Ronny Hadani

CURRICULUM VITAE

- **Contact address.** University of Texas at Austin, 1 University station, C1200, Austin Texas 78712-0257
- **E-mail.** hadani@math.utexas.edu
- **URL.** http://www.ma.utexas.edu/users/hadani/

Research Interests

- Representation theory.
- Theory of algebraic D-modules.
- Applications to harmonic analysis, signal processing, mathematical physics and three dimensional cryo-electron microscopy.

Education

1999-2006 Ph.D., Pure Mathematics. Tel-Aviv University, Title of Ph.D. Dissertation: The Geometric Weil representation and its applications. Submitted in Aug. 2006. Supervisor: Prof. Joseph Bernstein.

1996-1998 M.Sc., Computer Science and Applied Mathematics, Weizmann Institute, Israel. Title of Master Dissertation: "*Multi-scale Drawing Graphs Algorithm*" (With Distinction). Supervisor: Prof. David Harel. Date of award: 1998.

1993-1996 B.A., Open University, Israel. Date of award: 1996.

Employment

2009-present Assistant Professor, Department of Mathematics, University of Texas at Austin.

2006-2009 L.E. Dickson Instructor, Department of Mathematics, University of Chicago.

2000-2006 Lecturer and teaching assistant, Department of Pure Mathematics, Tel Aviv University.

1991-1994 Mandatory military service in the Israeli army.

July 2005 Teaching assistant (Lecturer - Prof. Joseph Bernstein), Summer School on "Perverse Sheaves", Beijing, China.

Pending Research Grants (Dollar amounts listed reflect the University of Texas portion of the award)

1. Collaborative Research: The Heisenberg Weil Symmetries and their applications, NSF, 2011-2014, co-PI, $201,602.

Publications (PDF versions of most publications can be found on my website: http://www.ma.utexas.edu/users/hadani/)

Papers in Journals

1. Hadani R. and Singer A., Representation theoretic patterns in three dimensional Cryo-Electron Microscopy I - The intrinsic reconstitution algorithm. *Annals of Mathematics* (2011).

2. Gurevich S. and Hadani R., Proof of the Kurlberg-Rudnick rate conjecture. *Annals of Mathematics* (2011).

3. Hadani R. and Singer A., Representation theoretic patterns in three dimensional Cryo-Electron Microscopy II - The class averaging problem. *Foundations of Computational Mathematics* (FoCM) (2011).

4. Singer A., Shkolnisky Y. and Hadani R., Viewing Angle Classification Of Cryo-Electron Microscopy Images Using Eigenvectors. *Siam Journal on Imaging Science* (2011).

5. Gurevich S. and Hadani R., The Categorical Weil Representation. *Submitted (2011).*

6. Gurevich S., Hadani R. and Singer A., Representation theoretic patterns in three dimensional Cryo-Electron Microscopy III - Presence of Point Symmetries. Submitted (2011).

7. Gurevich S. and Hadani R., The Weil representation in characteristic two. Accepted for publication in *Advances In Mathematics* (2009).

8. Gurevich S. and Hadani R., On the diagonalization of the discrete Fourier transform. *Applied and Computational Harmonic Analysis*, volume 27, 87–99 (2009).

9. Gurevich S., Hadani R. and Howe R., Quadratic reciprocity and sign of Gauss sum via the finite Weil representation. Accepted for publication in *IMRN* (2009).

10. Gurevich S. and Hadani R., Quantization of symplectic vector spaces over finite fields. *Journal of Symplectic Geometry*, volume 7, number 4, 475–502, (2009).

11. Gurevich S. and Hadani R., Incoherent dictionaries and the statistical restricted isometry property. Submitted (2009).

12. Gurevich S., Hadani R. and Sochen N., On some deterministic dictionaries supporting sparsity. Special issue on sparsity (Editors: A. Cohen, R. DeVore, M. Elad, A. Gilbert) of the *Journal of Fourier Analysis and its Applications* (2008).

13. Gurevich S., Hadani R. and Sochen N., The finite harmonic oscillator and it associated sequences. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, vol. 105 no. 29, 9869-9873, (2008).

14. Gurevich S., Hadani R. and Sochen N., The finite harmonic oscillator and its application to sequences, communication and radar. *IEEE Transaction on Information Theory*, volume 54, number 9, 9869-9873, Sep. 2008.

15. Gurevich S. and Hadani R., Self-reducibility of the Weil representation and higher dimensional quantum chaos. Submitted (2008).

16. Gurevich S. and Hadani R., The geometric Weil representation. *Selecta Mathematica*, New Series, 13 (3), 465-481 (2007).

17. Gurevich S. and Hadani R., Proof of the Kurlberg-Rudnick rate conjecture. *Comptes Rendus Mathematiqu*e, Volume 342, Issue 1, January 2006, Pages 69-72 (presented by Michele Vergne) (2006).

18. Hadani R. and Harel D., A multi-scale algorithm for drawing graph nicely. 25th International Workshop on Graph-Theoretic concepts in Computer Science (WG'99)(Ascona). *Discrete Appl. Math.* 113 (2001), no 1, 3–21.

Papers in Proceedings (refereed)

1. Gurevich S., Hadani R. and Sochen N., A Group representation design of digital signals and sequences. To appear in the *proceedings of the international conference on Sequences and Their Applications (SETA)* 2008, University of Kentucky, Lexington, KY - Sept. 14-18, 2008 (Editors: S. Golomb, A. Pott, M. Parker, A. Winterhof).

2. Gurevich S., Hadani R. and Sochen N., The discrete Fourier transform: A canonical basis of eigenfunctions. To appear in the *proceedings of the 2008 European Signal Processing Conference (EUSIPCO-2008)*, Lausanne, Switzerland, Aug. 25-29, 2008.

3. Gurevich S., Hadani R. and Sochen N., Deterministic dictionaries for sparsity: A group representation approach. To appear in the *proceedings of the 2008 European Signal Processing Conference (EUSIPCO-2008)*, Lausanne, Switzerland, Aug. 25-29, 2008.

4. Gurevich S. and Hadani R., Application of the Weil representation: Diagonalization of the discrete Fourier transform. To appear in the *proceedings of the Sixth Workshop on Lie Theory and Geometry*, Cordoba, November 13 - 17, 2007 (Editors: C. S. Gordon, F. Grunewald, C. Olmos, J. A. Tirao, J. A. Wolf) (2008).

5. Gurevich S. and Hadani R., Notes on quantization of symplectic vector space over finite fields. To appear in the *proceedings of the EMS Summer School, Arithmetic and Geometry Around Quantization*, Istanbul, June 5-15 2006 (Editors: O. Ceyhan, Yu. I. Manin and M. Marcolli) (2006).

6. Gurevich S. and Hadani R., Notes on self-reducibility of the Weil representation and higher dimensional quantum chaos. To appear in the *proceedings of the EMS Summer School, Arithmetic and Geometry Around Quantization*, Istanbul, June 5-15 2006 (Editors: O. Ceyhan, Yu. I. Manin and M. Marcolli) (2006).

7. Gurevich S. and Hadani R., Proof of The Kurlberg-Rudnick Rate Conjecture. Proceedings of the *2nd international conference on p-adic mathematical physics*, Belgrade (Serbia) and Montenegro, 15-21 September 2005, AIP Conference, Proceedings Volume 826 (Editors: Khrennikov, Rakic, Volovich) (2005).

8. Hadani R. and Harel D., A multi-scale algorithm for drawing graphs nicely. Graph-Theoretic concepts in Computer Science (Ascona, 1999), 262–277, *Lecture Notes in Comput. Sci.*, 1665, Springer, Berlin (1999).

Papers in preparation

1. Gurevich S., Hadani R. and Weinstein A., The linear symplectic category and quantization functor: the finite field setting.

2. Hadani R., The Weil representation over the complex numbers and localization of Schwartz spaces.

Preprints

1. Gurevich S. and Hadani R., The two dimensional Hannay-Berry model. arXiv:math-ph/0312039. (2003).

2. Gurevich S. and Hadani R., The Multidimensional Hannay-Berry Model. arXiv:math-ph/0403036 (2004).

3. Gurevich S. and Hadani Ronny., The higher dimensional Kurlberg-Rudnick conjecture. arXiv:math-ph/0409031 (2004).

4. Gurevich S. and Hadani R., Heisenberg realizations, eigenfunctions and proof of the Kurlberg-Rudnick supremum conjecture. Arxiv:math-ph/0511036 (2005).

Patents

1. Gurevich S., Hadani R. and Sochen N., "The finite harmonic oscillator". US patent and PCT. Pending (submitted 2007).

Visiting Positions

2001-2002 Visiting member, MSRI, Berkeley, USA.

Aug. 2002 Visiting member, IHES, Bures sur Yvette, France.

June. 2003 Visiting member, Fields Institute, Toronto, Canada.

Aug. 2003 IHES, Bures sur Yvette, France.

Sep. 2003 Visiting member, Chalmers University, Gothenburg, Sweden.

July-Aug. 2004 Visiting member, Max Planck Institute and Bonn University, Bonn, Germany.

Sep.-Oct. 2004 Visiting member, Courant Institute, NY, USA.

Selected Lectures

2004 Courant Institute, "*Proof of the Kurlberg-Rudnick Rate Conjecture*".

2004 Princeton University, Princeton, USA, number theory seminar, "*Proof of the Kurlberg-Rudnick Rate Conjecture*"..

2006 Arithmetic and Geometry Around Quantization, Istanbul, June 2006, (invited lecture).

2006 Geometric Langlands seminar, "The geometric Weil representation and Applications", Oct. 2006, University of Chicago, (three lectures).

2008 Applied mathematics seminar, "The finite harmonic oscillator with applications to radar and communication", Feb. 2008, Stanford University.

2008 Northern California symplectic geometry seminar, "Quantization of symplectic vector spaces - algebra geometric approach", Feb. 2008, Stanford University.

2008 Algebraic geometry seminar, "The geometric Weil representation with applications to digital signal processing", Feb. 2008, UC Berkeley.

2008 Scientific computation seminar, "On the diagonalization of the discrete Fourier transform", Feb. 2008, UC Berkeley.

2008 Number theory seminar, "Quadratic reciprocity and sign of Gauss sum via the finite Weil representation", Feb 2008, UC Berkeley.

2008 Networking communications and DSP seminar, "The finite harmonic oscillator with applications to radar and communication", Feb 2008, EECS, UC Berkeley.

2008 Representation theory and mathematical physics seminar, "Quantization of symplectic vector spaces - algebra geometric approach", March. 2008, Northwestern University.

2008 Number theory seminar, "Quadratic reciprocity and sign of Gauss sum via the finite Weil representation", April 2008, UIC University.

2008 Minicourse on applications of representation theory to signal processing, July 2008, TU Berlin.

2008 Conference on codes, modular forms and invariant theory, "The finite harmonic oscillator with applications to radar and communication", July 2008, MPI Bonn.

2010 Annual meeting of the American Mathematical Society (AMS), special session on algebraic methods in signal processing, "On the diagonalization of the discrete Fourier transform", January 2009.

2010 Analysis seminar, Stanford University, "Representation theoretic patterns in three dimensional Cryo-Electron Microscopy", January 2010.

Teaching

2006 Autumn: MATH 19900, Introduction to Analysis and Linear Algebra.

2007 Winter: MATH 20400, Analysis in $\mathbb{R}^n$-II.

2007 Spring: MATH 20500, Analysis in $\mathbb{R}^n$-III.

2008 Winter: MATH 19900, Introduction to Analysis and Linear Algebra.

2008 Spring: MATH 19900, Introduction to Analysis and Linear Algebra.

2008 Autumn: MATH 20300, Analysis in $\mathbb{R}^n$-I (IBL).

2009 Winter: MATH 20400, Analysis in $\mathbb{R}^n$-II (IBL).

2009 Spring: MATH 20500, Analysis in $\mathbb{R}^n$-III (IBL).

2009 Autumn: Advanced Analysis.

2010 Spring: Advanced Linear algebra.