

# Alexander Elgart

## *Curriculum Vitae*

**Contact**            Department of Mathematics  
448 McBryde Hall  
Virginia Tech  
Blacksburg, VA 24061  
USA  
Phone: +1 540-2315693  
Fax: +1 540-2315960  
  
aelgart@vt.edu

## **Research Interests**

Mathematical Physics, Analysis

## **Education**

*Ph.D. in Physics*, 2000  
Technion - Israel Institute of Technology  
Field: Mathematical physics  
Thesis: *Adiabatic theorems and their applications*  
Adviser: Prof. J. E. Avron

*M.S. in Physics*, 1998  
Technion - Israel Institute of Technology  
Field: Mathematical physics  
Thesis: *Adiabatic theorems without a gap condition*  
Adviser: Prof. J. E. Avron

*B.A. in Physics*, 1994  
Technion - Israel Institute of Technology

## **Research appointments**

2013 – present      Associate Professor, Department of Mathematics  
Virginia Tech

9/2014 – 3/2015    Visiting Associate Professor, Department of Mathematics  
University of California Irvine

2007 – 2013        Assistant Professor, Department of Mathematics  
Virginia Tech

2006 – 2007        Senior Lecturer, Department of Mathematics  
Ben Gurion University at Negev

2003 – 2005        Instructor, Department of Mathematics,  
Stanford University

2002 – 2003        Assistant Professor \ Courant Instructor, CIMS  
New York University

06/07 2003        Visiting Professor, Department of Mathematics,  
Université de Lille

2000 – 2002      Instructor, Department of Physics  
Princeton University

### Awards and Prizes

2017              *The Simons Foundation Grant # 443529, \$ 42,000*

2012              *US National Science Foundation Grant # 1210982, Co-PI (w/ G. Hagedorn), \$ 344,188*

2009              *US National Science Foundation Grant # 0907165, Co-PI (w/ G. Hagedorn), \$ 337,000*

2007              *Israel Science Foundation Grant, sole PI, \$170,000*

2007              *US-Israel Binational Science Foundation Grant, # 2006021, Co-PI (w/ D. Cohen and T. Kottos), \$ 96,650*

2007              *Zvi and Zahava Friedenberga award for the advancement of science and education, awarded by Israel Science Foundation.*

### Services

Referee for:

Communications in Mathematical Physics  
Journal of Functional Analysis  
Journal of Spectral Theory  
Quantum Information Processing  
Journal of Mathematical Physics  
Journal of Physics A  
Journal of Statistical Physics  
Letters in Mathematical Physics  
Waves in Random Media  
Probability Theory and Related Fields  
Proceedings of the Royal Society A  
Annales Henri Poincaré

### Teaching Experience

Spring 2018      Linear Algebra II

Spring 2017      Invitation to Analysis

Fall 2014        Introduction to Linear Algebra, UC Irvine

Spring 2014      Matrix Analysis, Virginia Tech

Spring 2014      Multivariable Calculus, Virginia Tech

Spring 2013      Mathematical Foundations of Quantum Mechanics, Virginia Tech

2011, 2016      Linear Algebra I, Virginia Tech

2011 – 2012      Calculus of Several Variables, Virginia Tech

Fall 2010        Intermediate Differential Equations, Virginia Tech

2009 – 2017      Functional analysis, Virginia Tech

2007 – 2010      Introduction to Differential Equations, Virginia Tech

2009, 2016, 2018	Real analysis, part II, Virginia Tech
2008, 2015, 2017	Real analysis, part I, Virginia Tech
Fall 2006	Ordinary differential equations, Ben Gurion University
Fall 2006	Functional Analysis, Ben Gurion University
Spring 2006	Linear Algebra, Ben Gurion University
Fall 2005	Partial differential equations, Stanford University
2004 – 2005	Elementary Functional Analysis, Stanford University
Fall 2003	Complex Variables, Stanford University
2003 – 2004	Calculus I and II, New York University
Fall 2002	Algebra and Calculus with Applications, New York University
2000 – 2001	General Physics courses, Princeton University

## Invited seminars and colloquia

2016	March - <i>UAB Math Colloquium</i> , Birmingham September - <i>VT Applied analysis seminar</i> , Blacksburg
2015	May - <i>Technion PDE and Applied Mathematics Seminar</i> , Israel September - <i>VT Math Colloquium</i> , Blacksburg October - <i>VT Applied analysis seminar</i> , Blacksburg
2014	October - <i>UCI Mathematical Physics Seminar</i> , Irvine October - <i>UCI Mathematical Physics Seminar</i> , Irvine
2010	May - <i>Tufts Seminar</i> , Boston
2008	October <i>UAB Math Colloquium</i> , Birmingham
2007	January - <i>VT Math Colloquium</i> , Blacksburg October - <i>UVA Mathematical Physics Seminar</i> , Charlottesville June - <i>HUJI PDE Seminar</i> , Jerusalem June - <i>BGU Operator and System Theory Seminar</i> , Beer Sheva
2006	May - <i>BGU PDE and Applied Math Seminar</i> , Beer Sheva
2004	December - <i>Technion PDE and Applied Math Seminar</i> , Haifa December - <i>GAFSA Seminar</i> , Tel Aviv December - <i>HUJI PDE Seminar</i> , Jerusalem November - <i>UCI Mathematical Physics Seminar</i> , Irvine January - <i>Joint Applied Math and Probability Seminar</i> , Stanford
2003	December - <i>Technion Mathematical Physics Seminar</i> , Haifa December - <i>U. of Chicago Computational and Applied Mathematics Seminar</i> , Chicago
2002	November - <i>UAB Math Colloquium</i> , Birmingham
1998	October - <i>TU Munich Mathematical Physics seminar</i> , Munich September - <i>TU Berlin Mathematical Physics seminar</i> , Berlin

## Invited lectures at workshops and conferences

Forthcoming	February '18 36th Western States meeting of Mathematical Physics, Irvine, CA November '18 Spectral Theory of Quasi-Periodic and Random Operators, Montreal, Canada December '18 Random Physical Systems, Patagonia, Chile April '19 Spectral Methods in Mathematical Physics, Stockholm, Sweden
2017	March Fisher-Hartwig asymptotics, Szego expansions, and applications to statistical physics, San Jose, CA May Mathematical Aspects of Disordered Systems, Zurich, Switzerland
2016	October <i>QMath13: Mathematical Results in Quantum Physics</i> , Atlanta, GA June <i>Great Lakes Mathematical Physics Meeting</i> , East Lansing, MI

- 2015            February 33<sup>rd</sup> Annual Western States Mathematical Physics Meeting, Pasadena, CA  
                   June Random and other ergodic problems, Cambridge, UK
- 2014            March AMS Sectional Meeting, Knoxville  
                   December The Mathematics of Quantum Disordered Systems, St. Petersburg, Russia
- 2013            March Nonlinear Evolution Equations and Wave Phenomena, Athens, GA  
                   July Quantum Spectra and Transport, Jerusalem
- 2012            October AMS Sectional Meeting, Tucson
- 2011            March 35<sup>th</sup> SIAM Southeastern Atlantic Section Conference, Charlotte
- 2010            March - AMS sectional meeting, Lexington  
                   October - SEARCDE-30, Blacksburg
- 2009            December - Modeling and Understanding Random Hamiltonians, Oberwolfach  
                   April - Random Schrödinger Operators, Banff
- 2008            March - Disordered Systems, Oberwolfach
- 2007            February - Partial Differential Equations and Spectral Theory, Jerusalem
- 2006            February - Mathematical Aspects of Quantum Adiabatic Approximation, Waterloo
- 2005            January - Quantum spectra and dynamics, Rehovot  
                   Open Quantum Systems, Vienna
- 2004            September - QMath9 International Conference, Giens  
                   July - Spectral Theory of Schrödinger Operators, Montreal
- 2003            August - XIV International Congress on Mathematical Physics, Lisbon
- 2001            November - AMS Sectional Meeting, Irvine  
                   August - Workshop on Mathematical Physics, Mambucaba
- 1999            June - Open Classical and Quantum Dynamical Systems, Lille  
                   June - Miniconference on Quantum Chaos, Dissipation and Adiabaticity, Haifa  
                   May - Spectral and Scattering Theory Workshop, Jerusalem
- 1998            June - Workshop in Mathematical Physics, Haifa

## Graduate advising

Zhenwei Cao, Ph.D. student, 2009 - 2013

Daniel Schmidt, Ph.D. student, 2011 - 2015

## List of Publications and Preprints

Publications in peer-reviewed journals

1. J. E. Avron and A. Elgart, "An Adiabatic Theorem without a Gap Condition: Two level system coupled to quantized radiation field" *Phys. Rev. A.*, **58**, 4300-4306, (1998).
2. J. E. Avron and A. Elgart, "Smooth adiabatic evolutions with leaky power tails" *J. Phys. A: Math. Gen.*, **32**, L537 (1999).
3. J. E. Avron and A. Elgart, "Adiabatic Theorem without a Gap Condition" *Comm. Math. Phys.*, **203**, 445, (1999).
4. J.E. Avron, A. Elgart, G.M. Graf, and L. Sadun, "Geometry, Statistics and Asymptotics of Quantum Pumps" *Phys. Rev. B*, **62**, R10618(R) (2000).
5. J.E. Avron, A. Elgart, G.M. Graf and L. Sadun, "Optimal Quantum Pumps" *Phys. Rev. Lett.*, **87**, 236601 (2001).
6. A. Elgart and J.H. Schenker "A strong operator topology adiabatic theorem" *Rev. Math. Phys.*, **14**, 569 (2002).
7. J.E. Avron, A. Elgart, G.M. Graf and L. Sadun, "Time-Energy coherent states and adiabatic scattering" *J. Math. Phys.*, **43**, 3415 (2002).
8. A. Elgart and B. Schlein, "Adiabatic Charge Transport and the Kubo Formula for Landau Type Hamiltonians" *Comm. Pure and Appl. Math.*, **57**, 590 (2004).
9. J.E. Avron, A. Elgart, G.M. Graf, L. Sadun and K. Schnee, "Adiabatic charge pumping in open quantum systems" *Comm. Pure and Appl. Math.*, **57**, 528 (2004).
10. J.E. Avron, A. Elgart, G.M. Graf and L. Sadun, "Transport and Dissipation in Quantum Pumps" *J. Stat. Phys.*, **116**, 425 (2004).
11. A. Elgart, L. Erdos, B. Schlein and H-T. Yau, "Nonlinear Hartree equation as the mean field limit of weakly coupled fermions" *J. Math. Pure Appl.*, **83**, 1241 (2004).
12. A. Elgart, G.M. Graf and J. H. Schenker, "Equality of the bulk and edge Hall conductances in a mobility gap" *Comm. Math. Phys.*, **259**, 185, (2005).
13. A. Elgart, L. Erdos, B. Schlein and H-T. Yau, "Gross-Pitaevskii Equation as the Mean Field Limit of Weakly Coupled Bosons" *Arch. Rat. Mech. Anal.*, **179**, 265, (2006).
14. M. Aizenman, A. Elgart, S. Naboko, J. H. Schenker and G. Stolz, "Moment Analysis for Localization in Random Schrödinger Operators" *Invent. Math.*, **163**, 343, (2006).
15. A. Elgart and B. Schlein, "Mean Field Dynamics of Boson Stars" *Comm. Pure and Appl. Math.* **60**, 500, (2007).
16. A. Elgart, "Lifshitz tails and localization in the three-dimensional Anderson model" *Duke Math. J.*, **146**, 331, (2009).
17. J. Aisenberg, I. Sela, T. Kottos, D. Cohen, and A. Elgart "Quantum decay into a non-flat continuum", *J. Phys. A: Math. Theor.* **43**, 095301, (2010).
18. J. Aisenberg, I. Sela, T. Kottos, D. Cohen, and A. Elgart "Anomalous decay of a prepared state due to non-Ohmic coupling to the continuum" *Phys. Rev. E* **81**, 036219 (2010).
19. A. Elgart, M. Tautenhahn, and I. Veselić "Localization via fractional moments for models on with single-site potentials of finite support", *J. Phys. A: Math. Theor.* **43**, 474021 (2010).
20. A. Elgart and G. Hagedorn, "An Adiabatic Theorem for Resonances", *Comm. Pure and Appl. Math.* **64**, 1029 (2011).
21. A. Elgart, M. Tautenhahn, and I. Veselić, "Anderson localization for a class of models with a sign-indefinite single-site potential via fractional moment method", *Ann. Henri Poincaré* **12**, 1571 (2011).
22. Z. Cao and A. Elgart, "On the efficiency of Hamiltonian-based quantum computation for low-rank matrices", *J. Math. Phys.* **53**, 032201 (2012).

23. A. Elgart and G. Hagedorn, "A note on the switching adiabatic theorem", *J. Math. Phys.* **53**, 102202 (2012).
24. Z. Cao and A. Elgart, "The weak localization for the alloy-type Anderson model on a cubic lattice", *J. Stat. Phys.* **148**, 1006 (2012).
25. A. Elgart and A. Klein, "Ground state energy of trimmed discrete Schrödinger operators and localization for trimmed Anderson models", *J. Spectr. Theory* **4**, 391 (2014).
26. A. Elgart, M. Shamis and S. Sodin, "Localisation for non-monotone Schrödinger operators", *JEMS* **16**, 909 (2014).
27. A. Elgart and D. Schmidt, "Eigenvalue counting inequalities, with applications to Schrödinger operators". *J. Spectr. Theory* **5**, 251–278 (2015).
28. A. Elgart and A. Klein, "An eigensystem approach to Anderson localization." *J. Funct. Anal.* **271**, 3465 (2016).
29. A. Elgart and S. Sodin, "The trimmed Anderson model at strong disorder: localization and its breakup." *J. Spectr. Theory* **7**, 87 (2017).
30. A. Elgart, L. Pastur and M. Shcherbina, "Large block properties of the entanglement entropy of free disordered fermions." *J. Stat. Phys.* **166**, 1092 (2017).
31. A. Elgart, A. Klein, and G. Stolz, "Droplet localization in the random XXZ model and its manifestations." *J. Phys. A: Math. Theor.* **51**, 01LT02 (2018). \* **IOPselect paper**
32. A. Elgart and A. Klein, "Eigensystem multiscale analysis for Anderson localization in energy intervals." *J. Spectr. Theory*, to appear.
33. A. Elgart, A. Klein, and G. Stolz, "Many-body localization in the droplet spectrum of the random XXZ quantum spin chain." *J. Funct. Anal.*, to appear.
34. A. Elgart, A. Klein, and G. Stolz, "Manifestations of dynamical localization in the disordered XXZ spin chain." *Comm. Math. Phys.*, to appear.

### Conference Proceedings

1. J. E. Avron and A. Elgart, "An adiabatic theorem without a gap condition" *Mathematical results in quantum mechanics* (Prague, 1998), 3, Oper. Theory Adv. Appl., **108**, Birkhäuser, Basel, (1999).
2. G. Stolz, M. Aizenman, A. Elgart, S. Naboko, and J. H. Schenker, "Fractional moment methods for Anderson localization in the continuum" *XIVth International Congress on Mathematical Physics*, 619, World Sci. Publ., Hackensack, NJ, (2005).
3. G. M. Graf, A. Elgart, L. Sadun, and K. Schnee, "Transport in adiabatic quantum pumps" *XIVth International Congress on Mathematical Physics*, 171, World Sci. Publ., Hackensack, NJ, (2005).
4. A. Elgart, "Adiabatic transport, Kubo formula and Anderson localization in some lattice and continuum models" *XIVth International Congress on Mathematical Physics*, 163, World Sci. Publ., Hackensack, NJ, (2005).
5. A. Elgart, "Equality of the bulk and edge Hall conductances in  $2D$ " *Mathematical physics of quantum mechanics*, 325, Lecture Notes in Phys., 690, Springer, Berlin, (2006).
6. A. Elgart, H. Krüger, M. Tautenhahn, and I. Veselić, "Discrete Schrödinger operators with random alloy-type potential", *Proceedings of Spectral Days 2010*, Santiago, Chile, (2011).

### Submitted Papers and Preprints

1. Dietlein and A. Elgart, "Level spacing for continuum random Schrödinger operators with applications." arXiv:1712.03925.

February 7, 2018