebra and Algebra III: Group Theory.

Mathematics Tutor

    Mathematics tutor for at University College, St Catherine's College, Somerville College and St Edmund Hall as well as one to one classes with visiting students.

Class Tutor

    Topology and Groups for Part B student classes.

Teaching assistant

    Marking coursework in Part B Topology and Groups, Group Theory and Introduction to Character Theory, and Part C Geometric Group Theory, and Infinite Groups.

Invited Talks

○ Tufts University, 17th November 2020
    "Homological filling functions for almost finitely presented groups"
○ WWU Münster, 2nd November 2020
    "Algebraic fibering and incoherence for surface bundles"
○ McGill University, 7th October 2020
    "A Groups of type FP_2 over fields"
○ *Geometric Groups Theory without Boundaries*, Zoom, 20th July 2020
    "A coherent introduction to (in)coherence" (3 lecture minicourse)
○ *Groups with Geometrical and Topological Flavours*, University of Southampton, 8th July 2020
    "(In)coherence of surface-by-surface groups"
○ University of Bristol, 15th May 2020
    "(In)coherence of surface-by-surface groups"
○ University of California at Riverside, 13th May 2020
    "(In)coherence of surface-by-surface groups"
○ University of Milwaukee at Wisconsin, 6th April 2020
    "Incoherence and virtual fibering of free-by-free groups"
○ The Ohio State University, 5th February 2020
    "Fibering and incoherence for free-by-free groups"
○ Rutgers University, Newark, 30th January 2020
    "Fibering and incoherence for free-by-free groups"
○ University of Cambridge, 24th January 2020
    "Fibering and incoherence for free-by-free groups"
○ University of Bristol, 22nd January 2020
    "Boundaries of Right-Angled Artin groups"
○ University of Nebraska Lincoln, 3rd December 2019
    "Fibering and incoherence for free-by-free groups"
○ Tufts University, 22nd November 2019

"Fibering and incoherence for free-by-free groups"
- Bielefeld University, 9th October 2019
  "Boundaries of right angled Artin groups"
- WWU Münster, 7th October 2019
  "Groups acting uniformly properly on hyperbolic spaces"
- "*Cohomological Methods*", IMPAN, Warsaw, 11th April 2019
  "Almost finitely presented subgroups of hyperbolic groups"
- University at Buffalo, 4th March 2019
  "Multiple context free groups"
- Tufts University, 11th December 2018
  "An introduction to medium scale curvature"
- *Geometry and Groups in the South East*, Southampton, 30th November 2018
  "Almost finitely presented subgroups of hyperbolic groups"
- *Summer Conference on Topology and its Applications*, Bowling Green, 19th July 2018
  "Almost finitely presented subgroups of hyperbolic groups"
- Cornell University, 19th April 2018
  "Almost finitely presented subgroups of hyperbolic groups"
- University of Oklahoma, 11th April 2018
  "Almost finitely presented subgroups of hyperbolic groups"
- Rice University, 9th April 2018
  "Uncountably many QI type of groups of type FP"
- SUNY at Albany, 29th March 2018
  "Branched Covers and Groups of Type FP"
- *Spring Topology and Dynamics*, Auburn, 17th March 2018
  "Groups of type FP_2"
- *Joint Math Meetings*, San Diego, 13th January 2018
  "Dimensions of discrete groups"
- Binghampton University, 12th October 2017
  "Uncountably many QI classes of groups of type FP"
- Brandeis University, 19th September 2017
  "Uncountably many QI classes of groups of type FP"
- ETH Zurich, 21st June 2017
  "An arbitrary cubical dimension gap"
- Tufts University, 11th April 2017
  "Subgroups of Hyperbolic Groups"
- *Spring Topology and Dynamics*, New Jersey City University, 8th March 2017
  "Some constructions of hyperbolic groups"
- *Non-positive curvature, group actions and cohomology*, Isaac Newton Institute, Cambridge, 10th January 2017
  "Hyperbolic groups and their subgroups"
- University of California Santa Barbara, 22nd November 2016
  "Finiteness properties and free abelian subgroups"
- Oxford University, 25th April 2016
  "Finiteness properties and free abelian subgroups"
- *5th meeting of Groups and Geometry*, Birkbeck, London, 9th December 2015
  "Almost Finitely Presented Subgroups of Hyperbolic Groups"
- Freie Universität Berlin,, 14th July 2015
  "Free-by-Cyclic groups and CAT(0) spaces"
- *ECSTATIC*, Imperial College, London,, 11th June 2015
  "Free-by-Cyclic Groups"
- *Young Researcher in Mathematics*, Warwick University, 30th June 2014

    "CAT(0) structures on Free-by-Cyclic Groups"

Reading Groups

- GGT reading group at Tufts, 2017 - 2020
  Topics included:
  - Hyperbolic Groups.
  - Mapping Class Groups.
  - Office Hours with a geometric group theorist.
  - Ricci Curvature.
  - The Virtual Haken Conjecture.
- "*Kinderseminar*", University of Oxford, 2012-2015
  Six talks entitled:
  - "Properties of Random Groups."
  - "Voting Systems and Arrow's Impossibility Theorem."
  - "The Number 6."
  - "CAT(0) Structures for Free-by-Cyclic Groups."
  - "Straight Edge and Compass to Origami."
  - "Non Constant Functions of Derivative 0."
- "*Junior Topology and Group Theory*", University of Oxford, 2012 - 2016
  Ten talks entitled:
  - "Homological Filling Functions."
  - "Subgroups of $\text{Aut}(F_n)$ and Actions on CAT(0) spaces."
  - "There is Only One Gap in the Isoperimetric Spectrum."
  - "Simple Homotopy Theory and the Poincaré Conjecture."
  - "Bestvina-Brady Morse Theory and some Conjectures in Low dimensional Topology."
  - "Subgroups of Hyperbolic Groups and Finiteness Properties."
  - "Aperiodic Tiling and Groups."
  - "A Gentle Introduction to Kirby Calculus."
  - "Some Decision Problems in Groups. "
  - "Relations between some Topological and Group Theoretic Conjectures."
- "*Poincaré Seminar*", University of Oxford, 2013 - 2015.
  12 Seminars on the following topics:
  - Smooth 4-Manifolds.
  - The Virtual Haken Conjecture.
  - The Rips Construction.
  - Sigma Invariants.
  - Limit Groups.
- A 6 lecture reading course on Bing Topology and Casson Handles.

Conference Participation

- "*Young Geometric Group Theory VIII*", Bilbao, 30th June to 5th July 2019
- "*Aspects of negative and non-positive curvature*", CIRM, Luminy, 17th to 21st June 2019
- "*Boundaries of Random Walks and Applications*", Bowdoin College, Brunswick, 4th to 6th June 2019
- "*Working group on coherence*", IAS, Princeton, 25th to 29th March 2019
- "*Structure of 3-manifolds*", Luminy, 26th February 2019 to 2nd March 2018
- "*Homological Algebra and Topological Groups*", Southampton, 10th to 14th July 2017
- "*GAGTA*", Bilbao, 3rd to 3rd July 2017
- "*Geometric Structures in Group Theory*", Oberwolfach, 21st to 27th June 2017
- "*Young Geometric Group Theory VI*", Oxford, 20th to 24th March 2017

- "*Beyond Hyperbolicity*", Cambridge, 20th to 24th June 2016
- "*Topological and Homological Methods in Group Theory*", Bielefeld, 4th to 8th April 2016
- "*Boundaries of CAT(0) cube complexes*", Nice, 9th to 11th March 2016
- "*Geometric Topology*", Oberwolfach, 18th to 24th January 2015
- "*Cube Complexes and Groups*", Copenhagen, 7th to 11th July 2014
- "*Geometry and Group after Thurston*", Dublin, 27th to 31st August 2013
- "*Geometric and Cohomological Group Theory*", Durham, 12th to 22nd August 2013
- "*Young Researchers in Mathematics*", Edinburgh, 17th to 20th June 2013
- "*Summer School on Geometry of Outer Space*", Marseille, 24th to 29th June 2013
- "*Young Topology Meeting UK 2013*", Imperial College London, 25th to 26th April 2013
- "*British Mathematical Colloquim*", Sheffield, 27th to 30th March 2013

Conference and Seminar Organisation

- "*Subgroups in Nonpositive Curvature*", AMS Sectional Meeting, Tufts, Cancelled due to Covid-19
- "*Topics around groups at Tufts*", Tufts, 1st – 2nd April 2019
- "*Geometric Group Theory Session*", Spring Topology and Dynamics, Birmingham, 14th – 16th March 2019
- "*GGTT Seminar*", Tufts, 2017 - 2020
- "*Postdoctoral Seminar*", MSRI, 2016
- "*Young Researchers in Mathematics*", Oxford, 17th – 20th August 2015
- "*Kinderseminar*", Oxford, 2015 – 2016
- "*Poincaré Seminar*", Oxford, 2014 – 2015
- "*Junior Topology and Group Theory Seminar*", Oxford, 2013 – 2014
- "*Topology Advanced Class*", Oxford, 2013

Service and Outreach

- Judge for Region IV Science Fair
- Implentation of the online grading system Gradescope at the Tufts Mathematics Department.
- Member of the Tufts Mathematics Department Outreach Committee
- Topology group webmaster, Oxford 2013 - 2016
- Referee for journals including: *Geom. Groups. Dyn., Math. Proc. Cam. Phil. Soc., Geom. Dedicata, Adv. in Math., Compos. Math., Int. Math. Res. Not., Trans. Am. Math. Soc., J. Topol. Anal., Geom. Topol.*