

PERSONAL INFORMATION

Full name: Tobias Grafke
Address: Mathematics Institute, Zeeman Building, University of Warwick,
Coventry CV4 7AL, UK
Nationality: German
Email: T.Grafke@warwick.ac.uk
Website: warwick.ac.uk/staff/T.Grafke

EMPLOYMENT

- **Mathematics Institute, University of Warwick**
 - Associate Professor (Reader): *since 2022* (current position)
 - Associate Professor (Senior Lecturer): *2019–2022*
 - Assistant Professor (Lecturer): *2017–2019*
- **Courant Institute of Mathematical Sciences, New York**—Courant Instructor
Feb 2015 – Aug 2017
- **Weizmann Institute of Science, Israel**—Dean of Faculty Research Fellow
March 2013 – Jan 2015
- **Ruhr University Bochum, Germany**—PhD student/Research Assistant
October 2008 – February 2013

ACADEMIC BACKGROUND

- **PhD**—Ruhr-University Bochum, Germany
September 2012
 - Topic: Lagrangian analysis of finite-time Euler singularities
- **Diploma**—Ruhr-University Bochum, Germany
September 2008
 - Topic: Existence, regularity and uniqueness of a modified Navier-Stokes equation and relation to turbulence models

FUNDING AND RESOURCES

- **DMS-EP SRC**—EP/V013319/1
PI, grant total GBP 120,000 (2020)
- **EP SRC**—EP/T011866/1
PI, grant total GBP 225,000 (2019)
- **Cathleen Morawetz Fellowship Award**—Courant Institute, New York
For best scientific achievement for postdocs at the Institute (Oct 2016)
- **Faculty Dean Fellowship**—Weizmann Institute of Science, Israel
Funding by the Dean's Fellowship (2013)

PUBLICATIONS

- [28] “*Symmetries and Zero Modes in Sample Path Large Deviations*”,
T. Schorlepp, T. Grafke, and R. Grauer, J Stat Phys **190** 50, 2023, doi:10.1007/s10955-022-03051-w
- [27] “*Mechanism for turbulence proliferation in subcritical flows*”,
A. Frishman, and T. Grafke, Proc. R. Soc. A **478** (2265), 2022, doi:10.1098/rspa.2022.0218
- [26] “*Extreme events and instantons in Lagrangian passive scalar turbulence models*”,
M. Alqahtani, L. Grigorio, T. Grafke, Phys Rev E **106** (015101), 2022, doi:10.1103/PhysRevE.106.015101
- [25] “*Spontaneous Symmetry Breaking for Extreme Vorticity and Strain in the 3D Navier-Stokes Equations*”,
T. Schorlepp, T. Grafke, S. May, R. Grauer, Phil Trans Roy Soc A **380** (2226), 2022, doi:10.1098/rsta.2021.0051
- [24] “*Dynamical landscape of transitional pipe flow*”,
A. Frishman, and T. Grafke, Phys Rev E **105** (045108), 2022, doi:10.1103/PhysRevE.105.045108
- [23] “*Dynamical Landscape and Multistability of a Climate Model*”,
G. Margazoglou, T. Grafke, A. Laio, and V. Lucarini, Proc. R. Soc. A **447** (2250), 2021, doi:10.1098/rspa.2021.0019
- [22] “*Gel'fand-Yaglom type equations for calculating fluctuations around Instantons in stochastic systems*”,
T. Schorlepp, T. Grafke, and R. Grauer, J. Phys. A: Math. Theor. **54** (235003), 2021, doi:10.1088/1751-8121/abfb26
- [21] “*Instantons for rare events in heavy-tailed distributions*”,
M. Alqahtani, and T. Grafke, J. Phys. A: Math. Theor. **54** (175001), 2021, doi:10.1088/1751-8121/abe67b
- [20] “*Approximate Optimal Controls via Instanton Expansion for Low Temperature Free Energy Computation*”,
G. Ferré and T. Grafke, SIAM Multiscale Model. Simul. **19** (3) 1310, 2021, doi:
- [19] “*Experimental Evidence of Hydrodynamic Instantons: The Universal Route to Rogue Waves*”,
G. Dematteis, T. Grafke, M. Onorato, E. Vanden-Eijnden, Phys. Rev. X **9** 041057, 2019, doi:10.1103/PhysRevX.9.041057
- [18] “*Extreme Event Quantification in Dynamical Systems with Random Components*”,
G. Dematteis, T. Grafke, E. Vanden-Eijnden, J. Uncertainty Quantification **7** (3) 1029–1059, 2019, doi:10.1137/18M1211003
- [17] “*Numerical computation of rare events via large deviation theory*”,
T. Grafke, E. Vanden-Eijnden, Chaos **29** (063118), 2019, doi:10.1063/1.5084025
- [16] “*String Method for Generalized Gradient Flows: Computation of Rare Events in Reversible Stochastic Processes*”,
T. Grafke, J. Stat. Mech **2019** 4, (043206), 2019, doi:10.1088/1742-5468/ab11db

- [15] “*Rogue waves and large deviations in deep sea*”,
G. Dematteis, T. Grafke, E. Vanden-Eijnden, Proc. Natl. Acad. Sci., 115 (5) 855-860,
2018, doi:10.1073/pnas.1710670115
- [14] “*Spatiotemporal Self-Organization of Fluctuating Bacterial Colonies*”,
T. Grafke, M. Cates, E. Vanden-Eijnden, Phys. Rev. Lett. 119, 188003, 2017, doi:
10.1103/PhysRevLett.119.188003
- [13] “*Non-equilibrium transitions in multiscale systems with a bifurcating slow manifold*”,
T. Grafke, E. Vanden-Eijnden, J. Stat. Mech **2017** 9, (093208), 2017, doi:10.1088/
1742-5468/aa85cb
- [12] “*Long Term Effects of Small Random Perturbations on Dynamical Systems:
Theoretical and Computational Tools*”,
T. Grafke, T. Schäfer, E. Vanden-Eijnden, Fields Institute Communications, In: Recent
Progress and Modern Challenges in Applied Mathematics, Modeling and Computa-
tional Science (Springer, New York, NY), 2017, doi:10.1007/978-1-4939-6969-2_2
- [11] “*Large Deviations in Fast-Slow Systems*”,
F. Bouchet, T. Grafke, T. Tangarife, E. Vanden-Eijnden, J. Stat. Phys. **162** (793),
2016, doi:10.1007/s10955-016-1449-4
- [10] “*Efficient Computation of Instantons for Multi-Dimensional Turbulent Flows
with Large Scale Forcing*”,
T. Grafke, R. Grauer, S. Schindel, Commun. Comp. Phys **18** (577), 2015, doi:10.
4208/cicp.031214.200415a
- [9] “*The instanton method and its numerical implementation in fluid mechanics*”,
T. Grafke, R. Grauer, T. Schäfer, J. Phys. A **48** (333001), 2015, doi:10.1088/
1751-8113/48/33/333001
- [8] “*Relevance of instantons in Burgers turbulence*”,
T. Grafke, R. Grauer, T. Schäfer, E. Vanden-Eijnden, Europhysics Letters **109** (34004),
2015, doi:10.1209/0295-5075/109/34003
- [7] “*Time-irreversibility of the statistics of a single particle in a compressible turbulence*”,
T. Grafke, A. Frishman, G. Falkovich, Phys. Rev. E **91** (043022), 2015, doi:10.1103/
PhysRevE.91.043022
- [6] “*Arclength parametrized Hamilton’s equations for the calculation of instantons*”,
T. Grafke, R. Grauer, T. Schäfer, E. Vanden-Eijnden, Multiscale Model. Simul. **12**
(566), 2014, doi:10.1137/130939158
- [5] “*Turbulence properties and global regularity of a modified Navier-Stokes equation*”,
T. Grafke, R. Grauer, T. Sideris, Physica D: Nonlinear Phenomena **254** (18), 2013,
doi:10.1016/j.physd.2013.03.007
- [4] “*Finite-Time Euler singularities: A Lagrangian perspective*”,
T. Grafke, R. Grauer, Appl. Math. Letters **26**, 2013, doi:10.1016/j.aml.2012.12.
004
- [3] “*Instanton filtering for the stochastic Burgers equation*”,
T. Grafke, R. Grauer, T. Schäfer, J. Phys. A **46**, 2013, doi:10.1088/1751-8113/46/
6/062002

- [2] “*Lagrangian and geometric analysis of finite-time Euler singularities*”,
T. Grafke, R. Grauer, *Procedia IUTAM* **9** (32), 2013, doi:10.1016/j.piutam.2013.09.005
- [1] “*Numerical simulations of possible finite time singularities in the incompressible Euler equations: Comparison of numerical methods*”,
T. Grafke, H. Homann, J. Dreher, R. Grauer, *Physica D: Nonlinear Phenomena* **237** (14), 2008, doi:10.1016/j.physd.2007.11.006

PREPRINTS AND OTHER PUBLICATIONS

- [A] “*Scalable Methods for Computing Sharp Extreme Event Probabilities in Infinite-Dimensional Stochastic Systems*”,
T. Schorlepp, S. Tong, T. Grafke, and G. Stadler, ArXiv:2303.11919, 2023
- [B] “*Metadynamics for transition paths in irreversible dynamics*”,
T. Grafke, A. Laio, ArXiv:2211.09476, 2023
- [C] “*A new stochastic framework for ship capsizing*”,
M.L. Bujorianu, R.S. MacKay, T. Grafke, S. Naik, E. Boulougouris, ArXiv:2105.05965, 2021
- [D] “*Numerics and analysis of Cahn-Hilliard critical points*”,
T. Grafke, S. Scholtes, A. Wagner, M. Westdickenberg, ArXiv:2104.03689, 2021
- [E] “*Sharp Asymptotic Estimates for Expectations, Probabilities, and Mean First Passage Times in Stochastic Systems with Small Noise*”,
T. Grafke, T. Schfer, and E. Vanden-Eijnden, ArXiv:2103.04837, 2021
- [F] “*European Physics News Highlight: Instanton filtering for the stochastic Burgers equation*”,
T. Grafke, R. Grauer, T. Schaefer, *European Physics News* **43**, 2013
- [G] “*Finite-time Euler singularities: A Lagrangian perspective*”,
T. Grafke, PhD thesis, 2012
- [H] “*Singularities and Turbulence in Hydrodynamical Models*”,
T. Grafke, Diploma thesis, 2008

ADMINISTRATIVE RESPONSIBILITIES

- **Research Councils** — Member of the EPSRC Mathematics Early Career Forum
- **Referee service** — Nature Comm., Math. Reviews, Proc. Natl. Acad. Sci., Proc. Royal Soc. A, Phys. Rev. Lett., Phys. Rev. Research, J. Comp. Phys., Euro. Geophys. Union, Amer. Geophys. Union, Europ. Phys. Lett., J. Stat. Phys., Chaos, J. Nonlinear Sci., J. Uncertainty Quantification, Commun. Pure Appl. Math., J. Phys. A, Nonlinearity, Phys. Rev. E, Multiscale Model. Simul., J. Sci. Comput., Physica A
- **Memberships** — German Physical Society (DPG), Society for Industrial and Applied Mathematics (SIAM), American Geophysical Union (AGU), European Geophysical Union (EGU)

TEACHING EXPERIENCE

• **University teaching:**

- Lecturer, “Rare Events” (2022)
- Lecturer, MMath MSc Projects (2019–2021)
- Lecturer, “Mathematics by Computer” (2018–2019)
- Lecturer, “Extreme Events” (2018)
- Lecturer, “Scientific Computing” (2017–2018)
- Lecturer, “Calculus 3” (2016–2017), evaluated at (4.5/5)
- Instructor, “General Relativity” (2012)
- Instructor, “Advanced Computational Methods” (2011)
- Instructor, “Quantum Mechanics” (2010)

• **Student (co-)supervision:**

- PhD Student Jiayao Shao (Ship Capsize via Dynamical Systems and Large Deviations, since 2022)
- PhD Student Nayef Shkeir (Stochastic Averaging for Atmospheric Flow, since 2019)
- PhD Student Mnerh Alqahtani (Extreme events in Passive Scalar Turbulence, 2017-2022)
- PhD Student Giovanni DeMattis (Numerical computation of extreme ocean surface elevation events/rogue waves, 2016–2019)
- PhD Student Stephan Schindel (Instanton calculus for the computation of shocks in Burgers turbulence, 2013–2016)
- Master Student Patrick Täubner (Instanton approach to transverse and longitudinal structure functions, 2016)
- Master Student Jan Friedrich (Higher order structure functions in MHD, 2012)
- Master Student Thomas Trost (Multifluid Maxwell MHD, reconnection, 2011–2012)
- Bachelor Student Nicole Raatz (Anisotropic diffusion, 2011)
- Bachelor Student Thomas Trost (Numerical simulation of grid generated turbulence, 2011)