Martin Fraas

Curriculum Vitae

PERSONAL DETAILS

Birth	August 14, 1982
Nationality	Slovak
Mail	fraas@math.ucdavis.edu

EDUCATION

PhD 2005-2008

Department of Theoretical Physics NPI AS ČR & Charles University

Supervisor: Prof. Pavel Exner

MSc 2000-2005

Charles University in Prague

Principal subject: Theoretical physics

WORK EXPERIENCE

Assistant Professor 2020-

Mathematics Department, UC Davis

Assistant Professor 2017-2020

Mathematics Department, Virginia Tech

Visiting Professor 2016-2017

Institute for Theoretical Physics, KU Leuven, Belgium

Visiting Professor 2014-2015

Mathematisches Institute, LMU, München, Germany

Postdoctoral Fellow 2011-2014

Institute for Theoretical Physics, ETH, Zürich, Switzerland

Mentor: Prof. Gian Michele Graf

Postdoctoral Fellow 2009-2011

Physics & Mathematics Departments, Technion, Haifa, Israel

Mentors: Prof. Y. Avron & Prof. Y. Pinchover

Research Assistant, PhD student 2006-2008
Department of Theoretical Physics, Nuclear Physics Institute, AS ČR, Řež

TEACHING EXPERIENCE

Lecturer, Funcional Analysis I, VT	2019
Lecturer, Introduction to Stochastic Analysis, VT	2019
Mentor, Undergraduate Research, VT	2019
Lecturer, Ordinary Differential Equations, VT	2019
Lecturer, Calculus of Several Variables, VT	2018
Mentor, Independent Study of Quantum Cryptography, VT	2018
Lecturer, Ordinary Differential Equations, VT	2017
Lecturer, Classical and Quantum Stochastic Calculus, KU Leuven	2016
Lecturer, Functional Analysis I, LMU	2015
Lecturer, Mathematical Statistical Physics II, LMU	2014
Supervision, Proseminar in mathematical physics, LMU	2014
Lecturer, Theory of Open Quantum Systems, ETH	2014
Head teaching assistant, Quantum mechanics I./II., ETH	2013-4
Tutor, Proseminar in theoretical physics, ETH	2012-3
Teaching assistant, Quantum information, Technion	2009
Teaching assistant, Mathematical methods for physicists, Charles University	2005

MENTORING

Simon Du (PhD.)

Lisa Hänggli (PhD. 2018)

SERVICE

Main organizer, 'Mathematical Physics at the Crossings' conference May 20.-24. 2019

Co-organizer, Quantum spin lattice seminar 2017-

Co-organizer, Analysis and mathematical physics seminar, VT 2017-

Co-organizer, Analysis and mathematical physics afternoon tea meetings, VT 2017-

Main organizer, Conference on mathematical physics and quantum mechanics, ETH 13.-17. Oct. 2014

Main organizer, Workshop on mathematical aspects of quantum field theory, ETH 28.-29. Nov. 2013

Main organizer, Workshop in mathematical physics, ETH 6.-7. March 2013

Co-organizer, Talks in mathematical physics, ETH 2012-3

Main organizer, Quantum information seminar, Technion 2010-1

GRANTS AND AWARDS

Awarded BIRS workshop 'Topology and Entanglement in Many Body Systems' joint with S. Bachmann and F. Brandao 2020

'Transport in Quantum Spin Systems' joint with Alex Elgart, DMS-1907435 2019-2021

'Early Career and Student Support for Mathematical Physics at the Crossing Conference' joint with Alex Elgart, DMS-1841860 2019

CRM Scholar in residence 2018

2018-9 TALKS

2019

- *A many-body Fredholm index for ground state spaces and Abelian anyons*, Math. Phys. Seminar, Princeton
- *Integers in Gapped Quantum Lattice Systems*, Invited talk at Math. Phys. Seminar, UC Davis
- *Braiding of Excitation in Fractional Quantum Hall Effect*, Invited talk at Quantissima III, Venice

- *Session on Quantum Trajectories*, Quantissima III, Venice
- *Abelian Anyons in Fractional Quantum Hall Effect*, Invited talk at Oberwolfach, Oberwolfach
- *Many Body Index for Quantum Charge Transport*, Invited talk at AMS Sectional, Binghamton

2018

- *Quantization of conductance in gapped interacting systems*, Mathematical Physics Seminar, MSU
- *Determinant invariants for local operators*, Analysis and Math. Phys. Seminar, VT
- *An index theory for many body quantum systems*, CRM Seminar, CRM Montreal
- *An index theory for many body quantum systems*, Quantum Information and Quantum Statistical Mechanics Conference, CRM Montreal
- *Perturbation theory for quantum trajectories*, Invited talk at AMS Sectional, Ann Arbor
- *Perturbation theory for quantum trajectories*, Analysis Seminar, Binghamton U.
- *An index theory for many body quantum systems*, Mathematical Physics Seminar, Hebrew U.

LANGUAGES

Slovak & Czech (mother tongue), English (fluent), Hebrew (advanced), German (basic)

PUBLICATIONS

[1] P Exner and M Fraas. Resonance asymptotics in the generalized Winter model. *Physics Letters A*, 360(1):57–61, 2006.

[2] P Exner and M Fraas. On the dense point and absolutely continuous spectrum for Hamiltonians with concentric δ shells. *Letters in Mathematical Physics*, 82(1):25–37, 2007.

[3] P Exner and M Fraas. On the essential spectrum of Schrödinger operators with spherically symmetric potentials. *Letters in Mathematical Physics*, 82:25–37, 2007.

[4] P Exner and M Fraas. A remark on helical waveguides. *Physics Letters A*, 369(5-6):393–399, 2007.

[5] P Exner and M Fraas. The decay law can have an irregular character. *Journal of Physics A: Mathematical and Theoretical*, 40:1333, 2007.

[6] P Exner, M Fraas, and EM Harrell. On the critical exponent in an isoperimetric inequality for chords. *Physics Letters A*, 368(1):1–6, 2007.

[7] P Exner and M Fraas. Interlaced dense point and absolutely continuous spectra for Hamiltonians with concentric-shell singular interactions. *Mathematical results in quantum mechanics: proceedings of the QMath10 Conference, Moieciu, Romania, 10-15 September 2007*, page 48, 2008.

[8] P Exner and M Fraas. On geometric perturbations of critical Schrödinger operators with a surface interaction. *Journal of Mathematical Physics*, 50(11):2101, 2009.

[9] JE Avron, M Fraas, GM Graf, and P Grech. Optimal time schedule for adiabatic evolution. *Physical Review A*, 82(4):040304, 2010.

[10] M Fraas, D Krejcirık, and Y Pinchover. On some strong ratio limit theorems for heat kernels. *Discrete Contin. Dynam. Systems A, a special special volume dedicated to Louis Nirenberg on the occasion of his 85th birthday*, 28:495–509, 2010.

[11] JE Avron, M Fraas, GM Graf, and P Grech. Landau-Zener tunneling for dephasing Lindblad evolutions. *Communications in Mathematical Physics*, 305:633–639, 2011.

[12] JE Avron, M Fraas, GM Graf, and O Kenneth. Quantum response of dephasing open systems. *New Journal of Physics*, 13:053042, 2011.

[13] M Fraas and Y Pinchover. Positive Liouville theorems and asymptotic behavior for p-Laplacian type elliptic equations with a Fuchsian potential. *Confluentes Mathematici*, 3:291–323, 2011.

[14] JE Avron, M Fraas, and GM Graf. Adiabatic response for Lindblad dynamics. *Journal of Statistical Physics*, 148(5):800–823, 2012.

[15] JE Avron, M Fraas, GM Graf, and P Grech. Adiabatic theorems for generators of contracting evolutions. *Communications in Mathematical Physics*, 314:163–191, 2012.

[16] B Devyver, M Fraas, and Y Pinchover. Optimal Hardy-type inequalities for elliptic operators. *Comptes Rendus Mathematique*, 2012.

[17] B Devyver, M Fraas, and Y Pinchover. Optimal Hardy weight for second-order elliptic operator: An answer to a problem of Agmon. *Journal of Functional Analysis*, 266(7):4422–4489, 2012.

[18] M Fraas and Y Pinchover. Isolated singularities of positive solutions of p-Laplacian type equations in $\mathbb{R}^d$. *J. Differential Equations*, 254:1097–1119, 2013.

[19] K Macieszczak, M Fraas, and R Demkowicz-Dobrzański. Bayesian quantum frequency estimation in presence of collective dephasing. *New Journal of Physics*, 16(11):113002, 2014.

[20] VV Albert, B Bradlyn, M Fraas, and L Jiang. Geometry and response of Lindbladians. *Physical Review X*, 6(4):041031, 2016.

[21] M Ballesteros, M Fraas, J Fröhlich, and B Schubnel. Indirect acquisition of information in quantum mechanics: states associated with tail events. *arXiv preprint arXiv:1611.07895*, 2016.

[22] M Fraas. An analysis of the stationary operation of atomic clocks. *Communications in Mathematical Physics*, 348(2):363–393, 2016.

[23] S Bachmann, W De Roeck, and M Fraas. The adiabatic theorem for many-body quantum systems. *Phys. Rev. Lett.*, 119, 2017.

[24] S Bachmann, M Fraas, and GM Graf. Dynamical crossing of an infinitely degenerate critical point. *Annales Henri Poincaré*, 18(5):1755–1776, 2017.

[25] M Ballesteros, N Crawford, M Fraas, J Fröhlich, and B Schubnel. Non-demolition measurements of observables with general spectra. *arXiv preprint arXiv:1706.09584, accepted in a Contemporary Mathematics volume*, 2017.

[26] M Ballesteros, N Crawford, M Fraas, J Fröhlich, and B Schubnel. Perturbation theory for weak measurements in quantum mechanics, systems with finite-dimensional state space. *Annales Henri Poincaré*, pages 1–37, 2017.

[27] M Fraas. Adiabatic theorem for a class of stochastic differential equations on a Hilbert space. *Functional Analysis and Operator Theory for Quantum Physics*, pages 223–243, 2017.

[28] M Fraas and L Hänggli. On Landau–Zener transitions for dephasing Lindbladians. *Annales Henri Poincaré*, 18(7):2447–2465, 2017.

[29] S Bachmann, A Bols, W De Roeck, and M Fraas. A many-body index for quantum charge transport. *accepted in CMP, arXiv preprint arXiv:1810.07351*, 2018.

[30] S Bachmann, A Bols, W De Roeck, and M Fraas. Note on linear response for interacting hall insulators. *arXiv preprint arXiv:1811.08699*, 2018.

[31] S Bachmann, A Bols, W De Roeck, and M Fraas. Quantization of conductance in gapped interacting systems. *Annales Henri Poincaré*, 19(3):695–708, 2018.

[32] S Bachmann, W De Roeck, and M Fraas. The adiabatic theorem and linear response theory for extended quantum systems. *Communications in Mathematical Physics*, pages 1–31, 2018.

[33] S Bachmann, W De Roeck, and M Fraas. The adiabatic theorem in a quantum many-body setting. *arXiv preprint arXiv:1808.09985*, 2018.

[34] S Bachmann, A Bols, W De Roeck, and M Fraas. A many-body fredholm index for ground state spaces and abelian anyons. *arXiv preprint arXiv:1910.04908*, 2019.

[35] T Benoist, M Fraas, Y Pautrat, and C Pellegrini. Invariant measure for quantum trajectories. *Probability Theory and Related Fields*, 174(1-2):307–334, 2019.

[36] T Benoist, M Fraas, Y Pautrat, and C Pellegrini. Invariant measure for stochastic Schrödinger equations. *arXiv preprint arXiv:1907.08485*, 2019.

[37] D Burgarth, P Facchi, M Fraas, and R Hillier. A quantum environment leading to non-exponential decay with zeno region which cannot be dynamically decoupled. *arXiv preprint arXiv:1904.03627*, 2019.

[38] M Fraas. Quantum adiabatic theory ventures into zeno dynamics. *Quantum Views*, 3:18, 2019.

[39] M Fraas, GM Graf, and L Hänggli. Indirect measurements of a harmonic oscillator. In *Annales Henri Poincaré*, volume 20, pages 2937–2970. Springer International Publishing, 2019.