Martin Jakob Steil

Dr. rer. nat.

github.com/MJSteil
martin-jakob-steil
0000-0001-8465-9803

Personal information

Date of birth	October 23, 1991
Place of birth	Offenbach am Main
Nationality	German

Professional experience

08/2017–12/2021	**Research associate**, *Institute for Nuclear Physics, Technische Universität Darmstadt* Study of inhomogeneous chiral condensates within the functional renormalization group (26h/week)
04/2016–09/2016 10/2011–10/2015	**Student assistant**, *Central student advisory office, Technische Universität Darmstadt* IT support, webmaster, print- and web-design (15h/week)

Education

08/2017–06/2024	**PhD in Physics**, *Technische Universität Darmstadt* Dissertation "From zero-dimensional theories to inhomogeneous phases with the functional renormalization group" under the supervision of Priv.-Doz. Dr. Michael Buballa
02/2015–07/2017	**Master of Science in Physics**, *Technische Universität Darmstadt* Master's thesis "Structure of slowly rotating magnetized neutron stars in a perturbative approach" under the supervision of Priv.-Doz. Dr. Michael Buballa
10/2011–02/2015	**Bachelor of Science in Physics**, *Technische Universität Darmstadt* Bachelor's thesis "Hadron-quark crossover and massive hybrid stars" under the supervision of Priv.-Doz. Dr. Michael Buballa
05/2011	**Abitur**, *Claus-von-Stauffenberg-Schule Rodgau*

Research profile

Dissertation

08/2024 M. J. Steil, *From zero-dimensional theories to inhomogeneous phases with the functional renormalization group*, PhD thesis, Technische Universität Darmstadt, 2024, DOI: 10.26083/tuprints-00027380

Publications

09/2022 A. Koenigstein, M. J. Steil, N. Wink, E. Grossi, J. Braun, M. Buballa, and D. H. Rischke, "Numerical fluid dynamics for FRG flow equations: Zero-dimensional QFTs as numerical test cases. I. The $O(N)$ model", *Phys. Rev. D* **106** (2022) 065012, arXiv: 2108.02504 [cond-mat.stat-mech]

09/2022 A. Koenigstein, M. J. Steil, N. Wink, E. Grossi, and J. Braun, "Numerical fluid dynamics for FRG flow equations: Zero-dimensional QFTs as numerical test cases. II. Entropy production and irreversibility of RG flows", *Phys. Rev. D* **106** (2022) 065013, arXiv: 2108.10085 [cond-mat.stat-mech]

09/2022 M. J. Steil and A. Koenigstein, "Numerical fluid dynamics for FRG flow equations: Zero-dimensional QFTs as numerical test cases. III. Shock and rarefaction waves in RG flows reveal limitations of the $N \to \infty$ limit in $O(N)$-type models", *Phys. Rev. D* **106** (2022) 065014, arXiv: 2108.04037 [cond-mat.stat-mech]

08/2022 A. Koenigstein, L. Pannullo, S. Rechenberger, M. J. Steil, and M. Winstel, "Detecting inhomogeneous chiral condensation from the bosonic two-point function in the (1 + 1)-dimensional Gross–Neveu model in the mean-field approximation*", *J. Phys. A* **55** (2022) 375402, arXiv: 2112.07024 [hep-ph]

08/2021 J. Stoll, N. Zorbach, A. Koenigstein, M. J. Steil, and S. Rechenberger, "Bosonic fluctuations in the $(1 + 1)$-dimensional Gross-Neveu(-Yukawa) model at varying μ and T and finite N" (2021), arXiv: 2108.10616 [hep-ph]

Teaching

08/2017–12/2021 **Teaching assistant**, *Department of Physics, Technische Universität Darmstadt*

- *"Quantum Field Theory II" (winter term 2019/20)*
- *"Quantum Field Theory I" (summer term 2019)*
- *"Classical Particles and Fields for Teachers" (winter term 2018/19)*
- *"Classical Particles and Fields for Teachers" (winter term 2017/18)*

08/2017–12/2021 **Supervision of theses**, *Department of Physics, Technische Universität Darmstadt*
Second referee and co-supervision of two bachelor theses

Languages

German	**fluent**	*mother tongue*
English	**fluent**	*oral and written*

Skills and qualifications

Theoretical high-energy physics	Functional renormalization group, zero-dimensional theories, strongly interacting systems, (in)homogeneoues phases, and statistical physics
Math	(Numerical) fluid dynamics, ordinary and partial differential equations, local and global minimization, high-dimensional integrals, and functional methods
Programming	Wolfram Language/Mathematica, C/C++, Python, Doxygen, and Git
Typesetting	LaTeX, Microsoft Office, and Adobe InDesign
Scientific visualization	Mathematica, Matplotlib, Axodraw2, and TikZ
Graphics design	Adobe Photoshop and Maxon Cinema 4D
Soft skill training	HGS-HIRe soft skill training program (2018-2020): • Basic Course 1: *Making an Impact as an Effective Researcher* • Basic Course 2: *Leading Teams in a Research Environment* • Basic Course 3: *Career and Leadership Development*
Drivers license	German driving license class B since 10/2008

Academic associations

08/2017–10/2024	Junior member of the *Collaborative Research Center TransRegio 211* (funded by Deutsche Forschungsgemeinschaft)
01/2018–07/2024	Member of the *Helmholtz Graduate School for Hadron and Ion Research* (HGS-HIRe)
since 08/2017	Member of the *Deutsche Physikalische Gesellschaft e. V.*

Awards

10/2019	Giersch-Excellence-Grant: in recognition of outstanding achievements in the doctoral thesis project *"Inhomogeneous Chiral Condensates within the Functional Renormalization Group"*
05/2011	GDCh-Award for the best high-school graduate in chemistry at the Claus-von-Stauffenberg-Schule Rodgau

Interests

Computer	Case modding, watercooling, and programming
Sports	Swimming, online chess, and Sudoku
Theoretical physics	Functional Renormalizationgroup, zero-dimensional theories, strongly interacting systems, in(homogeneous) phases
Artificial intelligence and machine learning	AI Art (Dall-E, Bing), AI Musik (Suno), Github Copilot und ChatGPT-Applications