Oliver Burch

Undergraduate Theoretical Physicist
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PROFILE

Third-year theoretical physics undergraduate at the University of Sheffield (Level 2 average 83.75%) with supervised research in molecular dynamics and movement ecology, and self-led simulation work in plasma and particle physics. Particularly interested in quantum theory and field theory. Seeking a funded PhD position from autumn 2027.

EDUCATION

MPhys Theoretical Physics — University of Sheffield

September 2024 – Present (BSc exit possible 2027; MPhys expected 2028)

Level 2 credit-weighted average: 83.75%. Key modules: Classical & Quantum Optics (96%) · Differential Equations (88%) · Special Relativity & Subatomic Physics (86%) · Classical & Quantum Physics (84%) · Mathematical Modelling (80%)

Current Level 3 modules: Mathematical Physics · Statistical Physics · Particle Physics · Dark Matter and the Universe · Advanced Programming in Python · Topics in Mathematical Biology

A-Levels — Chatham and Clarendon Grammar School, Ramsgate

September 2022 – June 2024

Further Mathematics (A), Mathematics (A), Physics (A), History (A).

RESEARCH EXPERIENCE

Level 3 Research Project: Molecular Dynamics of Drug–DNA Binding

Undergraduate Researcher, supervised by Prof. Sarah Harris | Autumn 2026 – Present

Running AMBER molecular dynamics simulations of drug–DNA binding, testing whether a staged NPT, NVT then NVE protocol reduces the noise that the thermostat and barostat introduce into binding free energy calculations.

What Can a Language Model Do for a Movement Ecologist? Reading Data and Generating Hypotheses

Summer Researcher (UGRE internship), supervised by Prof. Jonathan Potts & Dr Wei Xing | Summer 2026

Benchmarked four language models on GPS telemetry from the Ya Ha Tinda elk herd (234 elk-years, 2001–2020) across two studies: recovering a known migrant/resident split from the data under three framings, and generating hypotheses from dataset inventories diluted with decoys. Built the data pipeline and collection harness and scored 72 responses against pre-registered rubrics. Presented as a talk (September 2026), awarded second place in the UGRI talks, and as the poster *Error Detection by Language Models Depends More Heavily on the Vendor than the Prompt*, entered in the UGRI poster competition.

SELECTED COURSEWORK PROJECTS

A Topological Assessment of the RK4 Method for Chaotic Driven Damped Pendulums

Supervised by Prof. Mark Quinn | April 2026

Assessed RK4's performance on a chaotic damped driven pendulum, capturing topological features including braiding and unstable periodic orbits.

Your Future, Quantised: The Practical Superpowers of Quantum Mechanics

Co-author (group review), supervised by Prof. Matt Meers | March 2026

Reviewed current and future quantum technologies, focusing on their contributions to the UN Sustainable Development Goals.

On the Components of Kinetic Energy During a Barostatted Molecular Dynamics Simulation of Methanol Diffusion in Water

Supervised by Prof. Sarah Harris | December 2025

Ran a barostatted AMBER simulation of methanol in TIP3P water with SHAKE constraints to estimate the translational, rotational and vibrational components of the methanol molecules' kinetic energy.

All papers, the poster and the talk slides are available in full at olivergtburch.com

SELF-LED PROJECTS

Particle-in-Cell Simulation of Laser-Driven Wakefields in Dense Plasma

EPOCH | Built from source

Simulated a high-intensity laser pulse travelling through dense plasma and extracted the longitudinal accelerating wakefield it generates.

Microscopic Black Hole Decay and Parton Hadronisation

QBH + Pythia8

Linked QBH black hole production to Pythia8 parton showering to model hadronisation of the decay products into jets in a detector event display.

Detector-Level Simulation of Neutralino Dark Matter Signatures

MadGraph + Delphes

Generated parton-level neutralino production with MadGraph and applied Delphes detector simulation to calculate the observable missing transverse energy.

TECHNICAL SKILLS

Programming & Software	Python (NumPy, Matplotlib, pandas) · LaTeX · AMBER, including basic command-line workflows
Research Interests	Quantum Mechanics · Quantum Field Theory · Statistical Thermodynamics · Computational Physics · Quantum Optics
Professional Skills	Scientific Writing & Presentation · Data Visualisation · Critical Analysis · Chairing & Minute-Taking

EMPLOYMENT

Barista — IC Café, University of Sheffield
2025 – Present
Prepared coffee and hot food in a fast-paced university café; developed time management skills and strengthened interpersonal communication in a customer-facing role.

Bar Staff — Harpers Cocktail Bar, Broadstairs
Summer 2024
Learned 35 cocktails within a month to serve customers at a high-volume festival two months after starting. Operated with limited staff, requiring speed, composure and independent judgement under pressure.

Front of House & Barista — Archive Coffee Store & Home Kitchen, Ramsgate
April 2023 – February 2024
Worked across front of house, bar and kitchen support roles. Built strong customer service skills, particularly around dietary requirements and allergy awareness.

VOLUNTEERING

ACT (Action Community Thanet), Ramsgate
April 2021 – December 2023
Chaired and minute-took youth-led meetings; sat on hiring committee for youth centre leadership. Co-organised a charity fundraiser for MPS raising £349.80; ran two sleep-outs for Thanet Shelter and Support; ran 15 km raising £50 to keep the local youth centre open.

Movember Foundation
Ongoing
Participated in two charity rugby matches, raising awareness of men's health issues among hundreds of attendees. Shaved my head to fundraise, generating over £200 for the charity.

Physics Group Chair — Chatham and Clarendon Grammar School
2023 – 2024
Delivered presentations and interactive problem-solving sessions to A-level students, including olympiad-style problem classes, to encourage engagement with physics beyond the curriculum.

ACHIEVEMENTS & INTERESTS

- Second place in the UGRI research talks, University of Sheffield (2026)
- 10 years of guitar experience; performed with groups SUNPYG and Spiral Eyes
- Sold photography at an art exhibition raising funds for a local redevelopment project
- Interests: Lacrosse, model building, reading (currently: *Quantum Field Theory for the Gifted Amateur*), walking