Peter Hintz

ETH Zurich
Department of Mathematics
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Rämistrasse 101
8092 Zurich
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Research interests
Partial Differential Equations, General Relativity, Microlocal Analysis, Scattering Theory.

Employment
Associate Professor, ETH Zürich 07/2021–
Associate Professor (without tenure), Massachusetts Institute of Technology 07/2021–01/2022
Assistant Professor, Massachusetts Institute of Technology 01/2019–06/2021
Clay Research Fellow, Clay Mathematics Institute 08/2017–08/2020
Miller Research Fellow, University of California, Berkeley 10/2015–07/2017

Education
Ph.D. in Mathematics, Stanford University 09/2011-09/2015
Thesis advisor: András Vasy
Thesis title: Global analysis of linear and nonlinear wave equations on cosmological spacetimes
B.Sc. in Mathematics, University of Göttingen, Germany 10/2009–03/2011
B.Sc. in Physics, University of Göttingen, Germany 10/2008–04/2011

Publications
[30] “Mode stability and shallow quasinormal modes of Kerr–de Sitter black holes away from extremality”. Preprint, 2021. arxiv:2112.14431.
[29] “Elliptic parametrices in the 0-calculus of Mazzeo and Melrose”. Preprint, 2021. arXiv:2112.08130.
[28] “Quasinormal modes of small Schwarzschild–de Sitter black holes”, with YuQing Xie. Preprint, 2021. arXiv:2105.02347.
[27] “Quasinormal modes and dual resonant states on de Sitter space”, with YuQing Xie. Physical Review D, 104(6), 064037, 2021.
[26] “The Dirichlet-to-Neumann map for a semilinear wave equation on Lorentzian manifolds”, with Gunther Uhlmann and Jian Zhai. Preprint, 2021. arXiv: 2103.08110.
[25] “Semiclassical propagation through cone points”. Preprint, 2021. arXiv:2101.01008.
[24] “Resolvents and complex powers of semiclassical cone operators”. Preprint, 2020. arXiv: 2010.01593.
[23] “An inverse boundary value problem for a semilinear wave equation on Lorentzian manifolds”, with Gunther Uhlmann and Jian Zhai. International Mathematics Research Notices, rna088.
22. “A sharp version of Price’s law for wave decay on asymptotically flat spacetimes”. *Communications in Mathematical Physics*, 389:491–542, 2022.

21. “Black hole gluing in de Sitter space”. *Communications in Partial Differential Equations*, 46(7):1280–1318, 2021.

20. “Linear stability of slowly rotating Kerr black holes”, with Dietrich Häfner and András Vasy. *Inventiones mathematicae* 223:1227–1406, 2021.

19. “Normally hyperbolic trapping on asymptotically stationary spacetimes”. *Probability and Mathematical Physics*, 2(1):71–126, 2021.

18. “Strong cosmic censorship in charged black-hole spacetimes: still subtle”, with Vitor Cardoso, João Costa, Kyriakos Destounis, and Aron Jansen. *Phys. Rev. D*, 98(10), 104007, 2018.

17. “Quasinormal modes and Strong Cosmic Censorship”, with Vitor Cardoso, João Costa, Kyriakos Destounis, and Aron Jansen. *Phys. Rev. Lett.*, 120(3), 031103, 2018.

16. “Stability of Minkowski space and polyhomogeneity of the metric”, with András Vasy. *Annals of PDE*, 6(2), 2020.

15. “Reconstruction of Lorentzian manifolds from boundary light observation sets”, with Gunther Uhlmann. *International Mathematics Research Notices*, rnx320, 2018.

14. “Wave decay for star-shaped obstacles in $\mathbb{R}^3$: papers of Morawetz and Ralston revisited”, with Maciej Zworski. *Mathematical Proceedings of the Royal Irish Academy*, 117A(2):47–62, 2017.

13. “Resonances for obstacles in hyperbolic space”, with Maciej Zworski. *Communications in Mathematical Physics*, 359(2):699–731, 2018.

12. “Uniqueness of Kerr–Newman–de Sitter black holes with small angular momenta”. *Annales Henri Poincaré*, 19(2):607–617, 2018.

11. “Non-linear stability of the Kerr–Newman–de Sitter family of charged black holes”. *Annals of PDE*, 4(1):11, Apr 2018.

10. “The global non-linear stability of the Kerr–de Sitter family of black holes”, with András Vasy. *Acta mathematica*, 220:1–206, 2018.

9. “Analysis of linear waves near the Cauchy horizon of cosmological black holes”, with András Vasy. *Journal of Mathematical Physics*, 58(8):081509, 2017.

8. “Boundedness and decay of scalar waves at the Cauchy horizon of the Kerr spacetime”. *Commentarii Mathematici Helvetici*, 92(4):801–837, 2017.

7. “Resonance expansions for tensor-valued waves on asymptotically Kerr–de Sitter spaces”. *Journal of Spectral Theory*, 7:519–557, 2017.

6. “Asymptotics for the wave equation on differential forms on Kerr–de Sitter space”, with András Vasy. *Journal of Differential Geometry*, 110(2):221–279, 2018.

5. “Quasilinear waves and trapping: Kerr-de Sitter space”, with András Vasy. *Journées équations aux dérivées partielles*, 21(6):1–15, 2014.

4. “Global analysis of quasilinear wave equations on asymptotically Kerr–de Sitter spaces”, with András Vasy. *International Mathematics Research Notices*, 2016(17):5355–5426, 2016.

3. “Global analysis of quasilinear wave equations on asymptotically de Sitter spaces”. *Annales de l’Institut Fourier*, 66(4):1285–1408, 2016.
[2] “Non-trapping estimates at normally hyperbolic trapping”, with András Vasy. *Math. Res. Lett.*, 21(6):1277–1304, 2014.

[1] “Semilinear wave equations on asymptotically de Sitter, Kerr–de Sitter and Minkowski spacetimes”, with András Vasy. *Analysis&PDE*, 8(8):1807–1890, 2015.

**Awards and honors**

| Award / Fellowship                        | Start Year – End Year |
|-------------------------------------------|-----------------------|
| Plenary Lecture, 20th International Congress on Mathematical Physics | 08/2021               |
| Sloan Research Fellowship                 | 2020–2022             |
| NSF Grant DMS-1955614                     | 2020–2023             |
| Clay Research Fellowship                  | 2017–2020             |
| Miller Research Fellowship, University of California, Berkeley | 2015–2018             |
| Gerhard Casper Stanford Graduate Fellowship | 2011–2018            |
| Fellow of the German National Academic Foundation | 2009–2013           |
| Lower Saxony Science Award                | 2011                  |

**Teaching**

- *Introduction to Microlocal Analysis*, ETH  
  - Fall 2022
- 18.157 (Introduction to Microlocal Analysis), MIT  
  - Spring 2021
- 18.950 (Differential Geometry), MIT  
  - Spring 2020
- 18.157 (Introduction to Microlocal Analysis), MIT  
  - Spring 2019
- *Microlocal analysis and wave propagation*, Grenoble (teaching assistant)  
  - Summer 2014
- *Math 51 (Linear Algebra)*, Stanford University (teaching assistant)  
  - Spring 2014
- *Math 51 (Linear Algebra)*, Stanford University (teaching assistant)  
  - Spring 2013
- *Functional Analysis*, University of Göttingen, Germany (teaching assistant)  
  - Spring 2011

**Seminar and workshop organization**

- PDE & Mathematical Physics Seminar, ETH and University of Zürich  
  - 09/2021–

- PDE & Analysis Seminar, MIT  
  - 09/2018–06/2021
- Graduate Student Lunch Seminar, MIT  
  - Spring 2019
- Miller Institute Annual Interdisciplinary Symposium  
  - 06/2018
- Miller Institute Annual Interdisciplinary Symposium  
  - 06/2017
- Analysis & PDE Seminar, UC Berkeley  
  - 10/2015–07/2018

**Research talks and minicourses**

- *Quasinormal modes of small Schwarzschild–de Sitter black holes*  
  - Analysis Seminar, EPFL  
    - 11/2021
  - Analysis Seminar, Stanford University  
    - 04/2021

- *General Relativity, Spectral Theory, and Microlocal Analysis*  
  - Colloquium, SwissMAP General Meeting  
    - 09/2021
  - Plenary Lecture, 20th International Congress of Mathematical Physics  
    - 08/2021
  - Developments in the Mathematical Sciences, Max Planck Institute, Leipzig  
    - 01/2021

- *Wave decay on asymptotically flat spacetimes*  
  - Conference “New Trends in Geometric PDEs”, University of Münster  
    - 11/2021
  - Workshop “Scattering and inverse scattering”, RICAM, Linz  
    - 10/2021
  - Analysis Seminar, Caltech  
    - 04/2021
  - Analysis Seminar, Yale University  
    - 12/2020
Geometric Analysis Colloquium, Toronto 12/2020
Analysis Seminar, Dalhousie University 12/2020
Conference “Scattering, microlocal analysis and renormalisation”, Mittag-Leffler Inst. 06/2020
Seminar Monza, Online 04/2020

Recent developments in Strong Cosmic Censorship
Black Hole Initiative Colloquium, Harvard University 02/2020

Two lectures on Nonlinear wave equations
Introductory workshop on Microlocal Analysis, MSRI 09/2019

Minicourse on Scattering theory, joint with Maciej Zworski
Summer school in semiclassical analysis, Northwestern University 08/2019

Linear stability of slowly rotating Kerr black holes
One World Mathematical Physics Seminar, Online 11/2020
North British Mathematical Physics Seminar 07/2020
General Relativity Seminar, Harvard University 11/2019
Conference “Microlocal analysis and spectral theory”, Berkeley 10/2019
Conference “Microlocal analysis and applications”, Fudan, Shanghai 06/2019
Conference “Fredholm theory of non-elliptic operators”, Leeds 06/2019
Conference “Inverse Problems, Imaging and PDE”, Hong Kong 05/2019
Conference “Microlocal Methods in Analysis and Geometry”, Luminy 05/2019

Stability of Minkowski space and polyhomogeneity of the metric
Colloque des sciences mathématiques du Québec, Montreal 12/2018
Geometric Analysis Seminar, McGill University 12/2018
Conference “Geometric Singular Analysis and Mathematical Physics”, Oldenburg 09/2018
PDE/Analysis Seminar, MIT 09/2018
Conference “Mathematical Aspects of General Relativity”, Oberwolfach 08/2018
Conference “Mathematical General Relativity”, IHP 05/2018
Analysis Seminar, University College, London 02/2018
Conference “Quantum Fields, scattering and spacetime horizons”, Les Houches 05/2018
Analysis Seminar, UC San Diego 05/2018
AMS Special Session on General Relativity and Geometric Analysis 04/2018
Analysis Seminar, Purdue University 02/2018
CAAM Special Lecture Series, Rice University 11/2017
Conference “Frontiers of Theory and Applications of Nonlinear PDE”, Hong Kong 12/2017

Trapping in perturbations of Kerr spacetimes
Research Seminar, MSRI, Berkeley 12/2019
Bay Area Microlocal Analysis Seminar, Stanford 10/2018

Stability problems in General Relativity
Workshop on microlocal analysis, Murraramang, Australia 03/2018

Nonlinear stability via global analysis
Black Hole Initiative Colloquium, Harvard University 02/2018

Reconstruction of Lorentzian metrics from boundary light observation sets
Conference “Applied Inverse Problems”, Grenoble 07/2019
MATH+X Symposium, Rice University 01/2018
Geometry & Analysis Seminar, University of California, Santa Cruz 05/2017
Resonances for obstacles in hyperbolic space
Conference “Waves, Spectral Theory and Applications”, UNC Chapel Hill 10/2017
Bay Area Microlocal Analysis Seminar, Stanford University 05/2017

Minicourse on Black hole stability
Tokyo–Berkeley Workshop “PDE and Mathematical Physics”, Tokyo 01/2017

Nonlinear stability of Kerr–de Sitter black holes
Analysis Seminar, Shanghai Jiao Tong University 08/2019
Department Colloquium, Cardiff University 09/2018
AMS Special Session on Mathematics of Gravitational Wave Science, San Diego 01/2018
Analysis Seminar, Johns Hopkins University 10/2017
Geometry and Analysis Seminar, Columbia University 05/2017
Analysis Seminar, University of Washington 05/2017
Department Colloquium, Northwestern University 05/2017
Department Colloquium, Stanford University 04/2017
Analysis and PDE Seminar, University of Kentucky 04/2017
AMS Sectional Meeting, Pullman, Washington 04/2017
Department Colloquium, University of California, Berkeley 04/2017
Analysis Seminar, University of Melbourne 04/2017
Analysis Seminar, Texas A&M 03/2017
Analysis Seminar, MIT 03/2017
Conference “Resonances: Geometric Scattering and Dynamics”, Luminy 03/2017
Oberseminar Analysis, Universität Regensburg 03/2017
Analysis Seminar, Instituto Técnico Superior, Lisbon 03/2017
Conference “Geometric and Spectral Methods in PDE”, Oaxaca 12/2016
HKUST IAS Workshop on Inverse Problems, Imaging and PDE, Hong Kong 12/2016
AMS Sectional Meeting, Raleigh, North Carolina 11/2016
Analysis Seminar, Princeton University 11/2016
Analysis Seminar, Brown University 11/2016
Bay Area Microlocal Analysis Seminar, UC Berkeley 10/2016
Analysis Seminar, University of Cambridge 10/2016
Mathematical General Relativity Seminar, Université Pierre et Marie Curie, Paris 10/2016
Conference “Asymptotic Analysis in General Relativity”, Roscoff 10/2016
Geometry Seminar, University College, London 07/2016

Finite codimension solvability of quasilinear wave equations
Analysis Seminar, Université Joseph Fourier, Grenoble 05/2016
Analysis Seminar, UC Berkeley 04/2016
Analysis Seminar, UNC Chapel Hill 03/2016
Analysis Seminar, MIT 03/2016

Regularity of waves at the Cauchy horizon of black hole spacetimes
Conference “Evolution equations on singular spaces”, Luminy 04/2016
Department Colloquium, Hong Kong University of Science and Technology 12/2015
Paris/Berkeley/Bonn/Zürich Analysis Seminar 11/2015

Asymptotics for Maxwell’s equations on Kerr–de Sitter space
Analysis Seminar, MIT 03/2015
Conference “Geometric and analytic aspects of resonances”, Luminy 03/2015
Analysis Seminar, University of Washington 02/2015
Quasilinear wave equations on asymptotically Kerr–de Sitter spacetimes
Conference “Modern theory of wave equations”, ESI, Vienna 08/2015
Conference “Mathematical Aspects of General Relativity”, Oberwolfach 07/2015
May Midwestern Microlocal Meeting, Northwestern University 05/2015
Analysis Seminar, Johns Hopkins University 03/2015
Analysis Seminar, Princeton University 11/2014
Geometry Seminar, Stanford University 05/2014
Analysis Seminar, Purdue University 04/2014

Semilinear wave equations on asymptotically de Sitter spacetimes
Bay Area Microlocal Analysis Seminar, UC Berkeley 11/2013
AMS Sectional Meeting, Temple University 10/2013

Mentoring

Ph.D. students
Ethan Sussman 2018–

M.Sc. students
Ruiying Xu 2014–

Semester papers
Alexander Uhlmann Fall 2021
Ruiying Xu Fall 2021

Undergraduate Research Supervision
YuQing Xie 2020–2021

Last updated: January 17, 2022