

Curriculum Vitae

Kontakt Daten

Universität Potsdam
Institut für Mathematik
Campus Golm, Haus 9
Karl-Liebknecht-Straße 24-25
14476 Potsdam

E-mail: matthias.keller@uni-potsdam.de

URL: www.math.uni-potsdam.de/professuren/graphentheorie

Persönliche Daten

Geburtsdatum: 31. Dezember 1980
Staatsangehörigkeit: deutsch
Familienstatus: verheiratet, vier Kinder

Ausbildung

Habilitation in Mathematik (Mai 2015)

On the analysis and geometry of graphs,

Friedrich-Schiller-Universität Jena,

Gutachter: Jürgen Jost, Alexander Grigor'yan, Daniel Lenz, Karl-Theodor Sturm.

Promotion in Mathematik (Dezember 2010)

On the spectral theory of operators on trees,

Friedrich-Schiller-Universität Jena,

Gutachter: Daniel Lenz, Simone Warzel und Richard Froese.

Diplom in Mathematik (Juni 2006)

Produkte zufälliger Matrizen und der Lyapunov-Exponent,

Technische Universität Chemnitz,

Gutachter: Peter Stollmann und Daniel Lenz,

Nebenfach Physik, Vordiplom in Wirtschaftsmathematik.

Werdegang

Professor (W2), Universität Potsdam, seit Oktober 2015.

Visiting Associate Professor, Technion Haifa, März bis Juli 2019 und Februar bis August 2023.

Wissenschaftlicher Mitarbeiter, Friedrich-Schiller-Universität Jena, bei Daniel Lenz, Oktober 2008 bis September 2015.

Visiting Assistant Professor, Technion Haifa, auf Einladung von Yehuda Pinchover, Februar bis März 2015.

Postdoctoral Fellow, Hebrew University Jerusalem, bei Jonathan Breuer und Dan Mangoubi, Februar bis Juni 2011 und Oktober 2012 bis September 2013.

Visiting Student Research Collaborator, Princeton University, bei Michael Aizenman und Simone Warzel, Oktober 2007 bis Mai 2008.

Promotionsstipendiat, Stiftung der Deutschen Wirtschaft (SDW), Juli 2007 bis Juni 2010.

Wissenschaftlicher Mitarbeiter, Technische Universität Chemnitz, bei Daniel Lenz und Peter Stollmann, Juli 2006 bis Juni 2007.

Wissenschaftliche Hilfskraft, Fraunhofer Institut und Technische Universität Chemnitz, 2001 bis 2006.

Drittmittel

DFG-Projekt im Rahmen des Schwerpunktprogramms “Geometry at infinity”, *Boundaries and harmonic functions of simplicial complexes and Dirichlet spaces*, mit Daniel Lenz und Marcel Schmidt, (Sach- und Reisemittel) seit Mai 2020.

DFG-Projekt in Einzelförderung, *Hardy inequalities on graphs and Dirichlet spaces*, Middle Eastern Collaboration, mit Prof. Yehuda Pinchover und Felix Pogorzelski), Sach- und Reisemittel, Doktorandenstelle für 3 Jahre) seit Mai 2019.

DFG-Projekt in Einzelförderung, *Boundaries, Greens formulae and harmonic functions for graphs and Dirichlet spaces - follow up*, mit Daniel Lenz und Marcel Schmidt, (Sach- und Reisemittel, Doktorandenstelle für 3 Jahre) seit Februar 2018.

DFG-Projekt im Rahmen des Schwerpunktprogramms “Geometry at infinity”, *Boundaries, Greens formulae and harmonic functions for graphs and Dirichlet spaces*, mit Daniel Lenz, (Sach- und Reisemittel, Doktorandenstelle für 3 Jahre) seit Juni 2017.

DFG-Projekt in Einzelförderung, *Geometrie diskreter Räume und Spektraltheorie nicht-lokaler Operatoren*, mit Daniel Lenz, (Sach- und Reisemittel, Doktorandenstelle für 3 Jahre, Post-Doktorandenstelle für 1 Jahr), Juni 2012.

Programm zur Förderung der Drittmittelfähigkeit von Nachwuchswissenschaftlerinnen und Nachwuchswissenschaftlern, Programmlinie A (Advanced), Friedrich-Schiller-Universität Jena, zum Thema *Geometrie und Analysis auf Graphen*, (Sach- und Reisemittel) September 2014 bis September 2016.

Stipendien

Swiss Professorship für Forschungsaufenthalt am Technion Haifa, Februar bis August 2023.

Golda Meir Fellowship, für Forschungsaufenthalt an der Hebrew University Jerusalem, Oktober 2012 bis September 2013 (zusätzlich zu Stipendium der Hebrew University Grants von Jonathan Breuer und Dan Mangoubi).

Short visit grant der ESF für Forschungsaufenthalt an der Technischen Universität Graz, Juli 2012.

Post-Doc Stipendium der Hebrew University, Jerusalem, Februar bis Juni 2011.

Promotionsstipendium, Stiftung der deutschen Wirtschaft (SDW), Juli 2007 bis Juni 2010.

Forschungsinteressen

Dirichletformen und Markov-Prozesse

Funktional Ungleichungen für Schrödinger Operatoren auf Graphen

Krümmung und Spektrum von Graphen

Spektraltheorie von zufälligen Operatoren

Publikationen and Preprints

Bücher

1. Graphs and Discrete Dirichlet Spaces, (with Daniel Lenz, Radoslaw Wojciechowski), Springer, Grundlehren der mathematischen Wissenschaften, 358, 2021.
2. Analysis and Geometry on Graphs and Manifolds, (co-edited with Daniel Lenz, Radoslaw Wojciechowski), London Mathematical Society Lecture Note Series, 461, 2020.

Publikationen in referierten Journalen und Buchkapitel

3. Anchored heat kernel upper bounds on graphs with unbounded geometry and anti-trees (with Christian Rose), *Calculus of Variations and Partial Differential Equations* 63 (2024), no. 1, Paper No. 20, 18 pp.
4. Sobolev-Type Inequalities and Eigenvalue Growth on Graphs with Finite Measure (with Bobo Hua, Michael Schwarz, Melchior Wirth), *Proceedings of the American Mathematical Society*, 151 (2023), no. 8, 3401–3414.
5. On optimal Hardy weights for the Euclidean lattice, (with Marius Lemm), *Transactions of the American Mathematical Society*, 376 (2023), no. 9, 6033–6062.
6. Optimal Hardy Inequality for Fractional Laplacians on the Integers (with Marius Nietschmann), *Ann. Henri Poincaré* 24 (2023), no. 8, 2729–2741.
7. An Improved Discrete p -Hardy Inequality, (with Florian Fischer, Felix Pogorzelski), *Integral Equations Operator Theory* 95 (2023), no. 4, Paper No. 24, 17 pp.
8. On L^p Liouville theorems for Dirichlet forms, (with Bobo Hua, Daniel Lenz, Marcel Schmidt), in: Chen, ZQ., Takeda, M., Uemura, T. (eds) Dirichlet Forms and Related Topics. IWDFRT 2022. *Springer Proceedings in Mathematics & Statistics*, vol 394.
9. Feynman path integrals for magnetic Schrödinger operators on infinite weighted graphs (with Batu Güneysu), *Journal d'Analyse Mathématique*, 141, pages 751–770 (2020).
10. A note on eigenvalue bounds for non-compact manifolds (with Shiping Liu, Norbert Peyerimhoff), *Mathematische Nachrichten*, 294, no. 6 (2021).
11. Riesz Decompositions for Schrödinger Operators on Graphs (with Florian Fischer), *Journal of Mathematical Analysis and Applications*, 495 (2021), no. 1, 22 pp.
12. On the uniqueness class, stochastic completeness and volume growth for graphs (with Xueping Huang, Marcel Schmidt), *Transactions of the American Mathematical Society*, 373 (2020), no. 12, 8861–8884.
13. From Hardy to Rellich inequalities on graphs, (with Yehuda Pinchover, Felix Pogorzelski), *Proceedings of the London Mathematical Society*, 122 (2021), no. 3, 458–477.
14. Critical Hardy Inequalities on Manifolds and Graphs, book chapter, (with Yehuda Pinchover, Felix Pogorzelski), in *Analysis and Geometry on Graphs and Manifolds* 461, (2020) 172–202.
15. Magnetic sparseness and Schrödinger operators on graphs (with Michel Bonnefont, Sylvain Golénia, Shiping Liu, Florentin Münch), *Annales Henri Poincaré* 21 (2020), no. 5, 1489–1516.

16. Courant’s Nodal Domain Theorem for Positivity Preserving Forms (with Michael Schwarz), *Journal of Spectral Theory*, 10 (2020), no. 1, 271–309.
17. Criticality theory for Schrödinger operators on graphs (with Yehuda Pinchover, Felix Pogorzelski), *Journal of Spectral Theory*, 10 (2020), no. 1, 73–114.
18. A new discrete Hopf-Rinow theorem, (with Florentin Münch), *Discrete Mathematics*, 342 (2019), no. 9, 2751–2757.
19. Boundary representation of Dirichlet forms on discrete spaces (with Daniel Lenz, Marcel Schmidt, Michael Schwarz), *Journal de Mathématique Pure et Appliquée*, 126 (2019), 109–143.
20. Scattering the geometry of weighted graphs (with Batu Güneysu), *Mathematical Physics Analysis and Geometry*, 21, p. 21–28.
21. The Kazdan-Warner equation on canonically compactifiable graphs (with Michael Schwarz), *Calculus of Variations and Partial Differential Equations* 57 (2018), no. 2, Art. 70, 18 pp.
22. Optimal Hardy inequalities for Schrödinger operators on graphs (with Yehuda Pinchover, Felix Pogorzelski), *Communications in Mathematical Physics* 358 (2018), no. 2, 767–790.
23. An improved discrete Hardy inequality (with Yehuda Pinchover, Felix Pogorzelski) *American Mathematics Monthly*, 125 (2018), no. 4, 347–350.
24. Global properties of Dirichlet forms in terms of Green’s formula (with Sebastian Haeseler, Daniel Lenz, Jun Masamune, Marcel Schmidt), *Calc. Var. Partial Differential Equations* 56 (2017), no. 5, 56–124.
25. Geometric and spectral consequences of curvature bounds on tessellations, book chapter in *Modern Approaches to Discrete Curvature, Lecture Notes in Mathematics*, 2184, 2017.
26. Sectional curvature of polygonal complexes with planar substructures (with Norbert Peyerimhoff, Felix Pogorzelski), *Advances in Mathematics*, 307 (2017), 1070–1107.
27. General Cheeger inequalities for p -Laplacians on graphs (with Delio Mugnolo), *Nonlinear Anal.* 147 (2016), 80–95.
28. Note on uniformly transient graphs (with Daniel Lenz, Marcel Schmidt, Radoslaw K. Wojciechowski), *Revista Matemática Iberoamericana*, 33 (2017), no. 3, 831–860.
29. Note on short time behavior of semigroups associated to selfadjoint operators (with Daniel Lenz, Florentin Münch, Marcel Schmidt, Andras Telcs), *Bull. Lond. Math. Soc.* 48 (2016), no. 6, 935–944.

30. Geometry and spectrum of rapidly branching graphs, (with Florentin Münch, Felix Pogorzelski), *Math. Nachr.* 289 (2016), no. 13, 1636–1647.
31. A Feynman-Kac-Itô formula for magnetic Schrödinger operators on graphs (joint with Batu Güneysu, Marcel Schmidt), *Probability Theory and Related Fields* 165 (2016), no. 1-2, 365–399.
32. An overview of curvature bounds and spectral theory of planar tessellations, *Proceedings of the CIRM Meeting*, 3 nr. 1, Discrete Curvature; theory and applications (2013).
33. Eigenvalue asymptotics for Schrödinger operators on sparse graphs (with Michel Bonnefont, Sylvain Golénia), *Annales de l'Institut Fourier*, Volume 65 no. 5 (2015), 1969–1998.
34. Graphs of finite measure (with Agelos Georgakopoulos, Sebastian Haeseler, Daniel Lenz, Radosław Wojciechowski), *Journal Mathématiques Pures Appliquées*, Volume 103 (2015), no. 5, 1093–1131.
35. Intrinsic metrics on graphs: A survey, *Mathematical technology of networks*, 81–119, *Springer Proceedings in Mathematics and Statistics*, Volume 128, Springer, Cham, 2015.
36. Diffusion determines the recurrent graph (joint with Daniel Lenz, Marcel Schmidt, Melchior Wirth), *Advances in Mathematics*, Volume 269, (2015), 364–398.
37. An invitation to trees of finite cone type: random and deterministic operators, (joint with Daniel Lenz and Simone Warzel), *Markov Processes and Related Fields* 21 (2015), no. 3, part 1, 557–574.
38. Cheeger inequalities for unbounded graph Laplacians (joint with Frank Bauer, Radosław Wojciechowski), *Journal of the European Mathematical Society (JEMS)*, Volume 17 (2015), no. 2, 259–271.
39. Harmonic functions of general graph Laplacians (joint with Bobo Hua), *Calculus of Variations and Partial Differential Equations*, 51 (2014), no. 1–2, 343–362.
40. On the l^p spectrum of Laplacians on graphs (joint with Frank Bauer, Bobo Hua), *Advances in Mathematics*, Volume 248, Issue 25 (2013), 717–735.
41. Note on basic features of large time behaviour of heat kernels (mit Daniel Lenz, Hendrik Vogt, Radosław Wojciechowski), *Journal für die reine und angewandte Mathematik (Crelle's Journal)*, Volume 708 (2015), 73–95.
42. A note on self-adjoint extensions of the Laplacian on weighted graphs (joint with Xueping Huang, Jun Masamune, Radosław Wojciechowski), *Journal of Functional Analysis*, Volume 265, Issue 8 (2013), 1556–1578.

43. Volume growth and bounds for the essential spectrum for Dirichlet forms (joint with Sebastian Haeseler, Radosław Wojciechowski), *Journal of the London Mathematical Society*, Volume 88, Issue 3 (2013), 883–898.
44. Volume growth, spectrum and stochastic completeness of infinite graphs (joint with Daniel Lenz, Radosław Wojciechowski), *Mathematische Zeitschrift*, Volume 274, Issue 3 (2013), 905–932.
45. Spectral analysis of certain spherically homogeneous graphs (joint with Jonathan Breuer), *Operators and Matrices*, Volume 7, Number 4 (2013), 825–847.
46. Laplacians on infinite graphs: Dirichlet and Neumann boundary conditions (joint with Sebastian Haeseler, Daniel Lenz, Radosław Wojciechowski), *Journal of Spectral Theory*, Volume 2, Issue 4, (2012) 397–432.
47. Absolutely continuous spectrum for multi-type Galton Watson trees, *Annales Henri Poincaré*, Volume 13, Issue 8 (2012), 1745–1766.
48. Absolutely continuous spectrum for random operators on trees of finite cone type (joint with Daniel Lenz and Simone Warzel), *Journal d'Analyse Mathématique* Volume 118, Issue 1, 2012 363–396.
49. On the spectral theory of trees with finite cone type (joint with Daniel Lenz and Simone Warzel), *Israel Journal of Mathematics*, Volume 194, Issue 1, (2013), 107–135.
50. Dirichlet forms and stochastic completeness of graphs and subgraphs (joint with Daniel Lenz), *Journal für die reine und angewandte Mathematik (Crelle's Journal)*, Volume 2012, Issue 666, 189–223.
51. Curvature, geometry and spectral properties of planar graphs, *Discrete & Computational Geometry*, 46, Issue 3 (2011), 500–525.
52. Generalized solutions and spectrum for Dirichlet forms on graphs (joint with Sebastian Haeseler), *Random Walks, Boundaries and Spectra, Progress in Probability*, 2011 Birkhäuser, 181–201.
53. Cheeger constants, growth and spectrum of locally tessellating planar graphs (joint with Norbert Peyerimhoff), *Mathematische Zeitschrift*, 268, Issue 3–4 (2011), 871–886.
54. Unbounded Laplacians on Graphs: Basic Spectral Properties and the Heat Equation (joint with Daniel Lenz), *Mathematical modeling of natural phenomena: Spectral Problems*, 5, No. 4 (2010), 198–224.
55. The essential spectrum of the Laplacian on rapidly branching tessellations, *Mathematische Annalen*, 346, Issue 1 (2010), 51–66.

Vorveröffentlichungen

56. On Landis conjecture for positive Schrödinger operators on graphs (with Ujjal Das, Yehuda Pinchover), arXiv:2408.02149.
57. The space of Hardy-weights for quasilinear operators on discrete graphs (with Ujjal Das, Yehuda Pinchover), arXiv:2407.02116.
58. Recurrence and transience for non-Archimedean and directed graphs (with Anna Muranova), arXiv:2406.17344.
59. Capacity of infinite graphs over non-Archimedean ordered fields (with Florian Fischer, Anna Muranova, Noema Nicolussi) to appear in Journal of Mathematical Analysis and Applications, arXiv:2308.13264.
60. Gaussian upper bounds, volume doubling and Sobolev inequalities on graphs (with Christian Rose), arXiv:2406.19879.
61. Gaussian upper bounds for heat kernels on graphs with unbounded geometry (with Christian Rose), arXiv: 2206.04690.
62. Neumann semigroup, subgraph convergence, form uniqueness, stochastic completeness and the Feller property (with F Münch, RK Wojciechowski) to appear in Journal of Geometric Analysis, arXiv:2310.14927.
63. Gradient estimates, Bakry-Emery Ricci curvature and ellipticity for unbounded graph Laplacians (with Florentin Münch), to appear in Communications in Analysis and Geometry, arXiv:1807.10181.
64. Asymptotic expansion of the annealed Green's function and its derivatives (with Marius Lemm), to appear in Mathematical Research Letters, arXiv:2107.11583.
65. Agmon estimates for Schrödinger operators on graphs, (with Felix Pogorzelski), to appear in Journal d'Analyse Mathématique, arXiv:2104.04737.
66. Eigenvalue asymptotics and unique continuation of eigenfunctions on planar graphs, (with Michel Bonnefont, Sylvain Golénia), to appear in Annales de l'Institut Fourier, arXiv:2104.03582.
67. Gaussian upper bounds for heat kernels on graphs with unbounded geometry (with Christian Rose), arXiv:2206.04690.
68. Capacity of infinite graphs over non-Archimedean ordered fields with (Florian Fischer, Anna Muranova, Noema Nicolussi), arXiv:2308.13264.
69. Boundary representations of intermediate forms between a regular Dirichlet form and its active main part, (with Daniel Lenz, Marcel Schmidt, Michael Schwarz, Melchior Wirth), arXiv:2301.01035.

Gutachtertätigkeit für wissenschaftliche Organisationen

Alexander von Humboldt-Foundation
United States-Israel Binational Science Foundation (BSF)
German Academic Exchange Service (DAAD)
German Science Foundation (DFG)
German Israeli Foundation for Scientific Research and Development (GIF)

Gutachtertätigkeit für Zeitschriften und Buchreihen

Advances in Mathematics
AMS, University Lecture Notes series
Analysis and Geometry in Metric Spaces
Analysis, Mathematical Physics and Geometry
Annales Henri Poincaré
Archiv der Mathematik
Birkhäuser Operator Theory
Bulletin of the Australian Mathematical Society
Calculus of Variations and Partial Differential Equations
Cambridge University Press
Communications in Analysis and Geometry
Communications in Mathematical Physics
Complex Analysis and Operator Theory
Computers in Biology and Medicine
CRC Press, Mathematics, Physics, and Life Sciences
Discrete & Computational Geometry
Discrete Mathematics
Documenta Mathematica
European Journal of Combinatorics
Filomat
Hokkaido Mathematical Journal
International Journal of Mathematics
Israel Journal of Mathematics
Journal of Differential Equations
Journal for Analysis and Applications

Journal of Combinatorial Theory, Series A
Journal of Differential Equations
Journal of Differential Geometry
Journal of the European Mathematical Society
Journal of Fourier Analysis and Applications
Journal of Fractional Geometry
Journal of Functional Analysis
Journal of the London Mathematical Society
Journal of Mathematical Analysis and Applications
Journal of Mathematical Physics
Journal de Mathématiques Pures et Appliquées
Journal of Physics A
Journal of Spectral Theory
Journal of Statistical Physics
Letters in Mathematical Physics
Linear Algebra and Its Applications
Mathematical Physics, Analysis and Geometry
Mathematische Annalen
Modern Physics Letters B
New York Journal of Mathematics
Nonlinear Analysis: Theory, Methods & Applications
Nonlinearity
Operators and Matrices
Pacific Journal of Mathematics
Physica A
Potential Analysis
Revista Matemática Iberoamericana
Science China Mathematics
SIAM Journal on Discrete Mathematics
Springer Briefs
Springer Ergebnisse der Mathematik und ihrer Grenzgebiete
The Journal of Geometric Analysis
Transactions of the American Mathematical Society
Vietnam Journal of Mathematics

Organisation von wissenschaftlichen Treffen

Oberwolfach Mini-Workshop *Hardy Inequalities in Discrete and Continuum Settings*, (joint with Elvise Berchio, Yehuda Pinchover, Luz Roncal), March 2024.

Summer school in Potsdam *Spectral theory and geometry of ergodic Schrödinger operators* (joint with with Ram Band, Siegfried Beckus), Juli 2023.

ISEM 26, Internet seminar *Graphs and Discrete Dirichlet Spaces*, (joint with Daniel Lenz, Marcel Schmidt, Christian Seifert), 2022–2023.

Workshop on *Functional Analysis, Operator Theory and Dynamical Systems* in Potsdam (joint Siegfried Beckus, Felix Pogorzelski, Marcel Schmidt, Ram Band), September 2022

Oberwolfach Mini-Workshop *Variable Curvature Bounds, Analysis and Topology on Dirichlet Spaces*, (gemeinsam mit Gilles Carron, Batu Güneysu, Kazuhiro Kuwae), Dezember 2021.

Oberwolfach Workshop *Geometry, Dynamics and Spectrum of Operators on Discrete Spaces*, (gemeinsam mit David Damanik, Tatiana Nagnibeda, Felix Pogorzelski sowie Siegfried Beckus und Marcel Schmidt), Januar 2021.

Zwei-Tages-Workshop, *Dirichlet forms on graphs*, Friedrich Schiller University Jena, Oktober 2020.

Oberwolfach Mini-Workshop *Recent Progress in Path Integration on Graphs and Manifolds*, (gemeinsam mit Batu Güneysu, Kazumasu Kuwada, Anton Thalmeier), April 2019.

Zwei-Tages-Workshop, *Dirichlet forms on graphs*, Friedrich Schiller University Jena, Juni 2018.

Konferenz *Analysis and Geometry on Graphs and Manifolds*, Potsdam University 2017.

Workshop on Discrete Analysis, Fudan University Shanghai, August 2016.

Workshop on Spectral Geometry, Universität Potsdam, Januar 2016.

Ein-Tages-Workshop, *New directions in mathematical physics and beyond*, Friedrich-Schiller-Universität Jena, Januar 2014.

International Conference *Fractal Geometry and Stochastics V*, in Tabarz, lokales Organisationskommittee.

Workshop *Geometric aspects of probability and geometry*, Friedrich-Schiller-Universität Jena, September 2013.

Ein-Tages-Workshop *Schrödinger operators*, Friedrich-Schiller-Universität Jena, Dezember 2011.

Doktorandensymposium innerhalb der Sommerschule *Graphs and spectra*, Technische Universität Chemnitz, Juli 2011.

Doktorandensymposium innerhalb des *Walkshop 2010*, Friedrich-Schiller-Universität Jena, September 2010.

Einladungen zu kürzeren Forschungsaufenthalten

Die Dauer der Aufenthalte beträgt jeweils etwa 1 bis 2 Wochen.

Technion Haifa, Yehuda Pinchover, März/April 2024.

Graduate Center CUNY, New York City, Radoslaw Wojciechowski, Februar 2024.

University of Tübingen, Marius Lemm, Dezember 2022.

Graduate Center CUNY, New York City, Radoslaw Wojciechowski, Oktober 2022.

University of Insubria, Como, Alberto Setti, Juli 2022.

Graduate Center CUNY, Radoslaw Wojciechowski, Januar 2020.

Technion Haifa, Yehuda Pinchover, Forschungssemester März-Juli 2019.

Technion Haifa, Yehuda Pinchover, March/April 2018.

Technion Haifa, Yehuda Pinchover and Felix Pogorzelski, April 2017.

Remnin University Beijing, Yong Lin, August 2016.

Fudan University Shanghai, Bobo Hua, August 2016.

Graduate Center CUNY, New York City, Radoslaw Wojciechowski, Mai 2016.

Technion Haifa, Yehuda Pinchover, März 2016.

Tohoku University, Sendai, Japan, Jun Masamune, April 2015.

Université de Carthage, Bizerte Tunesia, Nabila Torki-Hamza, März 2014.

University of Toronto, Balint Virag, März 2013.

Harvard University, Arbeitsgruppe Shing-Tung Yau, März 2013.

University of Connecticut, Arbeitsgruppe Alexander Teplayev, Februar 2013.

Graduate Center CUNY, New York City, Jozef Dodziuk and Radoslaw Wojciechowski, Februar 2013.

Max-Planck-Institut Leipzig, Arbeitsgruppe Jürgen Jost, August 2012.

Technische Universität Chemnitz, Arbeitsgruppen Peter Stollmann und Ivan Veselic, Juli 2012.

Technische Universität Graz, Arbeitsgruppe Wolfgang Woess, Juli 2012.

Université Bordeaux 1, Sylvain Golénia, Mai 2012.

Max-Planck-Institut Leipzig, Arbeitsgruppe Jürgen Jost, Mai 2012.

Hebrew University Jerusalem, Jonathan Breuer und Dan Mangoubi, Dezember 2011.

Universität Bielefeld, Arbeitsgruppe Alexander Grigor'yan, November 2011.

Technische Universität München, Arbeitsgruppe Simone Warzel, Juli 2011.

Universität Bielefeld, Arbeitsgruppe Alexander Grigor'yan, Dezember 2010.

Humboldt Universität Berlin, Arbeitsgruppe Jochen Brüning, Dezember 2010.

University of Lisbon, Group of Mathematical Physics Jean-Claude Zambrini, November 2009.

Universität Bielefeld, Arbeitsgruppe Michael Baake, Dezember 2008.

Technische Universität Graz, Arbeitsgruppe Wolfgang Woess, November 2008.

Graduate Center New York City University, Arbeitsgruppe Jozef Dodziuk, Mai 2008.

Technische Universität München, Simone Warzel, Oktober 2008.

Durham University, Norbert Peyerimhoff, September 2007.

Einladungen zu wissenschaftlichen Treffen mit Vortrag

September 2024, Konferenz in Olsztyn, *10th Congressio-Mathematica, On Landis Conjecture on Graphs*.

Juni 2024, Conference at Institut Mittag-Leffler, *Quantum Dynamics and Spectral Theory, On Landis Conjecture on Graphs*.

Mai 2024, Workshop at BCAM Bilbao, *Fractional Calculus, Probability and Non-local Operators, Optimal Hardy inequality for the fractional Laplacian and beyond*.

Juli 2023, International Congress of Basic Science, Beijing, *From Hardy to Rellich inequalities on graphs*.

Februar 2023, Spring School at Braude College, Israel, *Geometric Methods for Data Analysis, Dirichlet forms on graphs, intrinsic metrics and the heat equation*.

November 2022, Konferenz am ESI Vienna, *Spectral Theory of Differential Operators in Quantum Theory, From Hardy to Rellich inequalities and Agmon estimates on graphs*.

Mai 2021, Konferenz *Probability and Analysis 2021, From Hardy to Rellich inequalities and Agmon estimates on graphs*.

Februar 2021, Online Workshop Hagen, *Variational methods on graphs and networks, From Hardy to Rellich inequalities and Agmon estimates on graphs*.

Oktober 2019, Oberwolfach Mini-Workshop *Self-adjoint Extensions in New Settings, Dirichlet forms and boundaries of graphs II*.

- September 2019, 6th Najman Conference on Spectral Theory and Differential Equations, Sveti Martin na Muri, *Optimal Hardy inequalities on graphs*.
- Juni 2019, Konferenz Technion Haifa, *Geometric aspects of harmonic analysis and spectral theory, Discrete spectrum for graphs*.
- Januar 2019, Mittag-Leffler-Institute, Stockholm, *Spectral Methods in Mathematical Physics, On optimal Hardy inequalities on graphs*.
- September 2018, Summer school *Generalized Curvatures GenCurv2018*, EPFL Lausanne, *Upper curvature bounds and spectral theory*.
- Januar 2018, Dodziuk Fest, CUNY, *On Cheeger inequality for graphs*.
- November 2017, ZiF Bielefeld, *Workshop – Discrete and continuous models in the theory of networks, Optimal Hardy inequalities on graphs*.
- Oktober 2017, Bordeaux *Journées du GDR AFHP, Optimal Hardy inequalities on graphs*.
- März 2017, TSIMF Sanya China *Curvatures of Graphs, Simplicial Complexes and Metric Spaces Workshop*, *Sectional curvature of polygonal complexes with planar substructures*.
- Februar 2017, Bielefeld University, *IRTG Workshop, Optimal Hardy inequalities on graphs*.
- August 2016, Fudan University Shanghai, *Discrete Analysis, On compactifications of graphs*.
- August 2016, Euler Institute St. Petersburg, *OTAMP 2016, Optimal Hardy inequalities on graphs*.
- Juli 2016, Universität Bielefeld, *Heat kernels and analysis on manifolds and fractals, On compactifications of graphs*.
- Januar 2016, CIRM Luminy, *Spectrum of Random Graphs, Does diffusion determine the geometry of a graph?*
- Juni 2015, BIRS Banff, *Groups, Graphs and Stochastic Processes, On the compactification of graphs ... the Royden compactification revisited*.
- Februar 2015, Oberwolfach Workshop *Discrete p -Laplacians: Spectral Theory and Variational Methods in Mathematics and Computer Science, On Cheeger's inequality for graphs*.
- Januar 2015, Oberwolfach Workshop *Spectral Theory and Weyl Functions, Cheeger inequalities for unbounded graph Laplacians*.
- Oktober 2014, Konferenz *Spectral Theory and Its Applications*, Bordeaux, *Intrinsic metrics on graphs*.
- September 2014, Konferenz *Mathematical Physics in Jena, Absolutely continuous spectrum of Galton-Watson trees*.

März 2014, Konferenz in Tabarz *Fractal Geometry and Stochastics V, Cheeger's inequality for unbounded graph Laplacians.*

März 2014, Cours pour Doctorants, Université de Carthage, Bizerte Tunisia, *L^p Spectrum of Graphs.*

März 2014, Journée-WorkShop *Géométrie et Analyse sur les Graphes*, Université de Carthage, Bizerte Tunisia, *Curvature and Spectrum on Tessellating Graphs.*

Dezember 2013, Conference on *Mathematical Technology of Networks - QGraphs 2013*, ZiF Bielefeld, *Intrinsic metrics on graphs.*

November 2013, *A colloquium on discrete curvature*, C.I.R.M. Luminy, *On the spectral theory of negatively curved planar graphs.*

September 2013, Fall school *Dirichlet forms, operator theory and mathematical physics* Chemnitz, Minikurs *Dirichlet forms on graphs.*

Juli 2013, LMS Symposium, *Graph Theory and Interactions*, Durham, *On negative curvature and spectrum of graph Laplacians.*

September 2012, *Workshop on Probability*, Kansai University Osaka, *Large time behavior of heat kernels.*

September 2012, Conference *Stochastic Analysis and Applications*, Okayama, *Essential spectra and volume growth of regular Dirichlet forms.*

August 2012, Conference *Spectral Theory and Differential Operators*, Graz, *Volume growth and spectra of Dirichlet forms.*

Januar 2012, Oberwolfach Mini-Workshop *Boundary Value Problems and Spectral Geometry, Curvature and spectrum on graphs.*

Oktober 2011, Oberwolfach Workshop *Correlations and Interactions for Random Quantum Systems, Absolutely continuous spectrum on trees.*

September 2011, BMS Summer School *Random motion and random graphs*, Berlin, *Absolutely continuous spectrum for multi-type Galton Watson trees.*

September 2010, Walkshop and PhD Symposium, Jena, *On the spectral theory of trees and tessellations.*

September 2010, Conference *QMath 11*, Hradec Kralove, *Absolutely continuous spectrum for substitution trees.*

Juli 2010, Workshop *Analysis on Graphs and its Applications*, Isaac Newton Institute for Mathematical Sciences Cambridge, *Absolutely continuous spectrum for trees of finite forward cone type.*

Juni 2010, Workshop *Random Schrödinger operators*, Lausanne CIB, *Stability of ac spectrum: Contraction properties of the recursion relation.*

Mai 2010, AIMS Conference *Dynamical Systems, Differential Equations and Applications*, Dresden, *Stability of ac spectrum under random perturbations on trees.*

September 2009, *Walkshop*, Chemnitz, *Dirichlet forms on discrete sets and absence of essential spectrum*.

Juli 2009, Workshop *Structure and Dynamics of Networks*, Blaubeuren, *Heat transport to the boundary on discrete graphs*.

Juli 2009, *Alp-Workshop*, St. Kathrein, *Random trees and absolutely continuous spectrum*.

Juni 2009, Workshop *Boundaries*, Graz, *Heat transport to the boundary*.

November 2008, Workshop *Structural Probability*, Erwin-Schrödinger-Institut Wien, *The Laplacian (plus potential) on trees and rapidly branching graphs*.

Einladungen zu Seminar- und Kolloquiumsvorträgen

April 2024, Technion Haifa, PDE Seminar *On Landis Conjecture on Graphs*.

May 2023, Technion Haifa, PDE Seminar *On Gaußian Heat Kernel Bounds on Graphs with Unbounded Geometry*.

April 2023, Hebrew University Jerusalem, Analysis Seminar, *On Gaußian Heat Kernel Bounds on Graphs with Unbounded Geometry*.

November 2021, Dortmund, Oberseminar Mathematische Physik, *Agmon Estimates on Graphs*.

Oktober 2021, Leipzig, *Graphs and discrete Dirichlet spaces - an introduction*.

Juni 2021, Regensburg, Oberseminar Global Analysis and Geometry, *Graphs and discrete Dirichlet spaces - an introduction*.

Juli 2019, Brauder College, *Improving Hardy's inequality*.

Juni 2019, Technion Haifa, Colloquium, *Stochastic completeness, uniqueness class and volume growth of graphs*.

Mai 2019, Hebrew University Jerusalem, PDE Seminar, *Path integral representations for magnetic Schrödinger operators on graphs*.

April, 2019, Technion Haifa, PDE and Applied Mathematics Seminar, *Path integral representations for magnetic Schrödinger operators on graphs*.

Dezember 2018, Universität Leipzig, Functional Analysis Seminar, *Stochastic completeness, uniqueness class and volume growth of graphs*.

Mai 2018, Universität Potsdam, GAMS Seminar, *Hardy inequalities on graphs*.

April 2018, Technion Haifa, PDE Seminar, *On Courant's nodal domain theorem for positivity preserving forms*.

Juli 2017, Universität Greifswald, Colloquium, *Curvature on graphs*.

April 2017, Technion Haifa, PDE Seminar, *Schrödinger operators on sparse graphs*.

März 2016, Technion Haifa, PDE Seminar, *Compactifications of graphs and the Dirichlet problem.*

November 2015, Universität Potsdam, Seminar Differentialgeometrie, *Intrinsische Metriken auf Graphen.*

Juni 2015, Universität Bonn, Probability Seminar, *Intrinsic metrics on graphs.*

Mai 2015, Tohoku University Sendai, Geometry and Analysis Seminar, *Intrinsic metrics on graphs.*

April 2015, FSU Jena, Habilitation Defense, *Über die Geometrie und Analysis auf Graphen.*

März 2015, Technion Haifa, PDE and Applied Mathematics Seminar, *Does diffusion determine the geometry of a graph?*

März 2015, Hebrew University Jerusalem, PDE Seminar, *Compactifications of uniformly transient graphs.*

Dezember 2014, Seminar Fernuniversität Hagen, *Schrödinger operators on sparse graphs.*

November 2014, Seminar Universität Bielefeld, *On the analysis and geometry on graphs.*

Mai 2014, Friedrich-Schiller-Universität Jena, PhD Seminar, *Intrinsic metrics on graphs.*

Mai 2014, Seminar Angewandte Analysis, Universität Ulm University, *Analysis and geometry on graphs.*

Mai 2013, Friedrich-Schiller-Universität Jena, PhD Seminar, *Negative curvature and spectrum of graphs.*

März 2013, University of Toronto, Special lecture, *Isoperimetric inequalities on graphs.*

März 2013, University of Toronto, Toronto Probability Geometry Seminar, *Absolutely continuous spectrum of Galton-Watson trees.*

März 2013, Harvard University, Differential Geometry Seminar, *Intrinsic metrics for Laplacians on graphs.*

Februar 2013, University of Connecticut, Analysis and Probability Seminar, *Graphs of unbounded geometry and intrinsic metrics.*

Februar 2013, Graduate Center CUNY, NY, Differential Geometry Seminar, *Spectral consequences of upper curvature bounds on planar graphs.*

Januar 2013, Technion Haifa, PDE and Applied Mathematics Seminar, *Isoperimetric inequalities and volume growth estimates for unbounded graph Laplacians.*

Dezember 2012, University of Haifa, Kolloquium, *Periodic and random Schrödinger operators on trees*.

November 2012, Hebrew University Jerusalem, PDE Seminar, *Cheeger inequalities and volume growth for unbounded graph Laplacians*.

August 2012, Max-Planck-Institut Leipzig, Special Seminar, *Geometric and spectral consequences of upper curvature bounds on planar graphs*.

Juli 2012, Technische Universität Chemnitz, Forschungsseminar Analysis, Stochastik und Mathematische Physik, *Anti-trees - the perfect (counter)example*.

Juli 2012, Friedrich-Alexander-Universität Erlangen, *Negative curvature and discrete spectrum for graphs*.

Juli 2012, Technische Universität Graz, Seminar Mathematische Strukturtheorie, *Stability of spectral types for Galton Watson trees*.

Mai 2012, Université Bordeaux 1, Séminaire Analyse, *On the spectral theory of operators on trees*.

Mai 2012, Max-Planck-Institut Leipzig, Special Seminar, *Negative curvature and spectrum of graph Laplacians*.

Dezember 2011, Hebrew University Jerusalem, PDE Seminar, *Absolutely continuous spectrum for Galton Watson trees*.

November 2011, Technische Universität Claustal, Oberseminar Analysis und Spektraltheorie, *Dirichlet forms on graphs*.

Mai 2011, Technion Haifa, PDE and Applied Mathematics Seminar, *On the long time behaviour of heat kernels*.

April 2011, Weizmann Institute Rehovot, Geometric Functional Analysis & Probability Seminar, *Absolutely continuous spectrum for trees*.

März 2011, Hebrew University Jerusalem, PDE Seminar, *Curvature and spectrum for graphs*.

Dezember 2010, Friedrich-Alexander-Universität Erlangen, *Absolutely continuous spectrum for trees*.

Dezember 2010, Universität Bielefeld, Oberseminar Geometric Analysis, *Curvature and spectrum for graphs*.

November 2010, Friedrich-Schiller-Universität Jena, Seminar Analysis, Geometrie und Stochastik, *Planar graphs of non-positive curvature*.

Juni 2010, Humboldt Universität Berlin, Seminar Geometrische Analysis und Spektraltheorie, *Cheeger constants, exponential growth and spectrum of planar graphs*.

Juni 2010, Technische Universität Chemnitz, Forschungsseminar Analysis, Stochastik und Mathematische Physik, *Cheeger constants, exponential growth and spectrum of planar graphs*.

Mai 2010, Friedrich-Schiller-Universität Jena, Seminar Analysis, Geometrie und Stochastik, *Discrete Spectrum for Schrödinger operators on graphs*.

Januar 2010, Friedrich-Schiller-Universität Jena, Seminar Analysis, *Cheegerkonstanten, exponentielles Wachstum und Spektrum von planaren Graphen*.

November 2009, University of Lisbon, Seminar of Mathematical Physics, *Cheeger constants, exponential growth and spectrum of planar graphs*.

Oktober 2009, Hebrew University Jerusalem, PDE Seminar, *Trees of finite vertex type and absolutely continuous spectrum*.

Dezember 2008, Universität Bielefeld, Seminar Mathematik in den Naturwissenschaften, *The Laplacian on rapidly branching graphs*.

November 2008, Technische Universität Graz, Seminar Mathematische Strukturtheorie, *The Laplacian on rapidly branching graphs*.

November 2008, Universität Wien, Seminar Analysis, *The Laplacian on rapidly branching graphs*.

Oktober 2008, Ludwig-Maximilian-Universität München, Seminar Analysis und Zufall, *The Laplacian on rapidly branching graphs*.

April 2008, Houston Rice University, Geometry-Analysis Seminar, *The Laplacian on rapidly branching graphs*.

Februar 2008, Graduate Center CUNY, NY, Differential Geometry Seminar, *The Laplacian on rapidly branching graphs*.

September 2007, Durham University, Geometry Seminar, *Spectral properties of rapidly branching graphs*.

Betreuung

Post Docs

Siegfried Beckus, seit 2018 (Haushaltsmittel, unbefristet seit 2020).

Christian Rose, seit 2021 (DFG).

Noema Nicolussi, 2020, 2022 (Marietta Blau und Erwin Schrödinger Stipendium).

Moritz Gerlach, 2015-2017 (Haushaltsmittel).

Promotion

Yannik Thomas, *Topic in Spectral Theory and Dynamical Systems*, Dissertation.

Matti Richter, *Topic on Asymptotic Formulas of the Heat Kernel*, Dissertation.

Philipp Bartmann, *On the Riesz Transform and Simplicial Complexes*, Dissertation.

Florian Fischer, *Topic on discrete Hardy inequalities*, Dissertation, 2023.

Florentin Münch, *Discrete Ricci curvature, diameter bounds and rigidity*, Dissertation, 2019 (Michelson Preis für beste Dissertation).

Michael Schwarz, *Nodal Domains and Boundary Representation for Dirichlet Forms*, Dissertation, 2020.

Master

Matti Richter, *Positive Generalised Eigenfunctions and the Heat Equation on Graphs with Nilpotent Group Actions*, Master 2023.

Florian Fischer, *Riesz Decompositions and Martin Compactification Theory for Schrödinger Operators on Graphs*, Master 2018 (Preis der DMV Studierendentagung).

Christian Scholz, *Boundary conditions and resolvent limits of graphs*, Master 2017.

Florentin Münch, *Li-Yau inequalities on graphs*, Master 2014 (Fakultätspreis der FSU, Hauptpreis der DMV Studierendentagung).

Bachelor

Robert Müller, *Topic on Gromov hyperbolicity*, Bachelor 2023.

Matthias Böhl, *On Upper Bounds for the First Eigenvalue on Surfaces and Planar Graphs*, Bachelor 2022.

Marius Nietschman, *Hardy Inequality for Fractional Laplacians on the Integers*, Bachelor 2022 (BMG Prize).

Wiebke Hanl, *Graphs, Markov Processes and Markov Semigroups*, Bachelor 2021.

Jonas Grünberg, *Mean field equations on canonically compactifiable graphs*, Bachelor 2020.

Matti Richter, *Harmonic functions on graphs with a group action*, Bachelor 2020 (BMG Preis, Leopold-von-Buch-Preis).

Sarah Burchert, *The Puisseux expansion*, Bachelor 2017 (BMG Preis).

Katja Ohde, *Geometry of rapidly growing graphs*, Bachelor 2016.

Melchior Wirth, *Does diffusion determine the graph structure?*, Bachelor 2013, (Hauptpreis der DMV Studierendentagung).

Oliver Siebert, *Spectra of lamplighter random walks associated with percolation*, Bachelor 2013.

Florentin Münch, *Ultra metric Cantor sets and boundaries of trees*, Bachelor 2012.

Lehre

WS 2024/25 Vorlesung *Functional Analysis*.
WS 2024/25 Vorlesung *C*-Algebras*.
WS 2024/25 Seminar *Complex Proofs for Real Theorems*
SS 2024 Vorlesung *Analysis IV*.
SS 2024 Seminar *Spectral Graph Theory*.
WS 2023/24 Vorlesung *Analysis III*.
WS 2023/24 Vorlesung *Analysis on Graphs*.
WS 2022/23 Vorlesung *Partial Differential Equations I*.
WS 2022/23 Vorlesung *Analysis on Graphs II*.
SS 2022 Vorlesung *Simplicial Complexes*.
WS 2021/22 Vorlesung *Analysis on Graphs*.
WS 2021/22 Seminar *Dirichlet forms on discrete spaces*.
SS 2021 Vorlesung *Functional Analysis II*.
SS 2021 Seminar *Hardy inequalities*.
WS 2020/21 Vorlesung *Funktionalanalysis*.
WS 2020/21 Seminar *Analysis on Graphs*.
SS 2020 Vorlesung *C*-Algebren*.
SS 2020 Vorlesung *Analysis IV für Mathematik*.
WS 2019/20 Vorlesung *Analysis III für Mathematik*.
WS 2019/20 Vorlesung *Mathematik für Wirtschaftsinformatik*.
WS 2019/20 Seminar *From functional inequalities to heat kernels*.
WS 2015/16 Vorlesung *Analysis auf Graphen*.
WS 2018/19 Vorlesung *Mathematik für Informatik I*.
WS 2017/18 Vorlesung *Analysis III für Mathematik*.
WS 2017/18 Vorlesung *Mathematik für Informatik I*.
WS 2017/18 Seminar *Choquet-Theorie*.
SS 2016 Vorlesung *Analysis II für Mathematik*.
SS 2016 Seminar *Heat kernels on graphs*.
WS 2016/17 Vorlesung *Analysis I für Mathematik*.

WS 2016/17 Vorlesung *C^* -Algebren*.

SS 2016 Vorlesung *Simpliziale Komplexe*.

WS 2015/16 Vorlesung *Analysis auf Graphen*.

WS 2015/16 Vorlesung *Mathematik für Wirtschaftsinformatik*.

SS 2015 Vorlesung *Analysis I für Physik*.

WS 2014/15 Vorlesung *Analysis II für Mathematik und Physik*.

SS 2014 Übung *Analysis II für Mathematik und Physik*.

WS 2013/14 Vorlesung *Anwendung von Operatortheorie*.

WS 2013/14 Übung *Analysis I für Mathematik*.

SS 2012 Vorlesung *Anwendung von Operatortheorie*.

WS 2011/12 Übung *Analysis III für Mathematik und für Physik*.

WS 2010/11 Übung *Analysis I für Mathematik*.

WS 2009/10 Übung *Analysis III für Physik*.

SS 2009 Übung *Analysis II für Physik*, Seminar *Zufällige Schrödinger Operatoren*.

Akademische Selbstverwaltung

Geschäftsführende Leitung Institut für Mathematik (2020-2022, stellvertretend 2018-2020).

Stellvertretender Prüfungsausschuss (seit 2015).