DANIEL BAIG

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PROFILE

Pursuing doctoral studies in topics related to gauge/gravity duality at the University of Southampton. Possesses 8 months of cumulative research experience developed through a number of research internships. Solves problems by applying mathematical and coding experience to study a variety of physical systems. Interested in pursuing a career in theoretical physics research.

RESEARCH EXPERIENCE

UNIVERSITY OF CAMBRIDGE, Cambridge, UK   *Jul - Aug 2025*
Sainsbury Laboratory Cambridge University (SLCU)
Cambridge Mathematics Placement
- Completed an 8-week project on modelling plant growth by implementing concepts from Riemannian geometry using C++.

UNIVERSITY OF OXFORD, Oxford, UK   *Jul - Sep 2023*
Department of Physics
Astrophysics Summer Research Programme
- Undertook an 8-week project on modelling disk winds from the accretion disk of X-ray binaries using the Monte Carlo radiative transfer code: PYTHON.
- Devised a method for approximating the movement of points in the output parameter space using a Monte Carlo string energy minimisation method.
- Successfully reproduced P-Cygni blueshifted absorption lines in the optical spectrum for an X-ray binary as seen in observations for the first time.

UNIVERSITY COLLEGE LONDON, London, UK   *May - Jul 2023*
UCL High Energy Physics (HEP)
MAPS Research Internship
- Undertook a 6-week project on analysing data from the LHC using the CONTUR package in Python to constrain the parameter space of dark meson masses in a composite dark matter model.
- Created code to verify simulated cross-sections from RIVET with detector data.
- Results of the project are available at:
  <https://hepcedar.gitlab.io/contur-webpage/results/HeavyDarkMesons/index.html>

THE FRANCIS CRICK INSTITUTE, London, UK   *May - Jul 2022*
UCL Institute for the Physics of Living Systems (IPLS)
Biophysics Research Internship
- Completed a 10-week project on using coupled, non-linear, differential equations to simulate the evolution of a gene regulatory network in Python to explore convergence in evolution.
- Delivered two presentations to other IPLS students and their supervisors on the aims and results of the project. Additionally, wrote a report on the outcomes of the investigation.

EDUCATION

UNIVERSITY OF SOUTHAMPTON, Southampton, UK *Sep 2025 - Present*
PhD Mathematical Sciences
- *Research Focus* - Gauge/Gravity Duality
- *Supervisor* - Dr Fridrik Gautason

UNIVERSITY OF CAMBRIDGE, Cambridge, UK *Oct 2024 - Jun 2025*
MASt Theoretical Physics (Part III of the Mathematical Tripos) **- Merit**
- *Essay Title* - Positivity of Bondi Energy in General Relativity.
- *Relevant Modules* - Quantum Field Theory, General Relativity, Advanced Quantum Field Theory, String Theory, and Black Holes.
- *Audited Modules* - Gauge/Gravity Duality; Solitons, Instantons and Geometry; Canonical Gravity; Cosmology; Symmetries, Particles and Fields; and Statistical Field Theory.

UNIVERSITY COLLEGE LONDON, London, UK *Sep 2020 - Jun 2024*
MSci Theoretical Physics **- First Class Honours**
- *Dean's list* - Top 5% of the Faculty of Mathematical and Physical Sciences.
- *Winton Prize* - Best overall academic achievement by a UCL 4th year MSci Theoretical Physics student.
- *Final Year Project* - Uncertainties on Parton Distributions.
- *Relevant Modules* - Quantum Field Theory, Mathematics for General Relativity, Practical Machine Learning for Physicists, Techniques of High-Performance Computing and Cosmology.

SKILLS AND INTERESTS

- Adept in **Python**, including NumPy, pandas, Astropy, Numba, SciPy and Keras packages.
- Ability to model physical systems in **Mathematica** and **C++**, utilising Eigen, gnuplot and SDL libraries.
- Proficient in producing reports and documents using LaTeX/Overleaf.
- Experienced in using the Unix shell in Linux to run simulations written in Python and C on a cluster developed in the research experiences listed above.
- Constructs programs in free time to develop coding aptitude and learn how to apply new concepts.

REFERENCES

Referee	Relation	Email
Prof Andrew Pontzen	UCL Personal Tutor	andrew.p.pontzen@durham.ac.uk
Prof Robert Thorne	UCL Final Project Supervisor	robert.thorne@ucl.ac.uk
Dr James Matthews	Oxford Astrophysics Supervisor	james.matthews@physics.ox.ac.uk
Prof Jonathan Butterworth	UCL HEP Supervisor	j.butterworth@ucl.ac.uk