# LORENZO A. SADUN
# BIOGRAPHICAL DATA

## PERSONAL DATA

| | | |
|---|---|---|
| Born: | November 3, 1960 | University of Texas |
| Married: | September 4, 1988 to Anita E. Glazer | Austin, TX 78712 |
| Children: | Rina Ellen Sadun, Allan Elvio Sadun, | (512) 471-7121 |
| | Jonathan Richard Sadun | sadun@math.utexas.edu |
| Citizenship: | USA | www.ma.utexas.edu/~sadun |

## EDUCATION

| | | |
|---|---|---|
| Ph.D. | University of California, Berkeley | 1987 |
| | (Ph.D. advisor: Cliff Taubes) | |
| M.A. | University of California, Berkeley | 1982 |
| B.S. | Massachusetts Institute of Technology | 1981 |

## PROFESSIONAL EXPERIENCE

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|---|---|
| 2003- | Professor, University of Texas at Austin. |
| 1999-2000 | Visiting Associate Professor, Israel Institute of Technology. |
| 1997-2003 | Associate Professor, University of Texas at Austin. |
| 1992-96 | NSF Postdoctoral Research Fellow. |
| 1991-97 | Assistant Professor, University of Texas at Austin |
| 1989-91 | Assistant Professor and Courant Institute Instructor, New York University |
| 1987-89 | Harry Bateman Research Instructor, California Institute of Technology |

## PROFESSIONAL SERVICE

Co-organizer: Special Session on Texas Geometry & Topology, Sectional Meeting of the Amer. Math. Soc., College Station, Texas, October 1993.

Texas Geometry & Topology Conference, Austin, Texas, April 1994.

Texas Geometry & Topology Conference, Austin, Texas, October 1998.

Special Session on Tilings, Sectional Meeting of the Amer. Math. Soc., Austin, Texas, October 1999.

Texas Geometry & Topology Conference, Austin, Texas, October 2002.

BIRS FRG on Topological Methods for Aperiodic Tilings, Banff, Canada, July 2005.

Texas Geometry & Topology Conference, Austin, Texas, October 2005.

## AWARDS AND HONORS

| | |
|---|---|
| 2000-2002 | The President's Associates Centennial Teaching Fellowship in Mathematics |
| 2001 | College of Natural Sciences Distinguished Teaching Award |
| 1999 | Invited lecture at AMS Sectional Meeting, Las Vegas, NV. |
| 1990 | Commendation for "superior performance" as an Instructor at New York University |
| 1983 | Distinguished Teaching Award, given by U.C.-Berkeley Physics Department |
| 1979 | Putnam Exam - Placed 12th |

## RESEARCH SUPPORT

| | |
|---|---|
| 2004- | PI on NSF individual grant |

| 2003- | Co-PI on NSF geometry group group |
| 2000-2002 | Texas Advanced Research Program Grant |
| 1998-2000 | Texas Advanced Research Program Grant |
| 1996-1999 | Co-PI on NSF Grant DMS-9626698 |
| 1994-1996 | Texas Advanced Research Program Grant |
| 1992-1996 | NSF Mathematical Sciences Postdoctoral Research Fellowship |
| 1990-1991 | Co-PI on Binational (USA-Israel) Science Foundation Grant |

## INVITED LECTURES AND SERVICE TO OTHER UNIVERSITIES

### Conference Talks Since 2001

Millenium Lecture, University of Texas at Austin, March 2001

Frontiers in Mathematical and Computational Biology, Denton, TX, June 2001

Park City/IAS Mathematics Institute, Park City, Utah, July 2001.

Session on Spectral Theory and Transport, AMS Central Sectional Meeting, Birminham, AL, November 2000

Millenium Lecture, University of Texas at Austin, March 2001

Frontiers in Mathematical and Computational Biology, Denton, TX, June 2001

Park City/IAS Mathematics Institute, Park City, Utah, July 2001.

Session on Symbolic Dynamics, AMS National Meeting, San Diego, CA, January 2002

Workshop in Topology in Condensed Matter Physics, Dresden, Germany, June 2002

Workshop in Aperiodic Order and Dynamical Systems, Victoria, British Columbia, August 2002

Conference on Open Problems in the Theory of Quasicrystals, Luminy, France, October 2002

2003 Spring Topology and Dynamical Systems Conference, Lubbock, Texas, March 2003

Conference in Dynamical Systems, Denton, Texas, May 2003

Workshop in Joint Dynamics, Banff, Alberta, June 2003

Workshop on the Mathematics of Aperiodic Order, Greifswald, Germany, August 2003

Spring Topology and Dynamical Systems Conference, Birmingham, Alabama, March 2004

Workshop in Geometry and Material Science, Aspen, Colorado, June 2004

International Conference on Quasicrystals, Ames, Iowa, May 2005

Conference on Topology and its Applications, Dennison, Ohio, July 2005

Workshop on Topological Methods in Aperiodic Tilings, Banff, Alberta, Canada, July 2005

Summer School in Aperiodic Order (featured lecturer), Victoria, BC, Canada, August 2005

Northwest Workshop in Dynamics, Victoria, BC, Canada, August 2005

AMS Special Session, Greensboro, NC, March 2006

Workshop on Sphere Packings, Aspen, Colorado, July 2006

Workshop on Phase Transitions, Palo Alto, California, August 2006

AMS Special Session, Davidson, North Carolina, March 2007

Spring Topology and Dynamical Systems Conference, Rolla, Missouri, March 2007

## UNIVERSITY AND DEPARTMENTAL COMMITTEES

| | |
|---|---|
| 1991- | Graduate Studies Committee |
| 1992-93 | M362K Textbook Selection Committee (Chair) |
| Summer 93 | Applied Math Prelim Committee |
| Jan. 94, 96 | Topology Prelim Committee |
| Aug. 94, 97 | Topology Prelim Committee (Chair) |
| 1996-97 | M340L Textbook Selection Committee (Chair) |
| 1997-99 | Colloquium Coordinator |
| 1997-99 | Administrative Subcommittee of the Graduate Studies Committee |
| 2000- | Undergraduate Studies Committee (Chair since 2003) |
| 2001- | Contests Committee (Chair since 2002) |
| 2001- | University Grievance Committee |

## GRADUATE STUDENT SUPERVISION AND COMMITTEE PARTICIPATION

### *Ph.D. Degrees Supervised*

Francis Handfield, 1998, "Adiabatic Limits of the Anti-Self-Dual Equation"

Jean Marie Linhart, 1999, "Numerical Investigations of Singularity Formation in Nonlinear Wave Equations in the Adiabatic Limit"

Dorothy Buck, 2001, "The Topology and Geometry of DNA and DNA-Protein Interactions"

Betsygail Rand, 2006, "Pattern-Equivariant Cohomology of Tiling Spaces with Rotations".

## COURSES TAUGHT SINCE 1991

| *Course* | *Title* |
|---|---|
| M403K | Business Calculus I |
| M403L | Business Calculus II |
| M408C | Engineering Calculus I |
| M408K | Engineering Calculus I |
| M408L | Engineering Calculus II |
| M408M | Engineering Calculus III |
| M311 | Linear Algebra |
| M340L | Matrices and Matrix Calculations |
| M358K | Applied Statistics |
| M375/M346 | Applied Linear Algebra |
| M361 | Complex Analysis |
| M362K | Probability |
| M365D | Analysis II |
| M373K | Algebraic Structures |
| M375 | Curves and Surfaces |
| M682CB | General Topology |
| M382C | Graduate Topology I |
| M382D | Graduate Topology II |
| M382E | Differential Geometry |
| M382E | Algebraic Topology |
| M382F | Algebraic Topology |
| M393C | Quantum Mechanics |
| M393C | Lie Groups |

## RESEARCH INTERESTS

Topology and dynamics of aperiodic tilings, adiabatic quantum transport, and other problems of both physical and geometric interest.

## PUBLICATIONS

### Book

1. Applied Linear Algebra: The Decoupling Principle. Published Fall 2000 by Prentice Hall. ISBN 0-13-085645-2.

### Book Chapter

2. Linear Algebra and Mathematical Physics, for the CRC Handbook of Linear Algebra, Leslie Hogben ed. (2006)

### Articles

3. (with A. C. Sadun and A. A. Sadun) Solar Retinopathy - A Biophysical Analysis, Arch. Opthalmol. 102(1984) 1510-1512.
4. (with Zvi Bern, M. B. Halpern and Clifford Taubes) Continuum Regularization of QCD, Phys. Lett. B 185(1985) 151-156.
5. (with Zvi Bern, M. B. Halpern and Clifford Taubes) Continuum Regularization of Quantum Field Theory I. Scalar Prototype, Nucl. Phys. B 284(1987) 1-34.
6. (with Zvi Bern, M. B. Halpern and Clifford Taubes) Continuum Regularization of Quantum

Field Theory II. Gauge Theory, Nucl. Phys. B 284(1987) 35-91.

7. (with Zvi Bern and M. B. Halpern) Continuum Regularization of Quantum Field Theory III. The QCD4 $\beta$-function, Nucl. Phys. B 284(1987) 92-102.

8. (with Zvi Bern and M. B. Halpern) Continuum Regularization of Quantum Field Theory IV. Langevin Renormalization, Z. Phys. C 35(1987) 255-283.

9. Continuum Regularization of Quantum Field Theory V. Schwinger-Dyson Renormalization, Z. Phys. C 36(1987) 407-424.

10. (with F. Gesztesy, D. Gurarie, H. Holden, M. Klaus, B. Simon and P. Vogl) Trapping and Cascading of Eigenvalues in the Large Coupling Limit, Commun. Math. Phys. 118(1988) 597-634.

11. (with J. E. Avron, Jan Segert and Barry Simon) Topological Invariants in Fermi Systems with Time Reversal Invariance, Phys. Rev. Lett. 61(1988), 1329-1332.

12. (with Jan Segert) Chern Numbers for Fermionic Quadrupole Systems, J. Phys. A. 22(1989) L111-L115.

13. (with J. E. Avron, Jan Segert and Barry Simon) Chern Numbers, Quaternions and Berry's Phase in Fermi Systems, Commun. Math. Phys. 124(1989), 595-624.

14. (with J. E. Avron) Chern Numbers and Adiabatic Transport in Networks with Leads, Phys. Rev. Letters 62(1989) 3082-3084.

15. (with J. E. Avron) Adiabatic Quantum Transport in Networks with Macroscopic Components, Ann. of Physics 206(1991) 440-493.

16. (with Jan Segert) Non-self-dual Yang-Mills Connections with Nonzero Chern Number, Bull. Amer. Math. Soc. 24(1991) 163-170.

17. (with A. C. Sadun) Relativistic Dynamics of Expanding Sources, Astrophys. & Space Sci. 185(1991), 21-36.

18. (with Jan Segert) Non-self-dual Yang-Mills connections with Quadrupole Symmetry, Comm. Math. Phys. 145(1992), 363-391.

19. (with Jan Segert) Stationary Points of the Yang-Mills Action, Comm. Pure & Appl. Math. 45(1992) 461-484.

20. (with J. E. Avron, M. Klein and A. Pnueli) Hall conductance, Adiabatic Charge Transport and Persistent Currents of Leaky Tori, Phys. Rev. Lett. 69(1992), 128-131.

21. (with Jan Segert) Constructing Non-Self-Dual Yang-Mills Connections with Nonzero Chern Number, Proceedings of the Symposia in Pure Mathematics 54, Part 2 (1993), 529-537.

22. (with M. Vishik) The Spectrum of the Second Variation of the Energy for an Ideal Incompressible Fluid, Phys. Lett. A 182 (1993), 394-398.

23. A Symmetric Family of Yang-Mills Fields, Commun. Math. Phys. 163 (1994), 257-291.

24. (with C. Radin) The Isoperimetric Problem for Pinwheel Tilings, Commun. Math. Phys. 177 (1996), 255-263.

25. A Simple Geometric Representative of $\mu$ of a Point, Commun. Math Phys. 178 (1996), 107-113.

26. (with J. Avron) Adiabatic Curvature and the $S$-Matrix, Commun. Math. Phys. 181 (1996), 685-702.

27. (with D. Auckly) A Family of Möbius Invariant 2-Knot energies, in "Geometric Topology: The Proceedings of the 1993 Georgia International Topology Conference", W. Kazez, ed. AMS/IP Studies in Advanced Mathematics 2, Part 1 (1997) 235–258.

28. Simple Type is Not a Boundary Phenomenon, in "Geometry, Topology and Physics", B. Apanasov, S. Bradlow, W. Rodrigues and K. Uhlenbeck, ed. (1997), 233–244.

29. Some Generalizations of the Pinwheel Tiling, Disc. Comp. Geom. 20 (1998), 79-110.

30. (with C. Radin) Subgroups of $SO(3)$ Associated with Tilings, J. Algebra. 202 (1998), 611–633.

31. (with M. Speight) Geodesic Incompleteness in the $CP^1$ Model on a Compact Riemann Surface, Lett. Math. Phys. 43 (1998), 329–334.

32. (with C. Radin) An Algebraic Invariant for Substitution Tiling Systems, to appear in Geom. Ded. 73 (1998) 21–37

33. (with C. Radin) On 2-generator subgroups of SO(3), Trans. Amer. Math. Soc. 351 (1999), 4469–4480

34. (with J. Conway and C. Radin) On Angles Whose Squared Trigonometric Functions are Rational, Discrete Comput. Geom. 22 (1999), 321–332.

35. (with B. Draco and D. Van Wieren) Growth Rates in the Quaquaversal Tiling, Discrete Comput. Geom. 23 (2000), 419–435.

36. (with J. Conway and C. Radin) Relations in SO(3) Supported by Geodetic Angles, Discrete Comput. Geom. 23 (2000), 453–463.

37. (with J.E. Avron, A. Elgart and G.M. Graf) Geometry, Statistics and Asymptotics of Quantum Pumps, Physical Review B (Rapid Communications) 62 (2000) R10618-R10621.

38. (with L. Guijarro and G. Walschap) Parallel Connections over Symmetric Spaces, J. Geom. Anal. 11 (2001), 265–281.

39. (with D. Groisser) Simple Type and the Boundary of Moduli Space, J. Geom. Phys. 36 (2000), 324–384.

40. (with C. Radin) Isomorphisms of Hierarchical Structures, Ergodic Theory Dynam. Systems 21(2001), 1239-1248.

41. (with J.E. Avron) Fredholm Indices and the Phase Diagram of Quantum Hall Systems, J. Math. Phys. 42 (2001), 1–14.

42. (with J.E. Avron, A. Elgart, and G.M. Graf) Optimal Quantum Pumps, Physical Review Letters **87** (2001), 236601.

43. (with Jean Marie Linhart) Fast and Slow Blowup in the $S^2$ Sigma Model and (4+1)-Dimensional Yang-Mills Model, Nonlinearity **15** (2002) 219–238.

44. (with N. Ormes and C. Radin) A Homeomorphism Invariant for Substitution Tiling Spaces, Geometriae Dedicata **90** (2002), 153–182.

45. (with F. Rodriguez Villegas and J. F. Voloch) Blet, a Mathematical Puzzle, American Mathematical Monthly **109** (2002) 729–740.

46. (with J.E. Avron, A. Elgart, and G.M. Graf) Time-Energy Coherent States and Adiabatic Scattering, Journal of Mathematical Physics **43** (2002), 3415–3424.

47. (with R.F. Williams) Tiling Spaces are Cantor Set Fiber Bundles, Ergodic Theory and Dynamical Systems **23** (2003) 307–316.

48. (with A. Marini) Spherically Symmetric Solutions of a Boundary Value Problem for Monopoles, Journal of Mathematical Physics **44** (2003) 1071–1083.

49. (with A. Clark) When size matters: subshifts and their related tiling spaces, Ergodic Theory and Dynamical Systems **23** (2003) 1043–1057.

50. (with S. Keel) Oort's Conjecture for $A_g \otimes C$, Journal of the Americal Mathematical Society **16** (2003) 887–900.

51. Tiling Spaces are Inverse Limits, Journal of Mathematical Physics **44** (2003) 5410–5414.

52. (with J.E. Avron, A. Elgart, G.M. Graf and K. Schnee) Adiabatic charge pumping in open quantum systems, Communications in Pure and Applied Math **57** (2004) 528–561.

53. (with J.E. Avron, A. Elgart and G.M. Graf) Transport and Dissipation in Quantum Pumps. Journal of Statistical Physics **116** (2004) 425–473.

54. (with C. Radin) Structure of the hard sphere solid, Phys. Rev. Lett. **94** (2005), paper 015502.

55. (with C. Holton and C. Radin) Conjugacies for Tiling Dynamical Systems. Communications in Mathematical Physics **254** (2005) 343–359.

56. (with P. Buczek and J. Wolny) Periodic Diffraction Patterns for 1D Quasicrystals. Acta Physica Polonica **B 36** (2005) 919-933.

57. (with L. Bowen, C. Holton and C. Radin) Uniqueness and Symmetry in Problems of Optimally

Dense Packings. Math Phys. Electron. J. **11** (2005) paper 1.

58. (with H. Koch and C. Radin), The most stable structure for hard spheres, Physical Review **E 72** (2005), paper 016708.

59. (with R. Kenyon and B. Solomyak) Topological Mixing for Substitutions on Two Letters, Ergodic Theory and Dynamical Systems **25** (2005) 1919-1934.

60. (with A. Clark) When Shape Matters: Deformations of Tiling Spaces, Ergodic Theory and Dynamical Systems **26** (2006) 69-86.

61. Tilings, tilings spaces and topology, Philosophical Magazine **86** (2006) 875-881.

### *Submitted*

62. Pattern-Equivariant Cohomology with Integer Coefficients.

63. (with N.P. Frank) Topology of (Some) Tiling Spaces without Finite Local Complexity.