Dr Matthew J. Doyle

Physicist & Scientific Software Developer

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Physicist and scientific software developer with a PhD in condensed matter physics. Developed numerical models, automated scientific data pipelines and experimental image-processing tools using Python, Fortran and C++. Combined research with AI model training, cross-platform application development and maths and physics education.

Experience

AI Trainer / RLHF Specialist, Self-employed

Remote, UK · 2025–Present

- Created training datasets and evaluation rubrics for complex physics, mathematics, programming and critical-reasoning tasks, contributing to frontier language-model training and fine-tuning.
- Provided expert instruction and corrections for model use of Google Workspace and Microsoft Office, with a focus on macOS-specific features and workflows.
- Undertook independent AI training work through Outlier AI, DataAnnotation and Pareto AI.

Maths and Physics Tutor, Self-employed / Luminary Education

Remote, UK · 2024–Present

- Tutored more than 60 students, typically delivering 25–30 contact hours per week across GCSE, A-Level, IB, SAT and AP, including AP Calculus AB/BC.
- Created individual learning plans using subject assessments and analysis of past examination scripts.
- Authored bespoke homework, revision guides and teaching resources in LaTeX.
- Supported students transitioning from European curricula into the UK education system.
- Maintained a cross-exam-board question database, coordinated lessons across time zones and wrote progress reports for parents and teachers.
- Developed a TypeScript tutoring website with a contact form and interactive practice quizzes.

PhD Researcher, University of Manchester

Manchester, UK · Oct 2020–Apr 2025

- Developed numerical models of quantum turbulence and experimental methods for visualising superfluid flow, combining scientific software, statistical analysis and low-temperature instrumentation.
- Managed the group's network data storage and connected HPC nodes and Linux laboratory computers to centralised storage.
- Coordinated research with academics, technicians and suppliers, adapting the programme during COVID-19 laboratory closures and liquid-helium shortages.

Graduate Teaching Assistant, University of Manchester

Manchester, UK · 2021–2024

- Delivered foundation-year physics tutorials for classes of approximately 20 and supervised undergraduate physics and computing laboratories.
- Led Python programming workshops, teaching coding fundamentals and practical problem solving.
- Guided experimental projects and assessed laboratory and programming assignments, providing structured feedback.
- Mentored and trained new GTAs as resident physics-laboratory GTA mentor in 2023–2024 and served as the first contact for escalated student problems.

Education

PhD, Condensed Matter Physics

2020–2025

University of Manchester, EPSRC-funded, Quantum Fluids Group

Thesis: Numerical Simulation and Experimental Visualisation of Quantum Turbulence in the Zero Temperature Limit

MSci Physics, First Class Honours

2016–2020

University of Bristol

Dissertation: Tracking at Lepton Colliders

A-Level

2014-2016

South Nottinghamshire Academy Sixth Form, A*AA in Maths, Further Maths, and Physics

Research Projects

Quantum turbulence in rough channels at the zero-temperature limit, PhD

Manchester, UK · 2020–2025

- Developed and adapted Fortran vortex-filament simulations with boundary algorithms and adaptive mesh routines.
- Reduced simulation runtimes from months to days by excluding negligible far-field contributions.
- Built Python processing and visualisation pipelines for individual runs generating approximately 40,000 files and 35 GB of raw data.
- Applied Biot–Savart and Local Induction models, Adams–Bashforth integration, finite differences and FFT spectral analysis; used OpenMP, MPI and HPC resources.
- Benchmarked a Barnes–Hut tree algorithm against a spatial cut-off approach.
- Determined effective momentum-transfer viscosity of $\nu_m = (0.12 \pm 0.01)\kappa$ for $\mathrm{Re} < 150$, and demonstrated velocity profiles resembling laminar Poiseuille flow with finite wall slip.

Experimental imaging and particle tracking, PhD

Manchester, UK · 2020–2025

- Built Python image-processing pipelines using OpenCV, pandas, SciPy and scikit-learn for high-noise, high-density particle images.
- Combined filtering, spline-based background estimation, sub-pixel centroiding, Gaussian-mixture classification and multi-frame trajectory linking.
- Checked detections and trajectories using visual overlays and assessed sensitivity to processing settings.
- Operated a rotating cryostat, laser optics and an intensified sCMOS camera at up to 990 fps; visualised particles down to 140 mK.
- Trained an undergraduate research intern in cryogenic operation, experimental safety and Python image processing.

Superfluid helium-4 rough-channel flow: apparatus design and calibration, PhD

Manchester, UK · 2020–2025

Design and calibration work completed; the pipe-flow programme was subsequently cancelled.

- Designed a helical pipe-flow experimental cell in CAD and collaborated with technicians on construction.
- Built and benchmarked low-noise AC pressure-transducer readout circuits; an alternative transformer bridge reduced zero-pressure noise by approximately a factor of two.
- Characterised sensor response at 294 K and 77 K, achieving pressure resolution around 10^{-4} mbar.
- Built a Python dashboard using PyVISA, PyQt4 and Matplotlib for live data visualisation and remote experiment operation.
- Procured equipment, operated dilution-refrigerator apparatus and performed leak testing.

Quantum vortex capture with a NEMS probe in superfluid helium-3, Visiting Researcher

Aalto University, Low Temperature Laboratory, Helsinki · May 2023

- Analysed experimental time series in MATLAB to guide experiments on vortex capture by a nanoelectromechanical probe.
- Investigated vortex retention as a function of temperature up to the superfluid phase boundary.

Tracking at Lepton Colliders, MSci

Bristol, UK · 2019–2020

Evaluated C++ and Python track-reconstruction algorithms for particle trajectories after high-energy electron–positron collisions in simulated CERN detector geometry, informing detector-design optimisation. Awarded a commendation for outstanding final-year research.

Marching Cubes for Fermi Surfaces, Summer internship

2019

- Implemented Marching Cubes 33 in Fortran 90 with a modular tight-binding engine for simple cubic, BCC, FCC and hexagonal lattices.
- Parallelised vertex finding with OpenMP and visualised Fermi surfaces using ggplot and Matplotlib.
- Achieved mean absolute energy error around 10^{-12} eV in analytical vertex benchmarks, approximately eight orders below the scikit-image comparison at a 100^3 grid.

Repository and benchmarks

Other Projects

webVort 2026

Implemented a real-time browser simulator of quantised vortex dynamics in TypeScript and React, adapting the Vortex Filament Method for teaching and outreach. Simulated solid-boundary pinning and vortex reconnections in an interactive web application.

TypeScript, React · Live demo

IC2V 2025

Built a cross-platform Python application that converts ordered image collections into MP4, MOV, WebM and animated GIF files using FFmpeg. Provided a Typer command-line interface and PySide6 desktop application for stop-motion, animation, timelapse and batch processing. Added unit and integration tests, with GitHub Actions running real encoding tests on Ubuntu, Windows and macOS.

Python, Typer, PySide6, Pillow, FFmpeg, GitHub Actions · Repository

LabFit 2025

Authored and packaged a pip-installable Python library for least-squares regression, automated error propagation and plotting. Built on NumPy, SciPy and Matplotlib, with documentation and examples for physics students.

Python, NumPy, SciPy, Matplotlib · Documentation

Physics Advent Calendar Dec 2025

Created a physics-themed advent calendar for the 2025 Christmas season, featuring a daily physics puzzle. Written in HTML, CSS and JavaScript.

QFS2023 Conference Manchester, UK · Aug 2023

Member of organising committee for the 23rd International Conference on Quantum Fluids and Solids

- Organised conference photography and banquet music.
- Coordinated speaker invitations and delegate reception.
- Facilitated live audience engagement by coordinating handheld audio transmission during Q&A proceedings.

Publications

Apparatus to visualize flows in superfluid ^{4}He below 1 K 2026

I. Skachko, J. A. Hay, C. O. Goodwin, **M. J. Doyle**, W. Guo, P. M. Walmsley, A. I. Golov

Review of Scientific Instruments, 97, 083702 · DOI: 10.1063/5.0331632

The motion of tracer particles in turbulent superfluid ^{4}He down to the zero-temperature limit 2026

C. O. Goodwin, **M. J. Doyle**, J. A. Hay, I. Skachko, W. Guo, P. M. Walmsley, A. I. Golov

Preprint — arXiv:2604.00707 · View preprint

Modelling Turbulent Flow of Superfluid ^{4}He Past a Rough Solid Wall in the $T = 0$ Limit 2024

M. J. Doyle, A. I. Golov, P. M. Walmsley & A. W. Baggaley

Journal of Low Temperature Physics, 215(5–6), 452–464 · DOI: 10.1007/s10909-024-03073-6

Achievements

Best Poster Award — QFS2023 2023

International Conference on Quantum Fluids and Solids

Received one of the conference's poster awards for Modelling turbulent flow of superfluid ^{4}He past a rough solid wall in the $T = 0$ limit.

Final Year Project Commendation 2020

University of Bristol

Commendation for outstanding MSci research, Tracking at Lepton Colliders.

Cryogenics Training — Cryocourse May 2023

Completed low-temperature physics training.

Technical Toolkit

Languages	Python, Fortran, C++, TypeScript, JavaScript, Bash, SQL, HTML/CSS, MATLAB, Rust.
Scientific Python	NumPy, SciPy, pandas, Matplotlib, OpenCV, scikit-learn.
Numerical and research computing	Vortex Filament Model, Biot–Savart, adaptive meshes, finite differences, FFTs, least-squares regression, error propagation, OpenMP, MPI, HPC, Linux.
Web development	React, Vite, Tailwind CSS, Framer Motion, React Router, Node.js, npm/pnpm, GitHub Pages.
Desktop and media	PySide6, PyQt4, Typer, Pillow, FFmpeg, PyInstaller, Inno Setup.
Development and testing	VS Code, Git, GitHub Actions, Docker, WSL, CMake, Make, Jupyter, PowerShell, unit and integration testing.
Data and infrastructure	SQLite, PostgreSQL, Samba, Tailscale, SSH.
Physics software	OriginLab, gnuplot, ROOT, Geant4, OpenFOAM, LabVIEW.
Laboratory and instrumentation	CAD, dilution refrigerators, rotating cryostats, laser alignment, intensified cameras, optical fibre bundles, nanopositioners, ultrasonic transducers, pressure sensors, vacuum gauges, lock-in amplifiers, PyVISA, leak testing.
Writing and productivity	LaTeX, Markdown, Google Workspace, Excel, PowerPoint, Overleaf, Zotero, Obsidian, Notion, Teams, Zoom, Acrobat.