

Mathias Driesse

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EDUCATION

MPhys (Hons) Theoretical Physics (88% – 1st Class)

Sept. 2019 – Present

University of Edinburgh

- **Master's Project:** deriving the Reissner-Nordström metric using the double copy method 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

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 -RuCl₃ using density functional theory
- Transferred tools developed for α -RuCl₃ 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× 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>

Scientific Assistant

July 2020 – April 2021

Fraunhofer Institute for the Mechanics of Materials

- Completed an online course on density functional theory and ab-initio electronic structure computation codes
- Independently developed a Quantum ESPRESSO plugin for the EU SimPhoNy project:
<https://github.com/simphony/quantum-espresso-wrapper>
- Acted as a scientific advisor for developers on the EU INTERSECT project for Device-to-Material and Material-to-Device modelling of nanoscale electronics, summarizing and explaining scientific papers

PUBLICATIONS

Ning, H., Mehio, O., Li, X., ... **Driesse, M.**, ... Hsieh, D. Light-induced switch of spin-orbit-coupled quadrupolar order in Ca₂RuO₄, submitted to *Nature Communications*

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 (~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, L^AT_EX, WSL2, Docker, bash, git, HPC

References: Donal O’Connell, donal.o’connell@ed.ac.uk; David Hsieh, dhsieh@caltech.edu