Employment

- 2025-now Research Fellow, University of Nottingham
 I am studying non-equilibrium quantum many-body physics from a circuit perspective, jointly supervised by Adam Gammon-Smith, Juan P. Garrahan, Bruno Bertini, and Igor Lesanovsky.

 2022. 2025 Research Fellow, University of Loads with Zlatka Danié
- 2023–2025 **Research Fellow**, *University of Leeds*, with Zlatko Papić Working with the Theory Group of the School of Physics and Astronomy, I researched out-of-equilibrium phenomena such as Hilbert space fragmentation in lattice gauge theories and many-body localisation using diverse numerical techniques such as exact diagonalisation, tensor networks, perturbation theory, Clifford circuits, and the real-space renormalisation group.

Education

- 2019–2023 **PhD, Condensed Matter Physics**, *University College London*, with Arijeet Pal Studied out-of-equilibrium phenomena in quantum mechanics, in particular quantum scars and many-body localisation, focusing on systems hosting symmetry-protected topological (SPT) order and their stabilisation at finite temperature via the mechanism of ergodicity breaking.
- 2015–2019 **BA, MSci Natural Sciences**, *University Of Cambridge*, Senior Scholar, First Class **Top-ranked First** in third year ("Part II"), Part II Hartree and Clerk Maxwell Prizewinner. Scored 95% overall in second-year Maths. Very high Firsts in all four years. See Research Experience for Master's project details.

Research Experience

- 2018–2019 **Master's Project**, *Cambridge University*, with Ulrich Schneider Investigating edge states in a 2D eightfold quasicrystal through exact diagonalisation methods at the Atomic, Mesoscopic & Optical Physics (AMOP) group. The quasicrystal, with 4 independent lattice directions, provides access to topological properties normally confined to four spatial dimensions: the project included investigating these properties and searching for signatures that could be realised experimentally.
 - 2018 **Summer Research Student**, *Cambridge University*, with Claudio Castelnovo Using Monte-Carlo simulations in C⁺⁺, I investigated the effect of correlated hopping on the dynamics of spin ice, with the aim of resolving a discrepancy between theory and experiment in the magnetic susceptibility at low temperatures.

Publications

- 2025 Hilbert space fragmentation at the origin of disorder-free localization in the lattice Schwinger model, Commun. Phys. 8, 172 (2025), first author, featured selection Recent works have reported potential disorder-free localization in the lattice Schwinger model. Using degenerate perturbation theory and numerical simulations based on exact diagonalization and matrix product states, we identify the origin of a claimed ultraslow growth of entanglement as due to an approximate Hilbert space fragmentation and an emergent dynamical constraint on particle hopping.
- 2023 Ergodicity breaking and stabilisation of quantum order, PhD Thesis
- 2023 Renormalisation view on resonance proliferation between many-body localised phases, Phys. Rev. B **108**, 094205, first author

In this work, we study the statistical properties of many-body resonances in a disordered interacting Ising chain – which can host symmetry protected topological order – using a Clifford circuit encoding of the real space renormalisation group. We show that both MBL phases present remain stable to resonances, but in the vicinity of the transition between them localisation is destabilised by resonance proliferation.

2021 Quantum scars and bulk coherence in a symmetry-protected topological phase, Phys. Rev. B 104, 014424, first author

Quantum many-body scars provide a novel mechanism for enhancing coherence of weakly entangled states; while coherent edge modes in certain symmetry protected topological (SPT) phases can persist away from the ground state. We uncover many-body scars and their implications on bulk coherence in such an SPT phase, shedding light on their role in preserving SPT order at finite temperature and the possibility of coherent bulk dynamics in models with SPT order beyond long-lived edge modes.

Talks and Posters

- Apr. 2025 **Poster**, *Hilbert Space Fragmentation and Disorder-Free Localisation in a Lattice Gauge Theory*, QuSymDyn (Munich)
- Sep. 2024 **Posters**, *Quantum Circuit Analysis of an MBL phase transition* and *Does Many-Body Localization* exist in U(1) lattice gauge theories?, Localisation: Emergent Trends and Novel Platforms (MPI-PKS)
- Jun. 2024 **Talk**, *Localisation and Hilbert Space Fracture in Lattice Gauge Theories*, Bridging the Physics and Mathematics of Quantum Many Body Chaos (Helsinki)
- Jan. 2024 **Poster**, *Quantum Circuit Analysis of an MBL phase transition*, International Quantum Tensor Network (Glasgow)
- Feb. 2023 Poster, Renormalisation view on resonance proliferation, Quantum Information Processing (Ghent)

Skills

- Physics Research experience includes non-equilibrium phenomena, lattice gauge theories, tensor networks, real space renormalisation group, Clifford circuits, exact diagonalisation, entanglement entropy, Schrieffer-Wolff transformations, Monte-Carlo simulations, and topological order
- Computational High proficiency in Python and Julia, with additional experience in Mathematica, C++, and MATLAB, using these to implement high-performance algorithms for quantum many-body physics. Completed an intensive machine learning course at UCL, and attended the European Tensor Network's 2021 workshop in Barcelona. Contributed to Python's numba package.
- Communication Published multiple papers as first author, with experience reviewing for various journals. Contributed posters and talks to conferences including at Locali24 and the International Quantum Tensor Network. Regularly lead discussions at group meetings, presenting my own research or topics of interest. Experience presenting difficult scientific concepts to school-age children, in an engaging and understandable manner, at live roadshows for CHaOS (see below, under Non-Research Experience). See also teaching experience, below.
 - Organisation Organise seminars in collaboration with Loughborough and Nottingham universities, including inviting speakers, hosting and recording seminars, and maintaining a website. Organised events for CHaOS, communicating with venues and campsites in order to secure their use as well as building longer term relationships. Former president of UCL Liberal Democrats.
 - Management Work closely with PhD students at Leeds, and also supervised MSci and BSc students. Managed teams of student demonstrators at numerous CHaOS events, many of whom were inexperienced. Ensured all of CHaOS's ~120 experiments were safety checked in time for deadlines as their Safety Officer.
 - Teaching Experience in both one-on-one and group settings, including leading & planning group tutorials and various other roles over four consecutive years at UCL. Completed the UCL Arena One Teaching Associate Program.

Competitions and Prizes

- 2018 Part II Hartree and Clerk Maxwell Prize Awarded for the highest mark in third-year Physics
- 2018 Ver Heyden de Lancey Prize For "coming first ranked in their subject out of a very large and very competent cohort"
- 2015 International Physics Olympiad (IPhO), Mumbai, Silver Medallist Highest scoring member of UK team

Non-Research Experience

- 2020-2022 **Postgraduate Teaching Assistant**, *University College London* Led and planned a series of problem-solving tutorials on mathematical methods. Assisted with classes on Python and scientific computation.
- 2016–2023 **Committee Member (various roles)**, *CHaOS* Cambridge Hands on Science, or CHaOS, is a student science outreach society which aims to inspire children to pursue STEM with fun, hands on experiments and demonstrations.

Non-Academic Interests

Science Outreach See CHaOS, above

Climbing Enthusiastic rock climber, both indoors and outdoors!

Travel Visited over 45 countries in four continents – confident travelling anywhere and interacting with people of any culture