KONRAD KOCKLER

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Inspire arXiv ORCID

RESEARCH EXPERIENCE

PhD research, ITP Heidelberg *since 2026*

- PhD researcher in the group "Strongly Correlated Systems" under Jan Pawlowski
- Investigating the QCD phase diagram at high baryon density using functional renormalization group methods
- Development of a momentum-dependent truncation combining a quark–gluon sector at high scales with a dynamically hadronised quark–meson sector at low scales
- Accessing non-perturbative phenomena including the critical endpoint, moat regime, and inhomogeneous phases
- Deriving experimentally testable predictions for the CBM experiment at FAIR

Bachelor and Master work, ITP Heidelberg *2023 - 2025*

- First self-consistent, manifestly Lorentz-invariant computation of spectral functions in the Quark-Meson model
- Research on spectral functions and real-time dynamics
- Scaling of the spectral function of 3d φ^4 theory close to the phase transition
- Spectral functions of the Quark-Meson model both in vacuum and at finite temperature

PUBLICATIONS

[1] Konrad Kockler, Jan M. Pawlowski, and Jonas Wessely. "Critical scaling for spectral functions". In: *Eur. Phys. J. C* 85.9 (2025), p. 950. DOI: 10.1140/epjc/s10052-025-14679-9. arXiv: 2506.09142 [hep-th].

RELEVANT RESEARCH SKILLS

Theoretical Methods

- Use of functional Renormalisation Group techniques for non-perturbative QFT
- Spectral function techniques in Minkowskian spacetime

Computational Skills

- Numerical solution of flow equations
- Inclusion both full (euclidean) momentum dependence and full effective potential
- Real-time dynamics in quantum field theory, full self-consistent inclusion of higher order scattering contributions

Programming

- Extensive use of Mathematica for the symbolical generation of flow equations
- Resulting integral-differential equations are solved numerically using Julia and C++

EDUCATION

University of Heidelberg *since 2026*
PhD in Theoretical Physics

University of Heidelberg *2023-2025*
M.Sc. Physics
Master thesis "*Self-consistent spectral functions of the Quark-Meson model at finite temperatures*"
Grade: 1.0

University of Heidelberg *2020 - 2023*
B.Sc. Physics
Bachelor thesis "*Into the scaling limit of scalar ϕ^4 theory: A spectral fRG approach*"
Grade: 1.1

WORK HISTORY AND INTERNSHIPS

Member of RF2.0 project at DESY *since 2024*

- Development of methods to reduce CO_2 emissions at datacenters with minimal impact on users
- Analysis of the carbon intensity of German electricity mix
- Quantifying the makeup and usage of the DESY datacenter, to use as model for simulating a digital twin for testing of energy saving policies

DESY summer school *16.07.24-05.09.24*

- Student internship at the IT group at DESY in Hamburg
- Work in the "Research facility 2.0" EU project

Tutor of various lectures in theoretical physics *2023 - 2025*

- Independently led weekly tutorial sessions in parallel to lectures
- Responsibilities include expanding on topics introduced during the lectures as well as discussion of exercises
- Lectures: theoretical electrodynamics (WS23/24), higher mathematics for physicists (SS24 and WS24/25) and Quantum Mechanics (SS25)