

Curriculum Vitae

1 Personal Data

- Name: Dr. Batu Güneysu
- Institute: Humboldt-University Berlin, Germany
- Born: 07.07.1982 in Aschaffenburg, Germany
- Nationality: Turkish (with an unlimited residence and work permit for the EU)
- Marital status: married, one child
- Address: Rudower Chaussee 25, 12489 Berlin
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2 Academic carrer

- 2001 - 2003: University of Applied Sciences Aschaffenburg, Germany. Studies of electrical engineering. Prediploma 2002.
- 2003 - 2007: University of Frankfurt, Germany. Studies of mathematics and theoretical physics.
 - 2004: Prediploma.
 - 2007: Diploma. Degree: With honours. Advisor of diploma thesis: Prof. Dr. Joachim Weidmann.
- 2007 - 2008: Research position in the group of Prof. Dr. Joachim Weidmann at the institute of mathematics of the University of Frankfurt. Organization of exercises and seminars, advisoral activities for diploma theses.
- 2008 - 2011: PhD student (mathematics) and Hausdorff scholar at the University of Bonn. PhD in 2011. Degree: Summa cum laude. Scientific committee of my PhD thesis: Prof. Dr. Sergio Albeverio, Prof. Dr. Andreas Eberle, Prof. Dr. Albrecht Klemm, Prof. Dr. Matthias Lesch. Advisoral activities for several diploma theses.
- 2011 - now: Research position at the Humboldt-University Berlin. Habilitation in October 2017. Scientific committee of my habilitation thesis: Prof. Dr. Wolfgang Arendt, Prof. Dr. Jochen Brüning, Prof. Dr. Gilles Carron.

3 Research

My field of research lies in the intersection of geometry, analysis, probability theory and theoretical physics. More specifically, I have written about 40 papers and one book on the following topics:

- stochastic analysis,
- Schrödinger operators (spectral theory, scattering theory and semiclassical analysis),
- elliptic and parabolic partial differential equations,
- models of nonrelativistic quantum electrodynamics,
- infinite dimensional analysis and infinite dimensional geometry,
- potential theory,
- stability of quantum matter,
- analysis on infinite graphs.

My list of co-authors: Francesco Bei, Jochen Brüning, Davide Guidetti, Matthias Keller, Matthias Ludewig, Oliver Matte, Ognjen Milatovic, Jacob Schach-Moeller, Diego Pallara, Markus Pflaum, Stefano Pigola, Olaf Post, Marcel Schmidt, Anton Thalmaier, Françoise Truc.

Scientific work

- [1] **Diploma thesis:** *Ein Kriterium für die Absolutstetigkeit des Spektrums von Sturm-Liouville-Operatoren* (60 pages). University of Frankfurt.
- [2] *The representation of strongly continuous operator semigroups on vector bundles as Hida distributions*. Infinite Dimensional Analysis and Quantum Probability 12 (2009), no. 3, 511–519.
- [3] *The Feynman-Kac formula for Schrödinger operators on vector bundles over complete manifolds*. Journal of Geometry and Physics 60 (2010), 1997–2010.
- [4] **PhD thesis:** *On the Feynman-Kac formula for Schrödinger semigroups on vector bundles* (128 Seiten). University of Bonn.
- [5] *Multiplicative matrix-valued functionals and continuity properties of semigroups corresponding to differential operators with matrix coefficients*. Journal of Mathematical Analysis and Applications 380 (2011), 709–725.
- [6] *On generalized Schrödinger semigroups*. Journal of Functional Analysis 262 (2012), 4639–4674.

- [7] *Nonrelativistic Hydrogen type stability problems on nonparabolic 3-manifolds*. Annales Henri Poincare 13 (2012), 1557–1573.
- [8] *Path integrals and the essential self-adjointness of differential operators on noncompact manifolds* (with Olaf Post). Mathematische Zeitschrift 275 (2013), 331–348.
- [9] *Kato’s inequality and form boundedness of Kato potentials on arbitrary Riemannian manifolds*. Proceedings of the American Mathematical Society 142 (2014), 1289–1300.
- [10] *Generalized Schrödinger semigroups on infinite graphs* (with Ognjen Milatovic und Françoise Truc). Potential Analysis, Volume 41, Issue 2 (2014), 517–541.
- [11] *Recent probabilistic results on covariant Schrödinger operators on infinite weighted graphs* (with Ognjen Milatovic). Begutachteter Artikel im Konferenzbericht der Konferenz QMATH 12 (2014).
- [12] *Stochastic calculus and nonrelativistic quantum electrodynamics* (with Oliver Matte und Jacob Schach-Møller). Begutachteter Artikel im Konferenzbericht der Konferenz QMATH 12 (2014).
- [13] *A Feynman-Kac-Itô Formula for magnetic Schrödinger operators on graphs* (with Matthias Keller und Marcel Schmidt). Probab. Theory Related Fields 165 (2016), no. 1-2, 365–399.
- [14] *Semiclassical limits of quantum partition functions on infinite graphs*. Journal of Mathematical Physics 56 (2015), no. 2., 13 pp.
- [15] *Functions with bounded variation on a class of Riemannian manifolds with Ricci curvature unbounded from below* (with Diego Pallara). Mathematische Annalen 363 (2015), no. 3-4, 1307–1331.
- [16] *On Some Generalisations of Meyers-Serrin Theorem* (with Davide Guidetti und Diego Pallara). Bruno Pini Mathematical Analysis Seminar (2015). doi: 10.6092/issn.2240-2829/5894.
- [17] *Scattering theory of the Hodge Laplacian under a conformal perturbation* (with Francesco Bei und Jörn Müller). Erscheint in Journal of Spectral Theory (2015 verfasst).
- [18] *The Calderón-Zygmund inequality and Sobolev spaces on noncompact Riemannian manifolds* (with Stefano Pigola). Advances in Mathematics 281 (2015), 353–393.
- [19] **Habilitation thesis:** *Covariant Schrödinger semigroups on noncompact Riemannian manifolds*. (206 Seiten). Humboldt University Berlin, 2017.
- [20] **Book:** *Covariant Schrödinger semigroups on noncompact Riemannian manifolds*. (237 pages). To appear as a textbook in the series *Operator Theory*:

Advances and Applications, Birkhäuser. (Corresponding editor: Prof. Dr. Christiane Trotter).

- [21] *The BMS conjecture*. Ulmer Seminare 2016 (Edited by: Prof. Dr. Wolfgang Arendt).
- [22] *Sequences of Riemannian second order cut-off functions*. Journal of Geometric Analysis 26 (2016), no. 1, 171–184.
- [23] *Stochastic differential equations for models of nonrelativistic matter interacting with quantized radiation fields* (with Oliver Matte und Jacob Schach-Møller). Probability Theory and Related Fields (2016), 100 pp, doi:10.1007/s00440-016-0694-4.
- [24] *q -parabolicity of stratified pseudomanifolds and other singular spaces* (with Francesco Bei). Annals of Global Analysis and Geometry (2016), 22 pp. doi:10.1007/s10455-016-9534-0
- [25] *Heat kernels in the context of Kato potentials on arbitrary manifolds*. Potential Analysis 46 (2017), no. 1, 119–134.
- [26] *L^1 -elliptic regularity and $H = W$ on the whole L^p -scale on arbitrary manifolds* (with Davide Guidetti und Diego Pallara). Annales Academiae Scientiarum Fennicae, Mathematica (2017) Volumen 42, 497–521.
- [27] *The profinite dimensional manifold structure of formal solution spaces of partial differential equations* (with Markus Pflaum). SIGMA Symmetry Integrability Geom. Methods Appl. 13 (2017), Paper No. 003, 44 pp.
- [28] *Quantitative C^1 -estimates on manifolds* (with Stefano Pigola). International Mathematical Research Notices (2017). <https://doi.org/10.1093/imrn/rnx016>.
- [29] *On the semimartingale property of Brownian bridges on complete manifolds*. **Preprint** available on my homepage.
- [30] *Heat kernel estimates and the relative compactness of perturbations by potentials* (with Jochen Brüning). **Preprint** available on my homepage.
- [31] *On the geometry of semiclassical limits on Dirichlet spaces*. **Preprint** available on my homepage.
- [32] *Nonlinear Calderón-Zygmund inequalities* (with Stefano Pigola). **Preprint** available on my homepage.
- [33] *Kac-regular sets in geometry, probability and quantum mechanics* (with Francesco Bei). **Preprint** available on my homepage.
- [34] *L^p gradient estimates on manifolds and regularity theory for the Poisson equation and magnetic Schrödinger semigroups* (with Stefano Pigola). **Preprint** available on my homepage.

- [35] *Geometric Analysis on Singular Spaces* (with Francesco Bei, Jochen Brüning, Matthias Ludewig). To appear as a chapter in the book *Space - Time - Matter*, De Gruyter, 2017.
- [36] *Feynman path integrals for magnetic Schrödinger operators on infinite weighted graphs* (with Matthias Keller). **Preprint** available on my homepage.
- [37] *Scattering theory without injectivity radius assumptions and spectral stability for the Ricci flow* (with Anton Thalmaier). **Preprint** available on my homepage.

4 Teaching

- Exercises to the course *Linear operators in Hilbert spaces*, University of Frankfurt, 2007.
- Exercises to the course *Mathematics for Physicists II*, University of Frankfurt, 2007.
- Seminar on *Mathematical Scattering Theory*, University of Frankfurt, 2007 / 2008.
- Lecture course *Several complex variables* (Substitute for Prof. Dr. Ingo Lieb), University of Bonn, November 2009.
- Exercises to the course *Group Theory*, Humboldt-Universität zu Berlin, 2012 / 2013.
- Lecture course *Topology*, Humboldt-Universität zu Berlin, 2016.
- Seminar on *Partial Differential Equations*, Humboldt-Universität zu Berlin, 2016.
- Seminar on *Wave Equations*, Humboldt-Universität zu Berlin, 2017 / 2018.
- I have been the co-advisor of the following theses:
 - Christoph Herold: *Schrödingeroperatoren auf Quantengraphen*. Diploma thesis, University of Frankfurt 2008.
 - Amru Hussein: *Streutheorie von Dirac-Operatoren*. Diploma thesis, University of Bonn, 2008.
 - Jan-Louis Mönning: *Die Wärmeleitungsgleichung*. Bachelor thesis, Humboldt-Universität zu Berlin, 2016.
 - Currently, I am the co-advisor of Robert Baumgarth's thesis on a topic on stochastic differential geometry (together with Prof. Dr. Anton Thalmaier, University of Luxembourg).
 - Currently, I am the co-advisor of the following Bachelor theses:

- * Tom Legel (*Die Wellengleichung*),
- * Florens Greßner (*Mathematische Methoden im Machine - Learning*),
- * Aaron Beumer (*Topologische Dimensionstheorie und das Serre-Swan-Theorem für nichtkompakte Mannigfaltigkeiten*).

5 Scholarships and further remarks

- 2008 - 2011: Hausdorff Scholarship of the Bonn International Graduate school (1486 Euro/month).
- Membership of the German collective research project SFB 647: space - time - matter (2011-2016).
- 2012 (May): Oberwolfach Leibniz Graduate Student for *Analysis and Geometric Singularities*.
- 2013 (September): Invited participant of the first *Heidelberg Laureate Forum: Abel, Fields and Turing Laureates meet the next Generation* (Klaus Tschira Stiftung).
- 2013 - now: Referee for the following journals:
 - Mathematische Nachrichten,
 - Rocky Mountain Journal of Mathematics,
 - Journal of Differential Equations,
 - Journal of Geometric Analysis,
 - Journal of Mathematical Analysis and Applications,
 - Integral Equations and Operator Theory,
 - Journal of Functional Analysis.
- 2015 (October): Invitation as a representative of the Humboldt-University Berlin to *Panorama of Mathematics*, Bonn.

6 Selected invited talks

- October 2007: University of Colorado at Boulder (Seminar on geometry and topology).
- May 2008: Rheinische Friedrich-Wilhelms-Universität Bonn (Hausdorff Trimester Programm *Geometry and Physics*).
- November 2008: University of Colorado at Boulder (Seminar on geometry).
- May 2009: Ernst-Moritz-Arndt-Universität Greifswald (Colloquium).

- November 2009: Université du Luxembourg (seminar on stochastics).
- May 2010: Rheinische Friedrich-Wilhelms-Universität Bonn (seminar on global analysis).
- June 2010: Humboldt-Universität zu Berlin (seminar on global analysis).
- February 2011: Universität Potsdam (seminar on geometry).
- September 2011: Technische Universität Clausthal (seminar on probability theory).
- October 2011: Universität Regensburg (Seminar of the German collective research project 1692 *Curvature, Cycles, and Cohomology*).
- January 2012: Freie Universität Berlin (Colloquium of the German collective research project SFB 647: Space - time - matter).
- January 2012: University of Colorado at Boulder (seminar on geometry).
- March 2012: Friedrich-Schiller-Universität Jena (Colloquium).
- July 2012: Max-Planck-Institut für Gravitationsphysik in Golm (seminar on geometry).
- August 2012: Invited speaker of the international Congresses of mathematical Physics XVII in Aalborg.
- September 2012: Invited speaker of the Konferenz *Asymptotic Analysis and Spectral Theory on Non-Compact Structures* in Mainz.
- March 2013: Universität Aarhus (seminar on mathematical physics).
- September 2013: Invited speaker of *QMATH 12* in Berlin.
- September 2013: Université Paris-Sud (seminar on Dirac operators).
- January 2014: University of Jena (seminar on analysis, geometry and stochastics).
- May 2014: Invited speaker of the conference *Geometric Structures and Spectral Invariants* (with a day dedicated to the work of Matthias Lesch) in Berlin.
- October 2014: Invited speaker of the conference *Spectral Theory and Its Applications* in Bordeaux.
- February 2015: Università dell'Insubria, Como (seminar on geometry).
- February 2016: Université du Luxembourg (seminar on probability theory).
- December 2016: University of Potsdam (seminar on geometry).

- December 2016: Università dell’Insubria, Como (seminar on geometry).
- January 2017: Invited speaker of *A Geometry Day in Como* in Como.
- February 2017: Invited speaker of the conference *Geometric and Singular Analysis* in Potsdam.
- July 2017: Invitation to the conference *GeoProb 2017* at the Université du Luxembourg (cancellation because of the defense of Habilitation thesis).
- July 2017: Invitation to the conference *Loop spaces, supersymmetry and index theory* am Chern Institute (cancellation due to health issues).
- August 2017: Invited speaker of the conference *Analysis and geometry on graphs and manifolds* (University of Potsdam).

7 Selected research trips

- October 2007: University of Colorado at Boulder (invitation by Prof. Dr. Markus Pflaum).
- November 2008 / December 2008: University of Colorado at Boulder (invitation by Prof. Dr. Matthias Lesch).
- May 2009: Ernst-Moritz-Arndt-Universität Greifswald (invitation by Prof. Dr. Hans-Christian Herbig).
- November 2009: Université du Luxembourg (invitation by Prof. Dr. Anton Thalmaier).
- September 2011: Technische Universität Clausthal (invitation by Prof. Dr. Michael Demuth).
- January 2012 / Februar 2012: University von Colorado at Boulder (invitation by Prof. Dr. Markus Pflaum).
- March 2012: Friedrich-Schiller-Universität Jena (invitation by Prof. Dr. Matthias Keller).
- March 2013: Universität Aarhus (invitation by Prof. Dr. Jacob Schach Møller).
- September 2013: Université Paris-Sud (invitation by Prof. Dr. Jean-Michel Bismut).
- January 2014: Friedrich-Schiller-Universität Jena (invitation by Prof. Dr. Daniel Lenz).
- February 2015: Università dell’Insubria, Como (invitation by Prof. Dr. Stefano Pigola).
- February 2016: Université du Luxembourg (invitation by Prof. Dr. Anton Thalmaier).