Mathias Driesse

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EDUCATION

PhD in Physics
Oct. 2023 – present

Humboldt University of Berlin, Supervisor: Prof. Dr. Jan Plefka

- **Research Topic:** High Precision Gravitational Wave Physics from a Worldline Quantum Field Theory
- **Relevant courses:** Scattering Amplitudes, String Theory
- Candidate Associate Member of Research Training Group 2575: Rethinking Quantum Field Theory
- Main author on 19 Mcore-h proposal at the supercomputer NHR@ZIB

MPhys (Hons) Theoretical Physics with First Class Honours
Sept. 2019 – July 2023

University of Edinburgh

- **Master's Project:** deriving the Reissner-Nordström metric from scattering amplitudes in quantum field theory under Prof. Donal O'Connell
- **Relevant courses:** Quantum Field Theory, General Relativity, Gauge Theories in Particle Physics, Advanced Statistical Physics
- **Awards:** Certificate of Merit for excellent performance, Edinburgh Award for Representing Students

Exchange Student (GPA: 4.0)
Sept 2021 – June 2022

California Institute of Technology

- **Relevant courses:** Advanced Condensed Matter Physics, Quantum Computation, Quantum Hardware and Techniques

PUBLICATIONS

M. Driesse *et al.* High-precision black hole scattering with Calabi-Yau manifolds, arXiv preprint.

M. Driesse *et al.* Conservative Black Hole Scattering at Fifth Post-Minkowskian and First Self-Force Order, *Phys. Rev. Lett.* **132**, 241402 (2024). *Editor's Suggestion*

Ning, H., Mehio, O., Li, X., ... **Driesse, M.**, ... Hsieh, D. A coherent phonon-induced hidden quadrupolar ordered state in Ca_2RuO_4, *Nat. Comm.* **14**, 8258 (2023).

PROFESSIONAL AND RESEARCH EXPERIENCE

Summer Undergraduate Research Fellow
June 2022 – August 2022

California Institute of Technology

- Performed THz pump-probe time-domain spectroscopy on Mott insulators, handling lasers and vacuum devices and analyzing data
- Designed and constructed new THz time-domain spectroscopy equipment
- Simulated effects of Floquet engineering Kitaev material candidate α-$RuCl_3$ using density functional theory
- Transfered tools developed for α-$RuCl_3$ to analyze phonon eigenmodes and their effects in Mott insulators, in agreement with experimental results
- Evaluated feasibility of performing metamaterial-enhanced Floquet engineering

Summer Student
June 2021 – August 2021

CERN

- Remote internship with ALPHA collaboration
- Researched existing literature for methods on simulating low-energy positron beams
- Developed simulations of longitudinal beam dynamics of positrons, extending existing models
- Investigated beam bunching (focusing) and simulated practical implementations thereof, leading to a potential $10\times$ improvement in positron transfer capabilities
- Summarized research progress in final report: Longitudinal Dynamics of Positron Beams in the ALPHA Antihydrogen Experiment http://cds.cern.ch/record/2779405

Volunteering and Extracurricular Activities

AI Competition Finalist April 2022
ClimateHack & Open Climate Fix
- Designed, implemented, and tested CNN models for cloud coverage nowcasting
- Mastered frameworks such as Pytorch, Tensorflow, Pytorch Lightning, Keras

Simulations Team Engineer Sept. 2020 – May 2021
HYPED – University of Edinburgh Hyperloop Society
- Collaborated with fellow students and industry professionals to create COMSOL Multiphysics simulations of various components of the Hyperloop pod
- Developed a genetic algorithm to create and evaluate the optimal shell shape
- Applied Solidworks, Matlab and Comsol Livelink for Matlab to automate changes in the structure to speed up the algorithm

Professional Skills

Languages: English (native), French (native), German (fluent); Chinese ($\sim$B1)

Programming languages: Python (numpy, scipy, pandas), Mathematica, MATLAB, C++

Software: Quantum ESPRESSO, phonopy, yambo, COMSOL Multiphysics, LabView

Various computer skills: Remote working, data science, MS Office, VS Code, Linux, LaTeX, WSL2, Docker, bash, git, HPC

References: Jan Plefka, jan.plefka@physik.hu-berlin.de, Donal O'Connell, donal.o'connell@ed.ac.uk; David Hsieh, dhsieh@caltech.edu