

FABIAN RENNECKE

Curriculum Vitae

(Updated: December 15, 2023)

Institute for Theoretical Physics
Justus Liebig University Giessen
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Research Interests

- ▶ **Phase structure of Quantum Chromodynamics**
QCD at high density – confinement and chiral symmetry breaking – thermodynamics and transport phenomena at finite temperature and density
- ▶ **Phenomenology of heavy-ion collisions**
particle correlations – signatures of novel phases at high density – dilepton spectra
- ▶ **Topological aspects of strongly interacting matter**
higher topological charge effects – axion dark matter – novel anomalous quark correlations
- ▶ **Nonperturbative methods in quantum field theory**
functional renormalization group techniques – effective field theories – semi-classical path integral methods – large- N and mean-field approximations
- ▶ **Critical phenomena**
Yang-Lee edge singularities – critical physics of QCD and QCD-like theories

Research Experience

- since 09/2021 **Habilitation position** (6 years, non-tenured)
Institute for Theoretical Physics, University of Giessen, Germany
- 10/2017 – 08/2021 **Research Associate**
Physics Department, Brookhaven National Laboratory, USA
Group: Nuclear Theory Group
Until 9/2019: *Research Fellow of the German Research Foundation (DFG)*
Host: Robert D. Pisarski
- 9/2016 – 9/2017 **Postdoctoral Researcher**
Institute for Theoretical Physics, Heidelberg University, Germany
Groups: Jan M. Pawłowski and Stefan Floerchinger
- 8/2015 – 8/2016 **Postdoctoral Researcher**
Institute for Theoretical Physics, University of Giessen, Germany
Group: Bernd-Jochen Schaefer
- 6/2014 – 9/2014 **Visiting Researcher**
Physics Department, Brookhaven National Laboratory, USA
Host: Robert D. Pisarski

Education

- 2012 – 2015 **Dr. rer. nat. (Ph.D.) in Physics**, Heidelberg University, Germany
Thesis: *The Chiral Phase Transition of QCD*
Advisor: Jan M. Pawłowski
- 2006 – 2012 **Diplom (M.Sc.) in Physics**, Heidelberg University, Germany
Thesis: *Renormalization Group Study of the Chiral Phase Transition in QCD*
Advisor: Jan M. Pawłowski

Funding and Grants

- 10/2017 – 9/2019 **Research Fellowship** (“Forschungsstipendium”)
German Research Foundation (DFG), ~ €82k
Project: *Signatures of the QCD Phase Diagram* [\[Link\]](#)
- 5/2014 – 8/2014 **Research Grant** “HGS-HiRe Abroad”
Helmholtz Graduate School for Hadron and Ion Research (HGS-HiRe), ~ €3k
- 2/2012 – 7/2015 **Ph.D. Scholarship**
Helmholtz Graduate School for Hadron and Ion Research (HGS-HiRe), ~ €68k

Publications

34 publications, 1284 citations, h-index: 19 (as of December 15, 2023; source: [\[INSPIRE\]](#))

Selected publications:

- ▶ *Particle Interferometry in a Moat Regime*
F. Rennecke, R. D. Pisarski and D. H. Rischke
Phys. Rev. D 107, 116011, [arXiv:2301.11484](#) (2023)
- ▶ *Signatures of Moat Regimes in Heavy-Ion Collisions*
R. D. Pisarski and **F. Rennecke**
Phys. Rev. Letters, 127, 152302, [arXiv:2103.06890](#) (2021)
- ▶ *Universal location of the Yang-Lee edge singularity in $O(N)$ theories*
A. Connelly, G. Johnson, **F. Rennecke** and V. Skokov
Phys. Rev. Letters, 125, 191602, [arXiv:2006.12541](#) (2020)
- ▶ *Higher Topological Charge and the QCD Vacuum*
F. Rennecke
Phys. Rev. Research, 2, 033359, [arXiv:2003.13876](#) (2020)
- ▶ *Multi-Instanton Contributions to Anomalous Quark Interactions*
R. D. Pisarski and **F. Rennecke**
Phys. Rev. D 101, 114019, [arXiv:1910.14052](#) (2019)
- ▶ *The QCD Phase Structure at Finite Temperature and Density*
W.-j. Fu, J. M. Pawłowski and **F. Rennecke**
Phys. Rev. D 101, 054032, [arXiv:1909.02991](#) (2019)
- ▶ *Strangeness Neutrality and Baryon-Strangeness Correlations*
W.-j. Fu, J. M. Pawłowski and **F. Rennecke**
Phys. Rev. D 100, 111501(R), [arXiv:1809.01594](#) (2018)

- ▶ *In-Medium Spectral Functions of Vector- and Axial-Vector Mesons*
C. Jung, **F. Rennecke**, R.-A. Tripolt, L. von Smekal and J. Wambach
Phys. Rev. D 95, 036020, [arXiv:1610.08754](https://arxiv.org/abs/1610.08754) (2016)
- ▶ *From Quarks and Gluons to Hadrons: Chiral Symmetry Breaking in Dynamical QCD*
J. Braun, L. Fister, J. M. Pawłowski and **F. Rennecke**
Phys. Rev. D 94, 034016, [arXiv:1412.1045](https://arxiv.org/abs/1412.1045) (2014)

A complete list of publications can be found under:

<http://inspirehep.net/author/profile/Fabian.Rennecke.1>

Talks and Seminars

49 talks in total, 11 invited/plenary talks at conferences and workshops, 14 invited seminar talks

Invited/plenary talks:

- 21/11/2023 *Criticality in QCD*
Seminar: Wigner Research Centre, Budapest, Hungary
- 06/11/2023 *Criticality in QCD*
Seminar: Goethe University Frankfurt, Germany
- 22/05/2023 *Correlations in a Moat Regime*
Workshop: From First-Principles QCD to Experiments
ECT* Trento, Italy
- 01/02/2023 *Interferometry in a Moat Regime*
Seminar: Technical University Munich, Germany
- 15/03/2022 *Exotic phases in Heavy-ion Collisions*
(joint seminar with R. D. Pisarski)
Seminar: RHIC Beam Energy Scan: Theory and Experiment (online)
- 08/11/2021 *Moat Regimes & their Signatures in Heavy-Ion Collisions*
Workshop: XXXIII International Workshop on High Energy Physics
Kurchatov Institute, Protvino, Russia (online)
- 09/09/2021 *Higher Topological Charge Effects in QCD and Beyond*
Workshop: Topological Aspects of Strong Correlations and Gauge Theories
International Centre for Theoretical Sciences, Bengaluru, India (online)
- 13/04/2021 *The Effects of Higher Topological Charge in QCD*
Seminar: University of Minnesota, Minneapolis, USA (online)
- 11/03/2021 *The Effects of Higher Topological Charge in QCD*
Seminar: Stony Brook University, Stony Brook, USA (online)
- 26/02/2021 *The Effects of Higher Topological Charge in QCD*
Seminar: University of Maryland, College Park, USA (online)
- 16/11/2020 *The Functional RG: Universality and Emergence*
Workshop: Renormalization Group Approaches to the Many-Body Problem,
Institute for Nuclear Theory, Seattle, USA (online)
- 03/11/2020 *QCD from an FRG Perspective*
Conference: Exact Renormalization Group 2020
Kyoto University, Japan (online)

- 07/01/2020 *The Myriad Uses of Instantons*
Seminar: Bielefeld University, Germany
- 01/04/2019 *Aspects of the QCD Phase Diagram*
Workshop: Functional Methods in Strongly Correlated Systems
Hirschegg, Austria
- 14/12/2018 *Strangeness Neutrality and the QCD Phase Structure*
Seminar: University of Illinois at Chicago, USA
- 27/11/2018 *Strangeness Neutrality and the QCD Phase Structure*
Seminar: University of Minnesota, Minneapolis, USA
- 26/09/2018 *Strangeness Neutrality and the QCD Phase Structure*
Conference: The Critical Point and Onset of Deconfinement Conference (CPOD)
Corfu, Greece
- 19/09/2018 *Strangeness Neutrality and the QCD Phase Structure*
Seminar: Technical University Darmstadt, Germany
- 18/09/2018 *Strangeness Neutrality and the QCD Phase Structure*
Seminar: Goethe University Frankfurt, Germany
- 11/09/2018 *Review of Critical Point Searches and Beam-Energy Studies*
Conference: Hot Quarks 2018
Texel, The Netherlands
- 26/07/2018 *Strangeness Neutrality and the QCD Phase Structure*
Workshop: QCD Continuum Field Theory Approaches and their Applications
Dalian, China
- 03/04/2018 *Strangeness Neutrality and the QCD Phase Structure*
Workshop: From Correlation Functions to QCD Phenomenology,
Bad Honnef, Germany
- 21/08/2017 *Towards Fluctuations in 2+1 Flavor QCD*
Workshop: Functional Methods in Hadron and Nuclear Physics
ECT* Trento, Italy
- 09/02/2016 *From Quarks and Gluons to Hadrons: Chiral Symmetry Breaking in QCD*
Seminar: University of Helsinki, Finland
- 12/06/2015 *The Vacuum Structure of Vector Mesons in QCD*
Seminar: University of Giessen, Germany

Teaching Experience

Supervision of students:

- 6/2020 – 6/2023 Ph.D. co-supervision of **Gregory Johnson**,
North Carolina State University, USA,
Thesis: *The Universal Location of The Yang Lee Edge Singularity for $O(N)$
Universality Classes*
- 3/2023 – 4/2023 Research internship supervision of **Timothy Herl**,
University of Giessen, Germany
- 3/2022 – 9/2022 Bachelor thesis supervision of **Maximilian Hänsch**,
University of Giessen, Germany,
Thesis: *Analytic Structure of Effective Low-Energy Models of QCD*

8/2015 – 7/2016 M.Sc. co-supervision of **Simon Resch**,
University of Giessen, Germany,
Thesis: *Mass Sensitivity of the QCD Phase Structure*

Lectures:

Winter term 23/24 *Quantum Field Theory II*,
University of Giessen, Germany

09-13/10/2023 *The Functional Renormalization Group, Critical Phenomena & QCD*,
Joint CRC-TR 211 & HGS-HiRe Lecture Week,
Rauischholzhausen, Germany

25-28/09/2023 *The Functional Renormalization Group and Critical Phenomena*,
CRC 1225 IsoQuant YRC Retreat, Baiersbronn, Germany

11-14/04/2022 *Dense Strongly Interacting Matter*,
HGSFP Graduate Days, Heidelberg University, Germany

Summer term 16 *The Theory of Electrodynamics and Thermodynamics* (substitute),
University of Giessen, Germany

Winter term 15/16 *The Theory of Thermodynamics* (substitute),
University of Giessen, Germany

Service to the Scientific Community

- ▶ **Organizer:** *12th International Conference on the Exact Renormalization Group (ERG2024)*,
Conference in Les Diablerets, Switzerland (~200 participants), co-organized with L. Classen,
N. Defenu and L./ Zambelli (22 – 27/09/2024)
- ▶ **Organizer:** *Functional Methods in Strongly Correlated Systems (FunSCS)*, Workshop in
Hirschegg, Austria (38 participants), co-organized with M. Buballa and N. Wink
(22 – 26/05/2023)
- ▶ **Organizer:** *FunQCD*, Hybrid Workshop in Valencia, Spain (97 participants), co-organized
with C. Aguilar, D. Ibanez, J. Papavassiliou, J. M. Pawłowski and R. D. Pisarski (13– 17/04/2022)
- ▶ **Organizer:** Weekly seminar *Lunch Club*, Institute for Theoretical Physics, University of
Giessen, Germany (09/2021 – present)
- ▶ **Organizer:** *FunQCD: from first principles to effective theories*, Online Workshop (156 par-
ticipants), co-organized with C. Aguilar, J. Papavassiliou, J. M. Pawłowski and R. D. Pisarski
(29/03 – 01/04/2021)
- ▶ **Organizer:** Weekly seminar *Cold Quantum Coffee*, Institute for Theoretical Physics, Hei-
delberg University, Germany (2012 – 2014)
- ▶ **Peer review:** Referee for Phys. Rev. Letters, Phys. Rev. C, Phys. Rev. D and Phys. Lett. B