

IZHAR OPPENHEIM

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Department of Mathematics ◊ Ben Gurion University of the Negev

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EDUCATION

B.A. in Mathematics (*summa cum laude*) 1999-2002
Technion - Israel Institute of Technology, Israel.

M.A. in Mathematics (*summa cum laude*) 2004-2008
Tel-Aviv University, Israel.
Thesis Title: The Rohlin property for the pseudo-arc
Thesis Adviser: Prof. Eli Glasner

Ph.D. in Mathematics 2008-2012
Technion - Israel Institute of Technology, Israel.
Dissertation Title: Groups acting on simplicial complexes.
Dissertation Adviser: Prof. Uri Bader.

APPOINTMENTS

Associate Professor at Ben-Gurion University 3/2023-now

Senior Lecturer (tenured) at Ben-Gurion University 12/2018-3/2023

Lecturer (tenure track) at Ben-Gurion University 9/2015-12/2018

Zassenhaus Assistant Professor (Postdoctoral position) at Ohio State University 8/2012-8/2015

HONORS AND AWARDS

Undergraduate awards. Technion's president's list 1999-2002, every semester

M.A. Award. Tel-Aviv Faculty excellence award for M.A. research 2008

Haim Hanani prize, Technion 2010

Elisha Netanyahu prize, Technion. Highest prize of the Technion's math department for excellence in Ph.D. research (awarded once a year to only one Ph.D. graduate) 2012

Teaching Excellence prize for large courses, Ben-Gurion University. Awarded once a year to three lecturers (out of the entire University) with very high teaching reviews in large courses 2021

RESEARCH GRANTS

Israel Science Foundation Individual Research Grant 293/18, Sole PI, Original period of grant: 10/18-9/22 (extended up until 9/23), Annual amount: 245,000 NIS (67,250 \$), Total Amount: 980,000 NIS (269,000 \$)

Israel Science Foundation Individual Research Grant 242/24, Sole PI, Period of grant: 10/24-9/28, Annual amount: 195,390 NIS (52,870 \$), Total Amount: 781,560 NIS (211,510 \$)

GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

M.Sc. Students

Zohar Grinbaum-Reizis, graduated 2020

Ph.D. Students

Zohar Grinbaum-Reizis, expected graduation 6/2025

Postdoctoral Fellows

Bakul Sathaye, 10/2019-8/2020

TEACHING EXPERIENCE

Ohio State University

- First course in calculus at OSU (Math 1151) - 2 times
- Accelerated Calculus I for Honors Engineers at OSU (Math 1161.02) - 2 times
- Second course in calculus at OSU (Math 1172) - 3 times
- Introduction to analysis (Math 4547) - 2 times
- Pre-calculus course (Math 1150)

Ben-Gurion University - Service courses

- Calculus I for engineers (course coordinator)
- Calculus I for electrical engineers - 2 times
- calculus II for mechanical engineers
- Integral calculus and ordinary differential equations for electrical engineers
- Multivariable calculus for electrical engineers - 2 times (course coordinator)
- Fourier analysis for electrical engineers
- Linear algebra 2 for electrical engineers - 2 times

Ben-Gurion University - Courses for math majors and/or graduate students

- Introduction to topology - 2 times
- Introduction to analysis - 5 times

- Basic concepts in modern analysis (graduate level course)
- Fourier analysis
- Fundamentals of measure theory
- Kazhdan property (T) (graduate reading course)
- Coarse geometry (reading course)
- Expansion in graphs and groups (undergraduate course)
- Expansion in groups - 2 times (graduate course)

SERVICE

Departmental Activities

Mathematics department Graduate Director

11/2017-now

Public Activities

- Referee for: Journal of the European Mathematical Society, Annales de l'Institut Fourier, Journal of Combinatorial Theory A, Journal of Functional Analysis, Israel Journal of Mathematics, Forum of Mathematics, Sigma, Random Structures and Algorithms, European Journal of Combinatorics, Discrete Analysis, RANDOM 2019, STOC 2020, FOCS 2021, ICALP 2021, RANDOM 2021, STOC 2022, CCC 2022, CCC 2023.
- Thesis committee: Bharat Rangarajan (Tel-Aviv University, M.Sc. in Computer Science, 2018), Vedat Levi Alev (University of Waterloo, Ph.D. in Computer Science, 2020)

PUBLICATIONS

Journal Publications

1. *An intermediate quasi-isometric invariant between subexponential asymptotic dimension growth and Yu's Property A*. Internat. J. Algebra and Comput., (2014) 24 (6) : 909-922.
2. *Property A and the existence of a Markov process with a trivial Poisson boundary*. Bull. London Math. Soc. (2014) 46 (4): 836-846.
3. *Fixed point theorem for reflexive Banach spaces and uniformly convex non positively curved metric spaces*. Mathematische Zeitschrift 278 (2014), no. 3-4: 649-661.
4. *Vanishing of cohomology and property (T) for groups acting on weighted simplicial complexes*. Groups Geom. Dyn. 9 (2015), no. 1: 67-101.
5. *Property (T) for groups acting on simplicial complexes through taking an "average" of Laplacian eigenvalues*. Groups Geom. Dyn. 9 (2015), no. 4: 1131-1152.
6. *Averaged projections, angles between groups and strengthening of property (T)*. Mathematische Annalen, (2017) 367 (1-2) : 623-666.
7. *Vanishing of cohomology with coefficients in representations on Banach spaces of groups acting on Buildings*. Commentarii Mathematici Helvetici, (2017) 92 (2) : 389-428.
8. *Angle criteria for uniform convergence of averaged projections and cyclic or random products of projections*. Israel Journal of Mathematics, 223 (2018), no. 1, 343-362.

9. *Local spectral expansion approach to high dimensional expanders I: descent of spectral gaps*. Discrete and Computational Geometry, 59 (2018), no. 2, 293–330.
10. With Tali Kaufman. *High Order Random Walks: Beyond Spectral Gap*. Combinatorica, 40 (2020), no. 2, 245–281.
11. *Local spectral expansion approach to high dimensional expanders II: Mixing and Geometrical Overlapping*. Discrete and Computational Geometry, 64 (2020), no. 3, 1023–1066.
12. With Alexander Lubotzky. *Non p -norm approximated groups*. Journal d’Analyse Mathématique, 141 (2020), no. 1, 305–321.
13. With Tali Kaufman. *Erratum: High Order Random Walks: Beyond Spectral Gap*. Combinatorica, 41 (2021), no. 5, 749–753.
14. With Zohar Grinbaum-Reizis. *Curvature criterion for vanishing of group cohomology*. Groups, Geometry and Dynamics, 16 (2022), no. 3, 843–862.
15. *Garland’s method with Banach coefficients*. Analysis and PDE, 16(2023), no.3, 861–890.
16. With Tali Kaufman. *High dimensional expanders and coset geometries*. European Journal of Combinatorics 111 (2023), Paper No. 103696, 31 pp.
17. *Banach property (T) for $SL_n(\mathbb{Z})$ and its applications*. Inventiones Mathematicae, 234(2023), no.2, 893–930.
18. *Zuk’s criterion for Banach spaces and random groups..* Forum of Mathematics, Sigma 11(2023), Paper No. e79.

Conference Publications

1. With Tali Kaufman. *Construction of new local spectral high dimensional expanders*. STOC’18—Proceedings of the 50th Annual ACM SIGACT Symposium on Theory of Computing, 773–786, ACM, New York, 2018.
2. With Tali Kaufman. *High Order Random Walk - Beyond Spectral Gap*. Approximation, randomization, and combinatorial optimization. Algorithms and techniques, Art. No. 47, 17 pp., LIPIcs. Leibniz Int. Proc. Inform., 116, Schloss Dagstuhl. Leibniz-Zent. Inform., Wadern, 2018.
3. With Tali Kaufman. *Coboundary and cosystolic expansion from strong symmetry*. 48th International Colloquium on Automata, Languages, and Programming, Art. No. 84, 16 pp., LIPIcs. Leibniz Int. Proc. Inform., 198, Schloss Dagstuhl. Leibniz-Zent. Inform., Wadern, 2021.
4. With Tali Kaufman. *High dimensional expansion implies amplified local testability*. Approximation, randomization, and combinatorial optimization. Algorithms and techniques, LIPIcs. Leibniz Int. Proc. Inform., 245, Schloss Dagstuhl. Leibniz-Zentrum für Informatik, Wadern, 2022.

Submitted Papers

1. *Banach fixed point property for Steinberg groups over commutative rings*.
2. *Coboundary expansion of coset complexes*, joint with Tali Kaufman and Shmuel Weinberger, submitted to STOC 25’.

Papers in preparation

1. Property (T) for groups acting on affine buildings, preprint available on Arxiv.
2. Cosystolic expansion of Kac-Moody high dimensional expanders (working title), joint with Inga Valentiner-Branth.

3. Trickle down theorem for partite simplicial complexes (working title), joint with Zohar Grinbaum-Reizis.

INVITED TALKS

Colloquium, Conference and Workshop Talks

- “Banach fixed point properties of groups”, Hebrew University Colloquium, June 2024.
- “Banach property (T) and Banach rigidity phenomena of groups and graphs”, Tel-Aviv University Colloquium, March 2023
- “Banach property (T) for $SL_3(\mathbb{Z})$ ”, Israel Mathematical union meeting, Ergodic Theory and Groups section, September 2022.
- “Relative property (T) of the unitriangular group in SL_3 ”, Group Actions, Geometry and Dynamics, Ohalo, Israel, July 2022.
- “Homomorphism stability and Expansion”, Workshop: Geometric Aspects of Flexible Stability, Erdos Center, Budapest, March 2022.
- “Random walks on partite complexes”, MPS Conference on High-Dimensional Expanders, Simons Foundation, New-York, October 2021.
- “The fixed point spectrum of a random group”, Workshop - Interactions between expanders, groups and operator algebras, Muenster University and Zoom, June 2021.
- “Stability of groups acting on buildings”, Stability in Group Theory and Operator Algebras, Copenhagen, November 2019.
- “Spectral high dimensional expanders construction” (4 hours), Summer cluster on error-correcting codes and high dimensional expanders, Simons institute, Berkeley, July 2019.
- “Vanishing of cohomology for groups acting on buildings”, Conference “Rigidity” part of the Simons Semester “Geometric and Analytic Group Theory” (held at the Banach center, Warsaw), June 2019.
- “Random walks on simplicial complexes”, Beyond Randomized Rounding and the Probabilistic Method workshop, Simons institute, Berkeley, February 2019.
- “Construction of new local spectral high dimensional expanders”, STOC 2018 TheoryFest (held at Los Angeles), June 2018.
- “Construction of new high dimensional local spectral expanders”, Research Group on High Dimensional Combinatorics, Israel Institute for Advanced studies in the Hebrew University, December 2017.
- “Garland method’s” (2 talks), School on Geometric, Topological and Computational Aspects of High-Dimensional Combinatorics (held at Sde-Boker), October 2017.
- “Cohomologies with coefficients in Banach representations for groups acting on buildings”, Workshop on High-dimensional Expanders at Les Diableretes, Switzerland (organized by the ETH), June 2016.
- “Between subexponential asymptotic dimension growth and Yu’s Property A”, 49th Spring Topology and Dynamics Conference (held at BGSU), May 2015.
- “High dimensional expanders from a 1-dimensional perspective”, Borel Seminar on High dimensional expanders at Les Diableretes, Switzerland (organized by the ETH), March 2015.
- “Property (T) from a spectral gap of the 1-dimensional links”, Topological Methods in Group Theory conference (held at OSU), June 2014.

- “Fixed point property for groups acting on simplicial complexes”, Non positive curvature, isometric actions and dynamics of cocycles conference (held at Cajon del Maipo, Chile), May 2013.
- “Local criteria for Kazhdan property (T)”, Israel Mathematical Union annual meeting, May 2012.
- “Criteria for Kazhdan property (T) - some variations on Zuk’s criterion”, Geometric group theory conference held by the center for Mathematical Sciences at the Technion, June 2011.
- “Triangle Buildings”, CAT(0) spaces and Affine Buildings workshop (held by the Israel Science Foundation). February 2010.

Seminar Talks

I have given seminar talks at the following universities: Action Now wandering seminar (held in Israel at changing locations), Bar-Ilan University, Ben-Gurion University (both math and computer science seminars and a Colloquium talk), Brandeis, Brown, Hebrew University, Indiana University, IMPAN, OSU, Rutgers, Technion-ILL, Tel-Aviv University (both math and computer science seminars), UIC, Université catholique de Louvain, Université de Genève, Weizmann Institute, Yale.

Mini Courses

- “Special Day on Random Groups and Property (T)” (4 talks), Research Group on High Dimensional Combinatorics, Israel Institute for Advanced studies in the Hebrew University. February 2018.
- “Spectral high dimensional expanders: the Garland method”(3 talks), Research Group on High Dimensional Combinatorics, Israel Institute for Advanced studies in the Hebrew University. December 2017.

ORGANIZING EVENTS

Organizer of the conference “What do we talk about when we talk about mathematics” aimed for advanced undergraduate students, Summer 2024.

SHORT VISITS

Simons Institute, Berkeley, Summer cluster on error-correcting codes and high dimensional expanders *July-August 2019*

Hausdorff institute Bonn, Germany, special trimester devoted to the subject of Rigidity. *September 2009*

REFERENCES

References regarding pure math research

- **Uri Bader**, Professor of Mathematics, University of Maryland, uri.bader@gmail.com
- **Tsachik Gelander**, Professor of Mathematics, Northwestern University, tsachik.gelander@northwestern.edu
- **Alexander Lubotzky**, Professor of Mathematics, Weizmann Institute of Science, alex.lubotzky@mail.huji.ac.il
- **Shmuel Weinberger**, Professor of Mathematics, University of Chicago, shmuel@math.uchicago.edu

References regarding theoretical computer science research

- **Irit Dinur**, Professor of Mathematics and Theoretical computer science, Institute for advanced study, dinuri@gmail.com
- **Tali Kaufman**, Professor of computer science, Bar-Ilan University, kaufmant@mit.edu

Teaching reference

- **Yair Glasner**, Professor of Mathematics, Ben-Gurion University of the Negev, yairgl@bgu.ac.il