KAI HALL

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EDUCATION & QUALIFICATIONS

UNIVERSITY OF CAMBRIDGE **2025-2026**

- MASTERS DEGREE: Part III of the Mathematical Tripos (M.A.St.)
- Graduated with a distinction: 81.0% (ranked 67/284)
- Member of Wolfson College
- Awarded the Jennings academic prize

IMPERIAL COLLEGE LONDON **2020-2024**

- MASTERS DEGREE: Physics with Theoretical Physics (MSci)
- Graduated with a First Class Honours: 77.0%

PETROC COLLEGE BARNSTAPLE **2018-2020**

- A-LEVELS: Physics (A*), Maths (A*), Further Maths (A*)

RELEVANT EXPERIENCE

M.A.St. ESSAY **2026**

- Project grade: 81.0%
- Subject Matter: The ADHM construction in twistor theory.
- As part of my degree at Cambridge I submitted an essay project supervised by Prof. David Skinner investigating the ADHM construction. This system, classifying solutions to the anti-self dual Yang Mills equations in four dimensions, can be built using holomorphic vector bundles on projective space trivial on each twistor line. The construction relies on Ward's correspondence between holomorphic data on $\mathbb{CP}^3$ and anti-self dual bundles on space-time.

MSci RESEARCH **2024**

- Project grade: 80.5%
- My masters project was embedded in a string theory approach to quantum gravity; supervised by Prof. Daniel Waldram, head of the theoretical physics group at Imperial College London. We studied group-theoretic approaches to analysing the locally symmetric moduli spaces arising from toroidal Kaluza-Klein compactifications. We realised these moduli spaces as certain quotients of Lie groups and verified the distance conjecture within the swampland program in a small class of compactifications. Our work was closely related to the 2025 publication by D.Waldram et al titled 'The Boundary of Symmetric Moduli Spaces and the Swampland Distance Conjecture'.

TECHNICAL PRESENTATION **2025**

- Subject Matter: Einstein-Cartan gravity and the unifying geometry of gauge theories.
- Gave a mathematical talk presenting Riemann-Cartan geometry and more broadly the bundle-theoretic geometry of gauge theories. This framework imposes local Lorentz symmetry and as such builds gravity as a gauge theory. This formulation is necessary for minimally coupling spinors to a classical theory of gravity.

SUMMER SCHOOL **2026**

- Subject Matter: Twistor Theory and Integrability
- Attended the Simons Institute workshop at the Mathematical Institute in Bedlewo Poland, engaging with current research on integrability.

WINTER SCHOOL **2026**

- Subject Matter: Positive Geometries in Quantum Field Theory and Cosmology.
- Attended the UNIVERSE+ workshop at the Physics Institute in Les Houches, France. The school focused on positive geometries (in algebraic geometry) with applications in Feynman integrals and cosmological correlators.

INTERNATIONAL CONFERENCE **2024**

- Subject Matter: String Theory and the Swampland Programme
- Attended the Swampland Program workshop at the Erwin Schrödinger Institute (Vienna), engaging with current research on string theory.

TUTORING **2017-*present***

- Have more than 1000 hours of teaching experience- one-on-one tutoring in British maths and physics Olympiad (BMO1, BMO2, BPhO1, BPhO2); Cambridge STEP (2 & 3); Oxford PAT/TMUA and undergraduate level topics including group theory, differential geometry, linear algebra and Maxwell's electrodynamics aswell as GCSE and A-level maths and physics.

RELEVANT TRAINING

KEY POSTGRADUATE MODULES - Cambridge **2020-2024**

Michaelmas courses:

- Differential Geometry (non-examined)
- General Relativity (78%)
- Quantum Field Theory (80%)
- Symmetries Particles and Fields (non-examined)

Lent courses:

- Advanced Quantum Field Theory (80%)
- String Theory (70%)
- Solitons Instantons and Geometry (87%)
- Black Holes (non-examined)
- Supersymmetry (non-examined)
- The Standard Model (non-examined)
- Canonical Gravity (non-examined)

KEY UNDERGRADUATE MODULES - Imperial **2020-2024**

- Group Theory: 90.0%
- Advanced Classical Physics: 88.0%
- Mathematical Methods: 84.4%
- General Relativity: 81.0%
- Statistical Mechanics: 89.7%
- Differential Topology: 86.0%
- Quantum Field Theory: 84.0%
- Unification: 79.0%

SOFTWARE SKILLS

- Proficient in Python, with experience in scripting, data analysis and building object-oriented programmes.
- Competent writing and formatting in LaTeX.

PROGRAMMING PROJECTS

- Simulated an ideal gas experiment in python to test the laws of thermodynamics.
- Simulated a relativistic neutrino beam produced by the bombardment of a graphite target.

REFERENCES

- Prof. Maciej Dunajski, professor at Cambridge, taught me Solitons Instantons and geometry. Contact:

md327@cam.ac.uk

- Prof. David Skinner, professor at Cambridge, taught me General Relativity and supervised my essay. Contact: dbs26@cam.ac.uk
- Prof. Claudia de-Rham, professor at Imperial College London; my personal tutor at Imperial and taught me Advanced Classical Mechanics. Contact: c.de-rham@imperial.ac.uk
- Prof. Daniel Waldram, head of the theoretical physics group at Imperial College London; my project supervisor. Contact: d.waldram@imperial.ac.uk
- Dr Stephen Lynch, Lecturer at Kings College London; taught me Differential Topology at Imperial. Contact: stephen.lynch@kcl.ac.uk