

# IZHAR OPPENHEIM

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Department of Mathematics ◊ Ben Gurion University of the Negev

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## EDUCATION

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**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

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Senior Lecturer (equivalent to Assistant Professor) at Ben-Gurion University 12/2018-now, (*tenured since 2/2019*)

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

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**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

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

## GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

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### **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

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### **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 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
- Fourier analysis for electrical engineers

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

- Introduction to topology - 2 times
- Introduction to analysis - 3 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 (graduate course)

## SERVICE

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### 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 2019, STOC 2020, FOCS 2021, ICALP 2021, RANDOM 2021, STOC 2022, CCC 2022.
- 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

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### 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 Tali Kaufman. *High dimensional expanders and coset geometries*. European Journal of Combinatorics (special issue), in press.
15. With Zohar Grinbaum-Reizis. *Curvature criterion for vanishing of group cohomology*. Groups, Geometry and Dynamics, in press.
16. *Garland's method with Banach coefficients*. Analysis and PDE, in press.

### 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, 2022, to appear.

### Submitted Papers

1. *Banach Zuk's criterion for partite complexes with application to random groups*.
2. *Banach property (T) for  $SL_n(\mathbb{Z})$  and its applications*.

### Papers in preparation

1. Various Random walks on partite simplicial complexes (working title), joint with Zohar Grinbaum-Reizis.

## INVITED TALKS

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### Conference and Workshop Talks

- “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, Indiana University, IMPAN, OSU, Rutgers, Technion-ILL, Tel-Aviv University (both math and computer science seminars), UIC, Université catholique de Louvain, Université de Genève, 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.

### SHORT VISITS

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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*