Martin Fraas

Curriculum Vitae

PERSONAL DETAILS

Birth	August 14, 1982
Citizenship	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

UC Davis: Functional Analysis (MAT 202), Probability (MAT 135A), Calculus (MAT 22B, MAT 16C), Analysis (MAT 201B) 2020 -

Virginia Tech: Functional Analysis, Introduction to Stochastic Analysis, Ordinary Differential Equations, Calculus of Several Variables 2017-20

KU Leuven: Classical and Quantum Stochastic Calculus 2016

LMU: Functional Analysis, Mathematical Statistical Physics 2014-15

ETH: Theory of Open Quantum Systems, Quantum Mechanics 2013-14

Technion: Quantum Information 2009

MENTORING

King Lin (Senior Thesis 2023)

Matthew Corbelli (PhD. in progress)

Simon Du (PhD. in progress)

Lisa Hänggli (PhD. 2018)

SERVICE

Main organizer, QMATH 15 2023

Associate editor, Reviews in mathematical physics 2021-

Co-organizer, BIRS workshop 'Topology and Entanglement in Many Body Systems' 2020

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

Co-organizer, Quantum spin lattice seminar 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

GRANTS AND AWARDS

"QMATH 15: Mathematical Results in Quantum Physics" joint with B. Nachtergaele, DMS-2153895 2022

2021 Hellman Fellow 2021

ANR project 'Quantum Trajectories', PI: Tristan Benoist, ANR-20-CE40-0024-01 2021

2021 AHP Prize 2021

'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

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. Perturbation theory for weak measurements in quantum mechanics, systems with finite-dimensional state space. *Annales Henri Poincaré*, pages 1–37, 2017.

[26] 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.

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

[28] 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.

[29] 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.

[30] Miguel Ballesteros, Nicholas Crawford, Martin Fraas, Jürg Fröhlich, and Baptiste Schubnel. Non-demolition measurements of observables with general spectra. *Mathematical Problems in Quantum Physics*, 717:241–256, 2018.

[31] 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.

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

[33] 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.

[34] S Bachmann, A Bols, W De Roeck, and M Fraas. Many-body fredholm index for ground-state spaces and abelian anyons. *Physical Review B*, 101(8):085138, 2020.

[35] S Bachmann, A Bols, W De Roeck, and M Fraas. A many-body index for quantum charge transport. *Communications in Mathematical Physics*, 375(2):1249–1272, 2020.

[36] S Bachmann, A Bols, W De Roeck, and M Fraas. Note on linear response for interacting hall insulators. *Analytic Trends in Mathematical Physics*, 741:23, 2020.

[37] S Bachmann, A Bols, W De Roeck, and M Fraas. Rational indices for quantum ground state sectors. *Journal of Mathematical Physics*, 62(1):011901, 2021.

[38] S Bachmann, W De Roeck, M Fraas, and M Lange. Exactness of linear response in the quantum hall effect. In *Annales Henri Poincaré*, volume 22, pages 1113–1132. Springer International Publishing, 2021.

[39] S Bachmann and M Fraas. On the absence of stationary currents. *Reviews in Mathematical Physics*, 33(01):2060011, 2021.

[40] Sven Bachmann, Wojciech De Roeck, Brecht Donvil, and Martin Fraas. Stability against large perturbations of invertible, frustration-free ground states. *arXiv preprint arXiv:2110.11194*, 2021.

[41] M Ballesteros, T Benoist, M Fraas, and J Fröhlich. The appearance of particle tracks in detectors. *Communications in Mathematical Physics*, pages 1–35, 2021.

[42] T Benoist, M Fraas, Y Pautrat, and C Pellegrini. Invariant measure for stochastic schrödinger equations. In *Annales Henri Poincaré*, volume 22, pages 347–374. Springer International Publishing, 2021.

[43] D Burgarth, P Facchi, M Fraas, and R Hillier. Non-markovian noise that cannot be dynamically decoupled by periodic spin echo pulses. *SciPost Physics*, 11(2):027, 2021.

[44] Alexander Elgart and Martin Fraas. On kitaev's determinant formula. *arXiv preprint arXiv:2110.00599*, 2021.

[45] Sven Bachmann, Wojciech De Roeck, Martin Fraas, and Tijl Jappens. A classification of g-charge thouless pumps in 1d invertible states. *arXiv preprint arXiv:2204.03763*, 2022.

[46] Tristan Benoist, Martin Fraas, and Jürg Fröhlich. The appearance of particle tracks in detectors–ii: the semi-classical realm. *arXiv preprint arXiv:2202.09558*, 2022.

[47] Wojciech De Roeck, Alexander Elgart, and Martin Fraas. Locobatic theorem for disordered media and validity of linear response. *arXiv preprint arXiv:2203.03786*, 2022.