

# Richard Matthias Höfer

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## Curriculum Vitae

### Personal details

First name Richard Matthias  
Family name Höfer  
Date of birth 19/12/1991  
Place of birth Carmel, New York  
Nationality German, U.S.  
E-mail richard.hoefer@ur.de  
Homepage <https://www.uni-regensburg.de/mathematics/mathematics-hoefer>

### Positions

- Since 01/2023 **Professor for partial differential equations (W2 with tenure track to W3)**  
Faculty of Mathematics, University of Regensburg.
- 01/2021–12/2022 **Leopoldina postdoc fellow**  
Institut de Mathématiques de Jussieu-Paris Rive Gauche, Université de Paris.  
Postdoctoral mentors: Prof. Dr. David Gérard-Varet, Prof. Dr. Laurent Desvillettes.
- 07/2020–12/2020 **Postdoctoral researcher**  
Institut de Mathématiques de Bordeaux, Université de Bordeaux.  
Postdoctoral mentors: Prof. Dr. Franck Sueur, Prof. Dr. Christophe Prange.
- 08/2019–06/2020 **Postdoctoral researcher**  
Institute for Applied Mathematics, Universität Bonn.  
Postdoctoral mentor: Prof. Dr. Juan J.L. Velázquez.

### Formation

- 10/2015–07/2019 **Ph.D. in Mathematics**  
*Institute for Applied Mathematics, Universität Bonn.*  
(Hausdorff scholarship 10/2015–9/2018).

#### Ph.D. Thesis

Title *Sedimentation of particle suspensions in Stokes flows*

Advisor Prof. Dr. Juan J.L. Velázquez

Committee Prof. Dr. Barbara Niethammer, Prof. Dr. Felix Otto (external report)

Prof. Dr. Martin Rumpf, Prof. Dr. Moritz Sokolowski  
Defence date July 23, 2019  
Final grade Summa cum laude (0,0)  
Research area Mathematical Analysis (Partial Differential Equations)

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## Education

10/2013–07/2015 **Master in Mathematics**, *Universität Bonn*.

**Master Thesis**

Title *Screening in the perforated space by the method of reflections*  
Advisor Prof. Dr. Juan J.L. Velázquez  
Final grade 1,0  
Research area Mathematical Analysis (Partial Differential Equations)

10/2010–7/2013 **Bachelor in Mathematics**, *Universität Bonn*.

**Bachelor Thesis**

Title *Konvexe Integration der Eulergleichungen*  
Advisor Prof. Dr. Stefan Müller  
Final grade 1,0  
Research area Mathematical Analysis (Partial Differential Equations)

2002–2010 **High School Diploma (Abitur)**, *Stiftsschule St. Johann, Amöneburg near Marburg, Hessen, Germany*.

Final grade 1,0

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## Awards

2021 – 2022 **Leopoldina postdoc fellowship**.

2020 **Hausdorff memorial prize**, awarded by the Bonn Mathematical Society for the best doctoral dissertation of the academic year 2018/2019.

2015 – 2018 **Hausdorff scholarship for PhD studies**.

2014 **Bachelorprize of the Bonn Mathematical Society**.

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## Research

Analysis of PDE, many-particle systems, fluid-structure interactions, homogenization, kinetic theory.

- Rigorous derivation of effective evolution equations for particle suspensions from microscopic systems.
- Well-posedness theory, qualitative analysis and asymptotic behaviour of the solutions of these macroscopic evolution equations.
- Homogenization in perforated domains.

### Peer-reviewed publications

1. **Sedimentation of particles with very small inertia I: Convergence to the transport-Stokes equation**  
Richard M. Höfer, Richard Schubert  
To appear in *Duke Math. J.* (2024) OA: arXiv:2302.04637
2. **Hindered settling of well-separated particle suspensions**  
Mathieu Hillairet, Richard M. Höfer  
*Pure and Applied Analysis*, Vol. 6, pp. 581–609 (2024) OA: arxiv:2301.09547
3. **Fluctuations in the homogenization of the Poisson and Stokes equations in perforated domains**  
Richard M. Höfer, Jonas Jansen  
To appear in *Arch. Rational Mech. Anal.* (2024) OA: arXiv:2004.04111
4. **A fast point charge interacting with the screened Vlasov-Poisson system**  
Richard M. Höfer, Raphael Winter  
To appear in *Analysis&PDEs* (2024) (<https://msp.org/soon/coming.php?jpath=apde>) OA: arXiv:2205.00035
5. **Non-existence of mean-field models for particle orientations in suspensions**  
Richard M. Höfer, Amina Mecherbet, Richard Schubert  
*Journal of Nonlinear Science* Vol.34, Art. No.3 (2024) OA: arxiv:221015382
6. **Homogenization of the Navier-Stokes equations in perforated domains in the invicid limit**  
Richard. M. Höfer  
*Nonlinearity* Vol.36, 6019 (2023) OA: arxiv:2209.06075
7. **Derivation of the viscoelastic stress in Stokes flows induced by non-spherical Brownian rigid particles through homogenization**  
Richard M. Höfer, Marta Leocata, Amina Mecherbet  
*Pure and Applied Analysis* Vol.5, pp. 409–460 (2023) OA: arXiv:2202.09317
8. **Convergence of the pressure in the homogenization of the Stokes equations in randomly perforated domains**  
Arianna Giunti, Richard M. Höfer  
*J. Diff. Equ.*, Vol. 320, pp. 399-418 (2022) OA: arXiv:2002.04846
9. **Motion of several slender rigid filaments in a Stokes flow**  
Richard M. Höfer, Christophe Prange, Franck Sueur  
*Journal de l'École Polytechnique*, Vol. 9, pp. 327-380 (2022) OA: arXiv:2106.03447 ,
10. **Darcy's law as low Mach and homogenization limit of a compressible fluid in perforated domains**  
Richard M. Höfer, Karina Kowalczyk, Sebastian Schwarzacher  
*Math. Models Methods Appl. Sci.*, Vol. 31, pp. 1787-1819 (2021) OA: arXiv:2007.09031

11. **Convergence of the method of reflections for particle suspensions in Stokes flows**  
Richard M. Höfer *J. Diff. Equ.*, Vol. 297, pp. 81-109 (2021) OA: arXiv:1912.04388
12. **The influence of Einstein's effective viscosity on sedimentation at very small particle volume fraction**  
Richard M. Höfer, Richard Schubert  
*Ann. Inst. H. Poincaré Anal. Non Linéaire*, Vol. 38, oo.1897-1927 (2021), OA: arXiv:2008.04813
13. **Mild assumptions for the derivation of Einstein's effective viscosity formula**  
David Gérard-Varet, Richard M. Höfer  
*Commun. Partial. Differ. Equ.*, Vol. 46, pp. 611-629 (2021), OA: arXiv:2003.04724
14. **Non-geometric convergence of the classical alternating Schwarz method**  
Gabriele Ciaramella, Richard M. Höfer  
*In Domain Decomposition Methods in Science and Engineering XXV, Lecture Notes in Computational Science and Engineering* (2020), OA: <http://nbn-resolving.de/urn:nbn:de:bsz:352-2-15ntblpo8erd48>
15. **Homogenization for the Stokes equations in randomly perforated domains under almost minimal assumptions on the size of the holes**  
Arianna Giunti, Richard M. Höfer  
*Ann. Inst. H. Poincaré Anal. Non Linéaire*, Vol. 35, pp. 1829–1868 (2019), OA: arXiv:1809.04491
16. **Homogenization for the Poisson equation in randomly perforated domains under minimal assumptions on the size of the holes**  
Arianna Giunti, Richard M. Höfer, Juan J.L. Velázquez  
*Commun. Partial. Differ. Equ.*, Vol. 43, pp. 1377–1412 (2018), OA: arXiv:1803.10214
17. **The inertialess limit of particle sedimentation modeled by the Vlasov–Stokes equations**  
Richard M. Höfer  
*SIAM J. Math. Anal.*, Vol. 50, pp. 5446–5476 (2018), OA: arXiv:1801.02333
18. **Sedimentation of inertialess particles in Stokes flows**  
Richard M. Höfer  
*Comm. Math. Phys.*, Vol. 360, pp. 55–101 (2018), OA: arXiv:1610.03748
19. **The method of reflections, homogenization and screening for Poisson and Stokes equations in perforated domains**  
Richard M. Höfer, Juan J.L. Velázquez  
*Arch. Rational Mech. Anal.*, Vol. 227, pp. 1165–1221 (2018), OA: arXiv:1603.06750

### Other publications

20. **Quantitative homogenization of the compressible Navier-Stokes equations towards Darcy's law**  
Richard M. Höfer, Šárka Nečasová, Florian Oschmann  
OA: arXiv:2403.12616 (2024)
21. **Sedimentation of particles with very small inertia II: Derivation, Cauchy problem and hydrodynamic limit of the Vlasov-Stokes equation**  
Richard M. Höfer, Richard Schubert  
OA: arXiv:2311.01891 (2023)
22. **Hydrodynamic limit of multiscale viscoelastic models for rigid particle suspensions**  
Mitia Duerinckx, Lucas Ertzbischoff, Alexandre Girodroux-Lavigne, Richard M. Höfer  
OA: arXiv:2310.17008 (2023)
23. **Sedimentation of particle suspensions in Stokes flows**  
Richard M. Höfer  
PhD Thesis, Rheinische Friedrich-Wilhelms-Universität Bonn (2019)

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## Research talks

### Invited talks at international conferences and workshops

- 24/03/2025 **Tba** *Research School: Kinetic theory and fluid mechanics: couplings, scalings and asymptotics*, CIRM, Luminy.
- 12/06/2024 **Quantitative derivation of the porous medium equation from the compressible Navier-Stokes equations** *Equadiff 2024, Minisymposium: Mathematics of porous media*, Karlstad.
- 05/06/2023 **Mean-field limits for particles in Stokes flows** *thematic day: Kinetic Equations in Cergy*, Cergy Paris Université.
- 14/11/2022 **Mean-field limits for particle suspensions in Stokes flows** *Conference: Kinetic theory*, Centre International de Rencontres Mathématiques, Marseille.
- 06/10/2022 **Homogenization of the Navier-Stokes equations in perforated domains in the inviscid limit** *Workshop of the GAMM activity group "Analysis of PDEs"*, IST Austria, Vienna.
- 11/07/2022 **Homogenization of the Navier-Stokes equations in perforated domains in the inviscid limit** *Minisymposium Analysis for fluid-structure interactions, Equadiff 15*, Brno, Czech Republic.
- 13/04/2022 **On the derivation of viscoelastic models for rod-like suspensions** *Conférence Singflows*, Université de Bordeaux.
- 16/03/2022 **Motion of several slender rigid filaments in a Stokes flow** *SIAM Conference on Analysis of Partial Differential Equations (PD22)*, Berlin.
- 06/07/2021 **On the derivation of visco-elastic models for rod-like suspensions** *Brijuni Applied Mathematics Workshop*, Brijuni, Croatia.
- 14/12/2020 **The method of reflections and its applications to homogenization problems** *Workshop: Collective behavior of particles in fluids*, Institut Henri Poincaré, Paris, online.
- 30/11/2020 **Mean field limits for inertialess particles sedimenting in a Stokes flow** *Workshop: Classical and quantum mechanical models of many-particle systems*, Mathematical Research Institute Oberwolfach, online.
- 15/09/2020 **On the effective viscosity of suspensions** *Mini-symposium: PDEs in fluid dynamics*, DMV Annual Meeting, online.
- 01/04/2020 **Mean field limits for particle sedimentation** *Workshop: Singular limits for particle systems*, ~~École Normale Supérieure Lyon~~.
- 11/07/2019 **Sedimentation of inertialess spherical particles in Stokes flows** *Mini-symposium: fluid-structure interactions, Equadiff 2019*, Leiden.
- 24/07/2018 **Applications of the method of reflections to homogenization and sedimentation problems** *25th International Conference on Domain Decomposition Methods*, St John's, Newfoundland.

## Other talks

- 18/03/2024 **Homogenization of the Navier-Stokes equations in perforated domains in the inviscid limit** *Multi-scale methods for reactive flow and transport in complex elastic media – Conference in memory of Andro Mikelić*, Dubrovnik.
- 30/01/2024 **On the derivation of viscoelastic models for rod-like suspensions** *Analysis-Probability Seminar*, Max Planck Institute for Mathematics in the Sciences, Leipzig.
- 18/09/2023 **Hydrodynamic limit of multiscale viscoelastic models for suspensions of rigid Brownian particles** *Gamm PDE Meeting*, Eichstätt.
- 30/05/2023 **Sedimentation of particles with very small inertia: Derivation of the Vlasov-Stokes equations** *Gamm Annual Meeting*, Dresden.
- 03/05/2023 **Homogenization of the Navier-Stokes equations in perforated domains in the inviscid limit** *Webinar on Evolution Equations and Dynamical Systems*, Universidade de São Paulo & Universidade Federal do Rio de Janeiro.
- 28/10/2022 **Homogenization of the Navier-Stokes equations in perforated domains in the inviscid limit** *Colloquium of the GRK IntComSin*, University of Regensburg.
- 10/10/2022 **A fast point charge interacting with the screened Vlasov-Poisson system** *Research Seminar Analysis*, Université de Nantes.
- 25/08/2022 **Transport-Stokes equations as mean-field limit of inertialess suspensions** *Benasque IX PDEs, optimal design and numerics*, Centro de Ciencias de Benasque Pedro Pascual.
- 24/06/2022 **A fast point charge interacting with the screened Vlasov-Poisson system** *Research Seminar Analysis*, University of Bonn.
- 23/06/2022 **On the derivation of viscoelastic models for rod-like suspensions** *Oberseminar Analysis*, University of Bonn.
- 11/05/2022 **A fast point charge interacting with the screened Vlasov-Poisson system** *Séminaire EDP Sophie Germain*, Université Paris Cité.
- 31/03/2022 **Deceleration of a point charge interacting with the screened Vlasov-Poisson system** *Séminaire EDP*, Université libre de Bruxelles.
- 16/12/2021 **Mean-field limits for inertialess particles in Stokes flows** *Analysis Seminar*, University of Regensburg.
- 14/10/2021 **On the derivation of visco-elastic models for rod-like suspensions** *SALVE Seminar*, Centre de Mathématiques de Laurent Schwartz, École Polytechnique.
- 26/04/2021 **Effective properties of suspensions** *Seminar of the SMAQ group*, Università degli Studi dell'Aquila.
- 03/11/2020 **Effective equations for fluids with many small particles** *Séminaire de l'équipe AC-SIOM*, Université de Montpellier.
- 13/10/2020 **Effective equations for fluids with many small particles** *Séminaire de Physique Mathématique - EDP*, Université de Bordeaux.
- 04/06/2020 **On the effective viscosity of suspensions** *Analysis-Probability Seminar*, Max Planck Institute for Mathematics in the Sciences, Leipzig.
- 22/01/2020 **The method of reflections and its applications to homogenization problems** *Workshop: The mathematical theory of particle suspensions*, Hausdorff Center for Mathematics, Universität Bonn.

- 31/10/2019 **Sedimentation of particle suspensions in Stokes flows** *EDDy seminar*, RWTH Aachen.
- 19/07/2019 **Sedimentation of particle suspensions in Stokes flows** *Applied Analysis seminar*, Max Planck Institute for Mathematics in the Sciences, Leipzig.
- 26/06/2019 **On the sedimentation of particle suspensions in Stokes flow** *Effective equations: frontiers in classical and quantum systems*, Workshop in the Kinetic Theory Trimester, Hausdorff Institute for Mathematics, Universität Bonn.
- 13/03/2019 **Screening in interacting particle systems** *Presentation of project B08 at the retreat of the Collaborative Research Center 1060*, Weilburg.
- 19/02/2019 **The method of reflections and its applications to homogenization problems** *LJLL PhD student seminar*, Laboratoire Jacques-Louis Lions, Université Paris Sorbonne.
- 16/10/2018 **The method of reflections and its applications to homogenization problems** *Research seminar WG Numerical Optimization*, Universität Konstanz.
- 12/03/2018 **Screening in interacting particle systems** *Presentation of project B08 at the retreat of the Collaborative Research Center 1060*, Bad Neuenahr.
- 22/03/2018 **Particle sedimentation in Stokes flows** *GAMM Annual Meeting*, Munich.
- 19/10/2017 **Particle sedimentation in Stokes flows** *Oberseminar Analysis*, Hausdorff Center for Mathematics, Universität Bonn.
- 07/07/2016 **Screening in interacting particle systems** *Presentation of project proposal B08*, On-site review for the Collaborative Research Centre (SFB) 1060: The Mathematics of Emergent Effects, funded by the German Research Foundation (DFG), Universität Bonn.

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## Short Visits to International Research Institutions

- 02/2025 **Mathematical Research Institute Oberwolfach**, Oberwolfach Research Fellows program.
- 11/2024 **Mathematical Research Institute Oberwolfach**, Oberwolfach Research Fellows program.
- 06/2024 **Karlstad Universitet**, Equadiff 2024.
- 03/2024 **Centre for Advanced Academic Studies Dubrovnik**, Conference: Multi-scale methods for reactive flow and transport in complex elastic media.
- 02/2024 **Universität Bonn**.
- 01/2024 **Max Planck Institute for Mathematics in the Sciences, Leipzig**.
- 12/2023 **Station Biologique de Roscoff**, Conference: New trends in homogenization.
- 11/2023 **Université libre de Bruxelles**.
- 09/2023 **Katholische Universität Eichstätt-Ingolstadt**, GAMM PDE Meeting.
- 06/2023 **Cergy Paris Université**.
- 03/2023 **Université Paris Cité**.
- 03/2023 **Universität Bonn**.
- 12/2022 **Centre International de Rencontres Mathématiques, Marseille**, Research in Pairs program.
- 11/2022 **Centre International de Rencontres Mathématiques, Marseille**, Workshop: Kinetic theory.

- 11/2022 **Czech Academy of Sciences.**
- 10/2022 **IST Austria**, Workshop of the GAMM activity group “Analysis of PDEs”.
- 10/2022 **Université de Nantes.**
- 08/2022 **Centro de Ciencias de Benasque Pedro Pascual**, Benasque IX PDEs, optimal design and numerics.
- 06/2022 **Universität Bonn.**
- 04/2022 **Université de Bordeaux.**
- 03/2022 **Université libre de Bruxelles.**
- 02/2022 **Universität Bonn.**
- 10–11/2021 **Mathematical Research Institute Oberwolfach**, Research in Pairs program.
- 12/2020 **Institut Henri Poincaré, Paris**, Workshop: Collective behavior of particles in fluids, online.
- 11/2020 **Mathematical Research Institute Oberwolfach**, Workshop: Classical and quantum mechanical models of many-particle systems, online.
- 10/2020 **Universität Bonn.**
- 09/2020 **École Normale Supérieure Lyon.**
- 11/2019 **Université Paris Diderot.**
- 10/2019 **RWTH Aachen.**
- 10/2019 **Université de Montpellier.**
- 07/2019 **Max Planck Institute for Mathematics in the Sciences, Leipzig.**
- 10/2018 **Universität Konstanz.**
- 02/2018 **Laboratoire Jacques-Louis Lions, Université Paris Sorbonne.**

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## Teaching Experience

- Summer 2024 **Lecture: Partial Differential Equations I**,  
Universität Regensburg.
- Summer 2024 **Seminar: Irrfahrten**,  
Universität Regensburg.
- Winter 2023/2024 **Lecture: Elliptic Partial Differential Equations**,  
Universität Regensburg.
- Summer 2023 **Lecture Partial Differential Equations I**,  
Universität Regensburg.
- Winter 2022/2023 **Mini-course (8 lectures): Optimal Transport and Applications to Mean-Field Limits**, Universität Regensburg.
- Winter 2019/2020 **Co-Advisor of Bachelor Thesis**, *Bachelor Candidate: Theresa Junkermann (Defended 02/2020)*, Thesis: Sedimentation niedrig konzentrierter Teilchensuspensionen in Fluiden, Universität Bonn.
- 2018/2019 **Co-Advisor (inofficial) of Master Thesis**, *Master Candidate: Karina Kowalczyk (Defended 09/2019)*, Thesis: Low Mach number limit of compressible fluids in domains perforated with large holes, Universität Bonn.



- Summer 2019 **Teaching assistant for Analysis II**,  
Lecturer: Prof. Dr. Margherita Disertori Universität Bonn.
- Winter 2019/2020 **Teaching assistant for Nonlinear Partial Differential Equations I**,  
Lecturer: Prof. Dr. Barbara Niethammer Universität Bonn.
- Summer 2020 **Teaching assistant for Nonlinear Partial Differential Equations II**,  
Lecturer: Prof. Dr. Juan Velázquez Universität Bonn.
- Winter 2018/2019 **Bachelorseminar: Nichtlineare Erhaltungsgleichungen – Theory der Schockwellen**,  
Universität Bonn.
- 2012 – 2018 **Tutor in exercise classes for Bachelor and Master students** Universität Bonn,  
Analysis I (Winter 2012/2013)  
Analysis II (Summer 2013)  
Analysis III (Winter 2013/2014)  
Einführung in die Partiellen Differentialgleichungen (Summer 2014)  
PDEs and Functional Analysis (Winter 2014/2015)  
PDEs and Modelling (Summer 2015)  
Nonlinear PDEs I and Nonlinear PDEs II (Winter 2015/2016 – Summer 2018).

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## Scientific responsibilities

### Research projects and grants

- 2024–2027 **Principal Investigator of the Research Training Group 2339, Interfaces, Complex Structures, and Singular Limits**, funded by the German Research Foundation (DFG).  
Universität Regensburg and Friedrich-Alexander-Universität Erlangen-Nürnberg.
- 2020 **Member of the research project BORDS, Boundaries, Oscillations, layers in Differential Systems**, funded by the French Research Foundation (ANR).  
Université de Bordeaux.
- 2016–2020 **Member of the Collaborative Research Centre 1060 (SFB 1060), The Mathematics of Emergent Effects**, Project B8: *Screening in interacting particle systems*, funded by the German Research Foundation (DFG).  
Universität Bonn.

### Organization of scientific events

- 05/2023 **Minisymposium: Emergent behavior in systems of hydrodynamically interacting particles** *GAMM Annual Meeting*, Dresden.  
Organizers: Richard Höfer, Richard Schubert
- 01/2020 **Workshop: The Mathematical Theory of Particle Suspensions** *Hausdorff Center for Mathematics*, Universität Bonn.  
Organizers: Arianna Giunti, Richard Höfer, Jonas Jansen, Juan J.L. Velázquez

### Referee activity

Journal of the European Mathematical Society,  
Archive for Rational Mechanics and Analysis,  
Probability Theory and Related Fields,  
Calculus of Variations and Partial Differential Equations,

SIAM Journal for Mathematical Analysis,  
Nonlinearity,  
Kinetic and Related Models,  
Multiscale Modelling and Simulation,  
Partial Differential Equations and Applications,  
Journal de l'École Polytechnique,  
Asymptotic Analysis,  
Nonlinear Analysis

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## Languages

German **native**  
English **fluent**  
French **advanced**