

Annegret Burtscher

Curriculum Vitæ

Department of Mathematics
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Research interests

geometric analysis, partial differential equations, mathematical general relativity

Education

- 2014 **PhD (Mathematics)**, *Université Pierre et Marie Curie (Paris 6) & University of Vienna*, France and Austria, *graduated with highest honors (sub auspiciis)*.
PhD thesis "Analytic and geometric aspects of spacetimes of low regularity"
advised by Philippe G. LeFloch and James D.E. Grant (via a Cotutelle agreement, Dec 2010)
- 2010 **Bachelor (Earth Sciences)**, *University of Vienna*, Austria, *with highest honors*.
- 2009 **Master (Mathematics)**, *University of Vienna*, Austria, *with highest honors*.

Employment

- 2018– **Assistant Professor** (tenure-track), *Department of Mathematics*, Radboud University, Nijmegen, The Netherlands.
- 2017–18 **Hill Assistant Professor**, *Department of Mathematics*, Rutgers University, New Jersey, United States of America.
- 2015–17 **Postdoctoral researcher**, *Mathematical Institute and Hausdorff Center for Mathematics*, University of Bonn, Germany.
- Mar–Jul 2014 **Riemann fellow**, *Riemann Center for Geometry and Physics*, Leibniz University Hannover, Germany.
- 2009–14 **Research assistant**, *Faculty of Mathematics*, University of Vienna, Austria.
- 2011–13 **Research assistant**, *Laboratoire Jacques-Louis Lions*, Université Pierre et Marie Curie (Paris 6), France.
- 2006–11 **Teaching assistant**, *Faculty of Mathematics*, University of Vienna, Austria.
- Jul–Sep 2008 **Intern**, *Seminar for Applied Mathematics*, ETH Zurich, Switzerland.

Maternity leave

- 2012, 2014–15 I have two children. In 2012 I was on *maternity leave* for 9 months (of which I worked 3 months parttime), in 2014–15 for 8 months. The mandatory leave was 4 months each.

Grants and awards

Research fellowships

- 2014–16 **Excellence fellowship**, *Federal Ministry of Science, Research and Economy*, Austria.
awarded to sub auspiciis candidates, support for national and international mobility for 2 years (€9.000)

- Mar–Jul 2014 **Riemann fellowship**, *Riemann Center for Geometry and Physics, Leibniz Universität Hannover, Germany.*
postdoctoral fellowship for a research stay at the Institute of Differential Geometry (€8.000)
- Oct 2012 – Jun 2013 **"For Women in Science" fellowship for the project "A synthetic approach to spacetimes of low regularity"**, *L'Oréal, UNESCO, Austrian Academy of Sciences, Federal Ministry of Science and Research, Austria.*
awarded to four outstanding, young, female scientists in basic research working in Austria (acceptance rate: 7%, €20.000)
- Sep 2011 – Jul 2012 **Eiffel excellence scholarship for the project "Spacetimes of low regularity"**, *Ministry of Foreign and European Affairs, France.*
awarded to outstanding international PhD students (acceptance rate: 31%, €15.035)
- Jan–Dec 2010 **PhD fellowship for the project "Analysis of singular geometrical structures" (FS 506)**, *University of Vienna, Austria.*
awarded to excellent PhD students at the University of Vienna (acceptance rate: 28%, €13.000)

Awards

- Nov 2014 **Thesis award**, *Austrian Mathematical Society, Austria.*
for my PhD thesis "Analytic and geometric aspects of spacetimes of low regularity" (€500)
- Nov 2014 **Award of appreciation**, *Federal Ministry of Science, Research and Economy, Austria.*
award of appreciation for outstanding performance during university studies (€2.500)
- Mar 2014 **Promotio sub auspiciis (præsidentis rei publicæ)**, *President of Austria, Austria.*
highest possible honor for achievements during school and university studies in Austria (approximately 0.8% of all graduates receive a PhD sub auspiciis)
- Feb 2005, 2006 and 2007 **Merit scholarships**, *University of Vienna, Austria.*
for excellence in undergraduate studies, awarded three times in Mathematics (€727 each)

Grants for conference organization

- 2019 **Conference Grant**, *NWO NDNS+ Cluster, Netherlands.*
financial support for the organization of the international conference "NonLinear Analysis Days", together with Stefanie Sonner (€1.000)
- 2019 **Radboud Internationalisation Grant**, *Radboud University, Nijmegen, Netherlands.*
financial support for the organization of the international conference "NonLinear Analysis Days", together with Stefanie Sonner (€2.500)

Selected other financial support and travel grants

- 2018 **AIP (Academic Initiatives Program) travel fund**, *Rutgers University, United States.*
for conference participation (\$ 2.154)
- Jul–Aug 2017 **ESI Junior Research Fellowship**, *Erwin Schrödinger International Institute for Mathematics and Physics, Austria.*
support for recent postdocs to work on their own project, connected to an ESI thematic program (€2.620)
- Sep–Dec 2015 **Institut Henri Poincaré**, France.
financial support to attend the trimester program on Mathematical General Relativity (€800)
- Sep 2013 **Klaus Tschira Foundation**, Germany.
selected among several hundred applicants to attend the 1st Heidelberg Laureate Forum (Abel, Fields and Turing laureates meet the next generation)
- Jun–Aug 2013 **Fondation Sciences Mathématiques de Paris**, France.
reimbursement for an extended research stay in Paris (€2.700)

Publications

Preprints

- [1] Initial data and black holes for matter models, [arxiv:1901.08346](https://arxiv.org/abs/1901.08346) (2019), 8 p.
- [2] with M.K-H. Kiessling and A.S. Tahvildar-Zadeh, Weak second Bianchi identity for spacetimes with timelike singularities, [arxiv:1901.00813](https://arxiv.org/abs/1901.00813) (2019), 20 p.

Peer-reviewed articles

- [3] with L. Andersson, On the asymptotic behavior of static perfect fluids, *Ann. Henri Poincaré* **20** (2019), no. 3, 813–857.
- [4] with R. Donniger, Hyperboloidal evolution and global dynamics for the focusing cubic wave equation, *Comm. Math. Phys.* **353** (2017), no. 2, 549–596.
- [5] Length structures on manifolds with continuous Riemannian metrics, *New York J. Math.* **21** (2015), 273–296.
- [6] with P.G. LeFloch, The formation of trapped surfaces in spherically-symmetric Einstein–Euler spacetimes with bounded variation, *J. Math. Pures Appl.* **102** (2014), 1164–1217.
- [7] with J.D.E. Grant and P.G. LeFloch, New energy inequalities for tensorial wave equations on spacetimes that satisfy a one-sided bound, *Comm. Partial Differential Equations* **37** (2012), 1596–1619.
- [8] with M. Frehner and B. Grasemann, Tectonic geomorphological investigations of antiforms using differential geometry: Permian Anticline, northern Iraq, *AAPG Bulletin* **96** (2012), 301–314.
- [9] with M. Kunzinger, Algebras of generalized functions with smooth parameter dependence, *Proc. Edinburgh Math. Soc.* **55** (2012), 105–124.
- [10] An algebraic approach to manifold-valued generalized functions, *Monatsh. Math.* **166** (2012), 361–370.

Theses

- [11] *Analytic and geometric aspects of spacetimes of low regularity*, PhD thesis in Mathematics, Université Pierre et Marie Curie (Paris 6) and University of Vienna, 2014.
- [12] *Curvature analysis of anticlines in the Zagros mountains (Iraq)*, Bachelor’s thesis in Earth Sciences, University of Vienna, 2010.
- [13] *Isomorphisms of algebras of smooth and generalized functions*, Master’s thesis in Mathematics, University of Vienna, 2009.

Other

- [14] with P. Meury and E. Fonn, *LehrFEM – a 2D finite element toolbox*, Manual for FEM MATLAB code, ETH Zurich, 2008.

Selected talks

- Apr 2019 [upcoming] *Timelike singularities and energy conservation in general relativity*
Applied Analysis Seminar, Mathematical Institute, University of Cologne, Germany
- Oct 2018 *Perfect fluids in general relativity*
Workshop (Geometric Analysis Days), School of Mathematical Sciences, Queen Mary University of London, United Kingdom
- Oct 2018 *Singularitäten in Raumzeiten* (Singularities in spacetimes)
University of Konstanz, Germany

- Oct 2018 *Spacetimes with matter and low regularity*
Quantum Gravity Seminar, Radboud University, Nijmegen, Netherlands
- Jun 2018 *On the formation of singularities in Einstein–Euler spacetimes*
HYP2018 (17th International Conference on Hyperbolic Problems), University Park, Pennsylvania, United States
- Apr 2018 *Static perfect fluids in general relativity*
Special Session (Mathematical Problems of Relativistic Physics) at the AMS Spring Eastern Sectional Meeting, Northeastern University, Boston, Massachusetts, United States
- Mar 2018 *A generalized notion of ADM mass for static perfect fluids*
Workshop (Mass in General Relativity), Simons Center for Geometry and Physics, Stony Brook University, New York, United States
- Feb 2018 *The geometry of spacetimes*
Junior Geometry Seminar, Department of Mathematics, Rutgers University, New Jersey, United States
- Nov 2017 *A mathematical approach to black hole formation*
Mathematical Physics Seminar, Department of Mathematics, Purdue University, Indiana, United States
- Oct 2017 *Singularities in spacetime*
Postdoc Colloquium, Department of Mathematics, Rutgers University, New Jersey, United States
- Aug 2017 *On the asymptotic behavior of static perfect fluids*
Erwin Schrödinger Institute, Vienna, Austria
- Mar 2017 *On the formation of singularities in general relativity*
University of Bristol, United Kingdom
- Jan 2017 *Spacetimes near the boundary of existence*
University of Vienna, Austria
- Jan 2017 *Spacetimes near the boundary of existence*
Radboud University, Nijmegen, Netherlands
- Dec 2016 *Hyperboloidal evolution for nonlinear wave equations*
Workshop (Young Women in Harmonic Analysis and PDE), Hausdorff Center for Mathematics, Bonn, Germany
- Nov 2016 *Perfect fluids in general relativity*
University of Hamburg, Germany
- Aug 2016 *The global behavior of spacetimes*
Dublin City University, Ireland
- Jan 2016 *Langzeitverhalten von nichtlinearen Wellen (Longtime behavior of nonlinear waves)*
University of Würzburg, Germany
- Sep 2015 *Weak metrics in general relativity and beyond*
University of Tübingen, Germany
- Jun 2015 *On the formation of trapped surfaces in Einstein–Euler spacetimes*
Workshop (Longtime Behaviour of Nonlinear Waves), Bielefeld University, Germany
- May 2015 *Geodesic incompleteness in general relativity*
Analysis seminar, Mathematical Institute, University of Bonn, Germany

- Mar 2015 *On the formation of trapped surfaces in Einstein-Euler spacetimes*
Gravitational physics seminar, Faculty of Physics, University of Vienna, Austria
- Jul 2014 *General relativity and semi-Riemannian geometry of low regularity*
5th Northern German Differential Geometry Day, Leibniz Universität Hannover
- Jun 2014 *Evolution problems in general relativity*
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
- Jun 2014 *Riemannian metrics of low regularity*
Goethe-Universität Frankfurt am Main, Germany
- May 2014 *Geometric bounds for vacuum spacetimes*
Differential geometry seminar, Leibniz Universität Hannover, Germany
- May 2014 *Riemannian manifolds meet metric (measure) spaces*
University of Warwick, Coventry, United Kingdom
- Feb 2014 *Self-gravitating collapse of compressible matter under spherical symmetry*
CERS 4 (4th Central European Relativity Seminar), Erwin Schrödinger International Institute for Mathematical Physics, Vienna, Austria
- Jan 2014 *Analytic and geometric aspects of spacetimes of low regularity*
PhD thesis defense, Faculty of Mathematics, University of Vienna, Austria, and via videoconference at the Laboratoire Jacques-Louis Lions, Université Pierre et Marie Curie, France
- Oct 2013 *Global aspects of mathematical general relativity*
Mathematics colloquium, University of Iceland, Reykjavík, Iceland
- Sep 2013 *Riemannian metrics of low regularity*
School in Geometric Analysis (Geometric Analysis on Riemannian and Singular Metric Spaces), Lake Como School of Advanced Studies, Italy
- Jun 2013 *Analytic and geometric aspects of general relativity*
University of Münster, Germany
- Feb 2013 *Energy inequalities under one-sided curvature bounds*
CERS 3 (3rd Central European Relativity Seminar), Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Golm, Germany
- Dec 2012 *On the mathematical framework in general relativity*
Colloquium for PhD students, Faculty of Mathematics, University of Vienna
- Nov 2012 *Kann man unser Universum in Formeln fassen? (Can we describe our universe in formulas?)*
talk for a general audience at the "For Women in Science" award ceremony of the Austrian Academy of Sciences, Vienna, Austria
- Mar 2011 *The metric space structure of Riemannian manifolds*
Faculty of Mathematics, University of Vienna
- Sep 2009 *Smooth regularization parameter in special Colombeau algebras*
International Conference on Generalized Functions (GF 2009), Vienna, Austria
Poster presentations
- Oct 2015 *Hyperboloidal evolution for the cubic wave equation: Asymptotic behavior of global solutions*
Conference Panorama of Mathematics, Hausdorff Center for Mathematics, Bonn, Germany
- Nov 2012 *Weyl fields on one-sided bounded spacetimes*
"For Women in Science" award ceremony of the Austrian Academy of Sciences, Vienna

- Apr 2011 *Tectonic geomorphological investigations of antiforms using differential geometry (Permian Anticline, Northern Iraq)*
European Geosciences Union General Assembly (EGU 2011), Vienna, Austria

Selected attended conferences and workshops

- Nov–Dec 2019 [upcoming] **Trimester program**, *General Relativity, Geometry and Analysis: beyond the first 100 years after Einstein*, Institut Mittag-Leffler, Djursholm, Sweden.
- Jul 2019 [upcoming] **Equadiff 2019**, *International Conference on Differential Equations*, Leiden University, Netherlands.
- Jun 2019 [upcoming] **BIRS Workshop**, *Women in Analysis*, Banff International Research Station, Alberta, Canada.
- Apr 2019 [upcoming] **SCGP Workshop**, *Convergence and Low Regularity in General Relativity*, Simons Center for Geometry and Physics, Stony Brook University, New York, United States.
- Oct 2018 **Geometric Analysis Days**, *Intersections of Geometric Analysis and Mathematical Relativity*, Queen Mary University of London, United Kingdom.
- Jun 2018 **HYP2018**, *17th International Conference on Hyperbolic Problems*, Pennsylvania State University, University Park, Pennsylvania, United States.
- Apr 2018 **AMS Spring Eastern Sectional Meeting**, Northeastern University, Boston, Massachusetts, United States.
- Mar 2018 **SCGP Workshop**, *Mass in General Relativity*, Simons Center for Geometry and Physics, Stony Brook University, New York, United States.
- Nov 2017 **Joint Princeton–Rutgers Seminar on Geometric PDEs**, Princeton University, New Jersey, United States.
- Jul–Sep 2017 **ESI Program**, *Geometry and Relativity*, Erwin Schrödinger International Institute for Mathematics and Physics, Vienna, Austria.
- Apr 2017 **Workshop**, *Young women in geometry*, Max Planck Institute for Mathematics, Bonn, Germany.
- Feb 2017 **ESI Workshop**, *Geometric transport equations in general relativity*, Erwin Schrödinger International Institute for Mathematics and Physics, Vienna, Austria.
- Dec 2016 **Workshop**, *Young women in harmonic analysis and partial differential equations*, Hausdorff Center for Mathematics, University of Bonn, Germany.
- Jul 2016 **School in Geometric Analysis**, *Geometric analysis on Riemannian and singular metric measure spaces*, Lake Como School of Advanced Studies, Italy.
- Mar 2016 **Workshop**, *Singularity formation and long-time behavior in dispersive partial differential equations*, University of Bonn, Germany.
- Sep–Dec 2015 **IHP Trimester program**, *Mathematical General Relativity*, Institut Henri Poincaré, Paris, France.
- Oct 2015 **Panorama of Mathematics**, *A conference outlining new trends, results, and challenges in mathematical sciences*, Hausdorff Center for Mathematics, Bonn, Germany.
- Jun 2015 **Workshop**, *Longtime Behaviour of Nonlinear Waves*, Bielefeld University, Germany.
- Jul 2014 **ESI-EMS-IAMP Summer school on Mathematical Relativity**, *99 years of General Relativity*, Erwin Schrödinger International Institute for Mathematical Physics, Vienna, Austria.

- Jul 2014 **5th Northern German Differential Geometry Day**, Leibniz Universität Hannover, Germany.
- Feb 2014 **CERS 4**, *4th Central European Relativity Seminar*, Erwin Schrödinger International Institute for Mathematical Physics, Vienna, Austria.
- Sep 2013 **School in Geometric Analysis**, *Geometric analysis on Riemannian and singular metric spaces*, Lake Como School of Advanced Studies, Italy.
- Sep 2013 **HLF 2013**, *Heidelberg Laureate Forum*, Heidelberg, Germany.
- Feb 2013 **CERS 3**, *3rd Central European Relativity Seminar*, Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Golm, Germany.
- Dec 2012 **ESI Workshop**, *Dynamics of general relativity: black holes and asymptotics*, Erwin Schrödinger International Institute for Mathematical Physics, Vienna, Austria.
- Nov–Dec 2011 **Cours d'École doctorale**, *Mathematical problems in general relativity* (by Richard Schoen), Institut Henri Poincaré, Paris, France.
- Aug 2011 **ESI summer school**, *Mathematical physics*, Erwin Schrödinger International Institute for Mathematical Physics, Vienna, Austria.
- Apr 2011 **EGU 2011**, *European Geosciences Union General Assembly*, Vienna, Austria.
- Jan 2011 **UK–Japan Winter school**, *New methods in geometry*, King's College London, UK.
- Aug 2009 **GF 2009**, *International conference on generalized functions*, Univ. of Vienna, Austria.
- Feb 2009 **Workshop**, *Generalized functions and partial differential equations*, University of Innsbruck, Austria.

Short research stays (≤ 2 weeks)

- Jun 2019 [upcoming] **University of Toronto**, *Dept. of Mathematics*, Toronto, Canada, 1 week.
- Jul 2015 **University of Vienna**, *Faculty of Mathematics*, Vienna, Austria, 2 weeks.
- May 2014 **Max Planck Institute for Gravitational Physics (Albert Einstein Institute)**, Golm, Germany, 3 days.
- Oct 2013 **University of Iceland**, *Mathematics Division*, Reykjavíc, Iceland, 1 week.
- Dec 2010 **Université Pierre et Marie Curie**, *Lab. Jacques-Louis Lions*, Paris, France, 1 week.
- Aug 2010 **Université Pierre et Marie Curie**, *Lab. Jacques-Louis Lions*, Paris, France, 2 weeks.

Long research stays (≥ 1 month)

- 2019 [upcoming] **Institut Mittag-Leffler**, *Djursholm*, Sweden, 5 weeks.
- 2017 **Erwin Schrödinger International Institute for Mathematics and Physics**, Vienna, Austria, 5 weeks.
- 2014 **Riemann Center for Geometry and Physics**, *Leibniz University Hannover*, Germany, 4 months.
- 2008 **ETH Zürich**, *Seminar for Applied Mathematics*, Switzerland, 2 months.

Teaching

Department of Mathematics, Radboud University, Netherlands

- spring 2019 *Optimization Problems in Geometry and Physics*^{†‡}, Bachelor lecture, 2 hours/week
- fall 2018 *Introduction to Partial Differential Equations*[†], Bachelor lecture, 2 hours/week

Department of Mathematics, Rutgers University, United States

- spring 2018 *Introduction to Mathematical Reasoning*[†], undergraduate lectures, 2 Sections, 4 hours/week each
- fall 2017 *Introduction to Real Analysis 1*[†], undergraduate lecture, Honors Section, 4 hours/week
- Mathematical Institute, University of Bonn, Germany
- fall 2016 *Selected topics in Analysis and PDE – Mathematical General Relativity*[‡], Master/PhD lecture, 2 hours/week
- spring 2016 *Introduction to the Calculus of Variations*[‡] (in German), Bachelor seminar, 2 hours/week
- Faculty of Mathematics, University of Vienna, Austria
- fall 2010 *Differential Equations* (in German), exercise course, 1 hour/week
- fall 2008 *Tutorial for beginners and Workshops* (in German), 2 hours/week
- spring 2008 *Tutorial for beginners* (in German), 2 hours/week
- fall 2007 *Analysis 2* (in German), revision course, 2 hours/week
- spring 2007 *Analysis 1* (in German), revision course, 2 hours/week, together with Roland Steinbauer
- fall 2006 *Analysis 3* (in German), revision course, 2 hours/week, together with Roland Steinbauer

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In all courses I was responsible for preparing and presenting the course material as well as for the assessment of students. If not indicated otherwise the language of instruction was English.

[†] These courses consisted of lectures and workshops, and I was also responsible for assigning homework and workshops problems. In this role I also supervised the workshop teaching assistants and homework graders.

[‡] In these courses I was solely responsible for everything, including the course title and content.

Supervision

Bachelor theses

- 2019 Willem van Oosterhout (Birkhoff's Theorem, in preparation), Radboud University

Academic services

Refereeing

- since 2015 **Peer-reviews and reviews** for the Bulletin of the London Mathematical Society, Communications in Mathematical Physics, Mathematical Reviews

Organizational activities

- Jul 2019 [upcoming] **Equadiff 2019**, *Leiden*, Netherlands.
organizer of a minisymposium at the biannual international conference on differential equations, together with A. Shadi Tahvildar-Zadeh
- Feb 2019 **NonLinear Analysis Days**, *Nijmegen*, Netherlands.
organizer of an international workshop on partial differential equations, together with Stefanie Sonner
- 2014 **Geometry, Analysis and Physics Seminar (GAP)**, *Vienna*, Austria.
co-founder of a joint seminar for Postdocs and PhD students at the University of Vienna (Mathematics and Physics) and the Vienna University of Technology (Mathematics)

Outreach

- May 2018 **Career Day**, *Irving Primary School*, Highland Park, NJ, United States.
I described what I do in my work as an assistant professor of mathematics to 5- to 7-year-old students (teaching, research, conferences etc.). Using simple drawings we discussed how light travels in the universe, in particular, we explored gravitational lensing and black holes.
- Feb 2018 **Postdoc Life Panel**, *Rutgers University*, United States.
I discussed on a panel what it means to work as a researcher and teacher in mathematics at a university. This event was primarily aimed at graduate and undergraduate students.

Other

- 2006–2010 **IAESTE**, *Vienna*, Austria, voluntary work.
The "International Association for the Exchange of Students for Technical Experience" organizes internships worldwide for engineering and science students. In 2008 I was board member for Exchange Outgoing and responsible for 68 students working abroad.

Memberships

- American Mathematical Society (AMS)
European Women in Mathematics (EWM)

Additional training

- Nov 2018 *Towards Equality in Science — Workshop for hiring and selection committees at the Science Faculty*, Radboud University
- Feb 2018 *Active Learning: Picking the right method for your class*, Rutgers University
- Jun 2016 *ERC Starting Grants in Horizon 2020*, University of Bonn
- May 2013 *How to reach general public?*, University of Vienna
- Apr 2013 *Publishing with impact*, University of Vienna
- Jan 2013 *Self-management*, University of Vienna
- Apr–May 2010 *Exposé and outline writing*, University of Vienna

Media coverage

- Dec 2014 *Mit mathematischen Methoden den Geheimnissen des Alls näherkommen: Raumzeiten?*, Falter – Heureka
- Mar 2014 *Exzellente in Mathematik*, Vorarlberger Nachrichten
- Mar 2013 *Relativitätstheorie zu Ende gedacht*, Forschungsnewsletter der Universität Wien
- Feb 2013 *Das Universum in Gleichungen*, Der Standard

Mar 2019