Dr. Paul P. Cook

CONTACT INFORMATION

Department of Mathematics
King's College London
The Strand, London, WC2R 2LS, UK
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RESEARCH INTERESTS

Kac-Moody algebras, M-theory, supergravity, and superstrings.

POSTDOCTORAL POSITIONS AND LECTURESHIPS

Department of Mathematics, King's College London,
The Strand, London WC2R 2LS UK

Principal Teaching Fellow in Mathematics **August, 2025 - present**

Senior Teaching Fellow in Mathematics **September, 2016 - August, 2025**

Teaching Fellow in Mathematics **September, 2013 - September, 2016**

Lecturer in Mathematics **October, 2008 - September, 2013**

Courses lectured and other departmental roles:

- Introductory Quantum Theory (2024-25)
- Special Relativity and Electromagnetism (2020-26)
- Groups and Symmetries (2017-26)
- Calculus I (2013-20)
- Intermediate Dynamics (2008-2013)
- Manifolds (2009-2011)
- Mechanics, Relativity and Quantum Theory (2010-11)
- Foundations of Mathematical Physics (2011-13)
- UG Project Modules co-ordinator (2021-24)
- Acting Deputy UG Exam Board Chair (2020-26)
- Department Education Committee member (2015-20)
- Member of the working group co-ordinating the UG programmes syllabus re-organisation (2017-18)
- Undergraduate Staff-Student Liaison Committee member (2016-20)
- UG Prize Committee (2020-26)
- Member of the panel for the King's awards in education (2016-17)
- Line Manager for Teaching Fellow (2018-19)
- Teaching Fellow Hiring Committee and Interviews (2015-17)
- Education and Communication in Mathematics - an undergraduate ambassador in schools programme (2013-16)
- The King's Factor (a widening participation programme for mathematics in the local community) (200 sixth-form students)
- GTA Departmental Lead (organising the workload for circa 65 tutors per year, including hiring, training, organising timetable, workload allocation, monitoring and giving feedback.) (2013-18, 2021-24)
- Academic lead for undergraduate class tests (2013-18)

Assistant lecturer (tutorial teaching, and skills session lecturer):

- Calculus I (2024-25)
- Calculus II (2023-26)
- Introduction to Dynamical Systems (2023-25)
- Linear Algebra and Geometry II (2023-24)

Scuola Normale Superiore di Pisa,
Piazza dei Cavalieri n.7, Pisa, Toscana, 56126 Italy

E.U. superstrings network postdoctoral research fellow. **October, 2006 - October, 2008**
Project title: "Symmetries of M-theory."

Supervision

Ph.D. students

- Michael Fleming, "Infinite Dimensional Symmetries of Extended Gravity Theories", 2010-2013. Defended thesis successfully in February 2014.
- Martin Hong, "Mixed Symmetry Fields and Supersymmetry", 2013-2014 (part-time student). Transferred to study an MSc in data science.
- Aimilios Pagouropoulos, "Exotic Coordinates in M-theory", 2017-2022 (part-time student).

M.Sc. or M.Sci. projects supervised

- *Inflationary Cosmology* by Jivesh Kaushal, 2011;
- *Black Holes in String Theory* by Edward Hull; 2011;
- *Towards a Spin-2 Theory of Gravity* by Nicholas Iles, 2011;
- *The Weyl Character Formula* by Paul Bennett 2011-2012;
- *Hidden Symmetries of Supergravity* by Martin Hong, 2012;
- *Cosmological Inflation* by Ciaran Murphy, 2012;
- *Black Hole Thermodynamics and String Theory* by Mahmut Kamadan, 2012;
- *Generation of Solutions in General Relativity* by Roderick Dunnett, 2014;
- *From Ehlers to E_{11}* by Aimilios Pagouropoulos, 2016;
- *The KdV Equation and Integrable Models* by Emanuela-Nicole Giura, 2022;
- *Hidden Symmetries of 11D Supergravity* by Ayanle Mohamed, 2023;
- *E_{11} as a Symmetry Group of String Theory in 10 and 11 Dimensions* by Chengyi Sun, 2023.
- *Kac-Moody Algebras, the E_{11} Conjecture, and Supergravity Unification* by Rhys Evans, 2023.
- *Kac-Moody Algenbras: From finite to infinite dimensional Lie algebras* by Sarah Tobin McGovern, 2025.

B.Sc. projects supervised

- *The Mathematical Evolution of Models of the Universe* by Nathalie Cameron, 2008-09;
- *Solitons* by Aimilios Pagouropoulos, 2012-13;
- *The KdV Equation* by Jake Belton, 2021-22;
- *The Mobius Transform* by Wing Kwan Chan, 2021-22;
- *Classification of the Mobius Transformations* by Simon Borkevec, 2023-24;
- *Mobius Transformations* by Jingchun Xu, 2023-24;
- *The KdV Equation and Inverse Scattering* by Lusine Nasibyan, 2024-25;

Vacation Bursary Projects (funded by EPSRC)

- *Exploring the KdV Equation and Solitons* by Craig Poku, 2013;
- *KdV Solitons* by Marta della Rocca, 2015; and
- *KdV Solitons and Integrability* by Bowen Han, 2016.

Education

King's College London, University of London,
Department of Mathematics, Strand, London, WC2R 2LS, UK

Ph.D., Theoretical Physics, **September, 2003 - September, 2006**

- Thesis: "Connections between Kac-Moody Algebras and M-Theory"
- Advisor: Professor Peter West FRS

M.Sc., Theoretical Physics, **September, 2002 - September, 2003**

- Grade: Pass with distinction
- Dissertation: "An Introduction to Supergravity and Branes"
- Courses: Mechanics, Relativity and Quantum Theory; Operator Theory; Quantum Field Theory; Advanced General Relativity; Space-Time Geometry and General Relativity; Lie Groups and Algebras; Supersymmetry; and, Point Particles and String Theory.

Oriel College, Oxford University, Oxford, OX1 4EW, UK

B.A. in physics, **October 1996 - June, 1999**

- Modules studied: Special Relativity, Mathematical Physics, Quantum Mechanics, Classical Mechanics, Electromagnetism and Optics, Thermodynamics, Statistical Mechanics, Atomic Theory, Further Electromagnetism, Theoretical Mechanics (optional course) and Theoretical Quantum Mechanics (optional course), Solid State Physics, Nuclear Physics, Particle Physics and Chaos Theory (optional course)
- Final Year Project: Mapping the Fermi Surface in Bismuth

Other Employment History

- *Junior Software Engineer,* BAE Systems/Alenia Marconi Systems,
  Newport Road, Cowes, Isle of Wight, PO31 8PF, **2001 - 2002**
- *Administration Assistant, Lambeth Council*
  The Learning Disabilities Team, Commercial Road, Limehouse, **2000 - 2001**
- *Junior Consultant, Towers Perrin,*,
  Swan Gardens, 10 Piccadilly, London, W1V 0AE, **1999 - 2000**

Referees

Available on request.

Publications and Preprints

N. Boulanger, P. P. Cook, J. A. O'Connor, and P. West, *Unfolding E_{11}*, SciPost Phys. 18 149 (2025) `arXiv:2410.21206`,

N. Boulanger, P. P. Cook, J. A. O'Connor, and P. West, *Higher dualisations of linearised gravity and the A_1^{+++} algebra*, JHEP 152 (2022) `arXiv:2208.11501`,

P. P. Cook and S. Sarkar, *The Two-Parameter Brane Sigma-Model: M*, M' solutions and M-theory solutions dependent on exotic coordinates*, `arXiv:1610.00724` (Preprint),

P. P. Cook and M. Fleming, *Gravitational coset models*, JHEP 1407 (2014) 115 `arXiv:1309.0757`,

N. Boulanger, P. P. Cook and D. Ponomarev, *Off-Shell Hodge Dualities in Linearised Gravity and E11*, JHEP 1209 (2012) 089 `arXiv:1205.2277`,

P. P. Cook, *Bound states of string theory and beyond*, JHEP 1203 (2012) 028 `arXiv:1109.6595`,

P. P. Cook, *Exotic E_{11} branes as composite gravitational solutions*, Class. Quant. Grav. 26:235023, 2009 `hep-th/0908.0485`,

P. P. Cook and P. West, *Charge multiplets and masses for E_{11}*, JHEP **0811** 091 (2008), `hep-th/0805.4451`

P. P. Cook, *Kac-Moody algebras and M-theory.*, contribution to Cargese Summer School on Strings and Branes: The Present Paradigm for Gauge Interactions and Cosmology, Cargese, France, 22 May - 3 Jun 2006., Nucl. Phys. Proc. Suppl. **171** 271-274 (2007)

P. P. Cook, *Connections between Kac-Moody Algebras and M-Theory*, PhD Thesis, King's College London (2006), `hep-th//0711.3498`

P. P. Cook and P. West, *M-theory solutions in multiple signatures from E(11)*, JHEP **0512** 041 (2005), `hep-th/0506122`

P. P. Cook and P. West, *G^{+++} and brane solutions*, Nucl. Phys. **B705** (2005), `hep-th/0405149`

Awards, Nominations and Citations

- Winner of the Teaching Excellence Award at King's College London, 2019-20.
- Cited in the Teaching Excellence Framework 2017 submission for King's College London:

  > 'We were inspired by the following student comment on the nomination form when we selected Paul Cook as our 2016 King's Award winner: 'He helped me to rekindle my belief in myself and in my abilities at a time when I felt like all hope was lost. Without his whole-hearted support and belief in me, I doubt that I would have finished this project on time. In short, he is both an exceptional lecturer and an extremely kind and supportive mentor.'

- Winner of the inaugural King's Award for Teaching Excellence, a university-wide prize, 2016.
- Winner of the Teaching Excellence Award at King's College London, 2015-16.
- Nominated by the department of mathematics for a National Teaching Fellowship, 2013-14.
- Letter of commendation for the Teaching Excellence Award at King's College London, 2013-14 (ineligible, having won in the previous year).
- Winner of the Teaching Excellence Award at King's College London, 2012-13.
- Letter of commendation for the Teaching Excellence Award at King's College London, 2011-12.
- Nominated for the Teaching Excellence Award at King's College London, 2011-12, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15, 2015-16, 2016-17, 2017-18, 2018-19, 2019-20, 2020-21, 2021-22, 2022-23, 2023-24, 2024-25.

Outreach, Talks and Seminars

"Some Paradoxes in Special Relativity" Talk introducing space-time diagrams, special relativity and three paradoxes given to the Maths Society at St. Paul's School, London, 6^{th} March, 2026

"I don't like it, and I'm sorry I ever had anything to do with it." Talk on quantum mechanics given to the Maths Society at St. Paul's School, London, 17^{th} March, 2025

Group Theory: Symmetry, Knots and Monsters, talk at the Maths Society at Westminster School, London, 24^{th} May, 2019

The Mathematics of Water Waves: From Catastrophe to Solitons, talk at St. Paul's School, London, 21^{st} November, 2017

An Introduction to Lie Algebras and Kac-Moody Algebras: their footprints in M-theory, series of talks at I Mesoamerican School on Modern Mathematics in Theoretical Physics: Lie Algebras, Geometry and their Generalizations, UNACH, Tuxtla Gutièrrez, Mexico, $21^{\text{st}} - 27^{\text{th}}$ June, 2017

Reference Frames: Galileo, Newton and Einstein, talk at St. Paul's School, London, 9^{th} March, 2015

Rotating Supergravity Solutions with Very-Extended Kac-Moody Algebras, Workshop on Higher Spin Gravities and Related Topics, Universty of Mons, 4^{th} September, 2012

One-dimensional solutions of M-theory, Isaac Newton Institute, Cambridge University, 9^{th} February, 2012

String Theory Bound States and Beyond, Institut des Hautes Études Scientifiques, Bures-sur-Yvette, France, 17^{th} February, 2011

Bound States of M-theory, University of Liverpool, String theory seminar, 24^{th} November, 2009

Bound States of M-theory, Université Libre de Bruxelles, 12^{th} November, 2009

Bound States of M-theory, Université de Mons, 13^{th} November, 2009

Conferences, Schools, Workshops and Visits

The Quantum Quest: A Fascinating Journey, a workshop celebrating Francois Englert's 80th birthday and commemorating Laurent Houart, Universite Libre de Bruxelles and the Solvay Institute, 5th - 7th November, 2012.

Workshop on Black Holes in M/Superstring Theory, Max Planck Institute for Gravitational Physics, AEI Potsdam, 10th - 12th September, 2012.

Workshop on Higher Spin Gravities and Related Topics, University of Mons, Belgium, 4th - 6th September, 2012.

Branes, Supergravity and M-theory, Department of Applied Mathematics and Theoretical Physics, Cambridge University, 2nd - 3rd July, 2012.

Branes and Black Holes, King's College London, 28th May - 1st June, 2012.

Maths of String and Gauge Theory, City University London and King's College London, 3rd - 5th May, 2012.

Mathematics and Applications of Branes in String and M-theory, Isaac Newton Institute for Mathematical Sciences, Cambridge University, 22nd January - 18th February, 2012.

UK Workshop on Fundamental Physics 4.0 (FPUK), Trinity College, Cambridge, November, 2011

Invited one month vist to Institut des Hautes Études Scientifiques, Bures-sur-Yvette, Paris, February, 2010

UK Workshop on Fundamental Physics 3.0 (FPUK), Trinity College, Cambridge, November, 2009

UK Workshop on Fundamental Physics 2.0 (FPUK), King's College London, November, 2008

European Young Researchers' Workshop, Cyprus, 2008

Strings 2008, CERN, Geneva, 2008

Eurostrings 2008, University of Amsterdam, Spring, 2008

RTN Winter School on Supergravity and Gauge Theory, CERN, 2008

Eurostrings '07, Kolymbari, Crete, 2007

Noncommutative Geometry and Physics: Fundamental Structure of Space and Time, Isaac Newton Institute, Cambridge, 2006

Winter School on the Attractor Mechanism, Frascati, Italy, 2006

Strings and Branes: The Present Paradigm for gauge interactions and cosmology, Cargese Summer School, 2006

Annual Theory Meeting ("Christmas Meeting"), Durham, 2005

Geometry, Conformal Field Theory and String Theory, University of Durham, 2005

Annual Theory Meeting ("Christmas Meeting"), Durham, 2004; and

British Universities Summer School in Theoretical Elementary Particle Physics, University of Plymouth, Summer 2004.