

Richard Chapling

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Positions

2024/10–present St Catharine's College, Cambridge: Bye-fellow in Mathematics

2024/10–present Selwyn College, Cambridge: Teaching Bye-fellow in Mathematics

Education

2012/10–2016,2024–present *Ph.D* Thesis title: *Bound States of the Schrödinger–Maxwell Equations*
Department of Applied Mathematics and Theoretical Physics, University of Cambridge
Supervisor: Dr David Stuart Expected completion: Winter 2024/5

2011/10–2012/06 *MMath* (Part III of the Mathematical Tripos)
Trinity College, University of Cambridge
Essay: $H \rightarrow \gamma\gamma$ (A discussion of methods of regularisation in the one-loop calculation of a standard-model Higgs boson decay into two photons)
Graduated 2012/06/28: *BA with MMath (Honours pass with Distinction)*

2008/10–2011/06 *BA in Mathematics*
Trinity College, University of Cambridge
First class attained in all three of Part IA, IB and II of Mathematics Tripos

Prizes and Scholarships

2014 Smith–Knight Prize, Group 5

2012 Trinity College Heilbronn Prize

2009–11 Junior Scholar, Senior Scholar at Trinity, Tripos Prizes for first-class examination results (2009,2010,2011)

Teaching Experience

Supervising in the Cambridge Mathematical Tripos:

Lent 2014 Part IB Pure, *Complex Analysis* (Trinity, 6 pairs, 18 hours)

Michaelmas 2014 Part IB Applied, *Variational Principles and Methods* (Trinity, 4 pairs, 24 hours)

Lent 2015 Part IB Pure, *Complex Analysis* (Trinity, 3 pairs, 9 hours)

Michaelmas 2015 Part II Applied, *Principles of Quantum Mechanics* (Trinity, King's, Robinson, Clare, Trinity Hall, St Catharine's, 5 pairs, 20 hours)

Lent 2016 Part II Applied, *Further Complex Methods* (Clare, Peterhouse, 3 pairs and 1 singleton, 16 hours)

Easter 2016 Part II Applied, *Further Complex Methods* and *Principles of Quantum Mechanics* (5 pairs and 2 singletons, 11 hours)

Michaelmas 2016 Part IB Applied, *Quantum Mechanics* (Girton, 4 pairs and 1 singleton, 15 hours)

Easter 2017 Part II Applied, *Quantum Mechanics* (Girton, 3 pairs, 3 hours)

Lent 2018 Part II Applied, *Asymptotic Methods* (Downing, Girton, Homerton, Magdalene, Pembroke, Queens', Selwyn, St Edmund's, 7 pairs, 22 hours)

Easter 2018 Part II Applied, *Asymptotic Methods* (Downing, Girton, Homerton, Magdalene, Pembroke, Queens', Selwyn, St Edmund's, 5 pairs and 3 singletons, 8 hours)

Michaelmas 2018 Part IA Applied, *Differential Equations* (Girton, 5 pairs, 20 hours)

Part IB Applied, *Variational Principles* (St. John's and St Edmund's, 8 pairs, 16 hours)

Lent 2019 Part IA Pure, *Probability* (Corpus Christi, King's, Selwyn, 9 pairs and 1 singleton, 40 hours)

Part IA Pure, *Analysis I* (Newnham, 2 pairs, 8 hours)

Part II Applied, *Asymptotic Methods* (Corpus Christi, Downing, Newnham, Pembroke, Queens', Selwyn, 5 pairs and 1 singleton, 18 hours)

- Easter 2019 Part IA Applied, *Differential Equations* (Girton, 5 pairs, 5 hours)
 Part IB Applied, *Variational Principles* (St. John's and St Edmund's, 6 pairs and 1 singleton, 7 hours)
 Part IA Pure, *Probability* (Corpus Christi, King's and Selwyn, 9 pairs, 9 hours)
 Part IA Pure, *Analysis I* (Newnham, 2 pairs, 1 hours)
 Part II Applied, *Asymptotic Methods* (Corpus Christi, Downing, Newnham, Pembroke, Queens', Selwyn, 1 pair and 4 singletons, 7 hours)
- Michaelmas 2019 Part IA Applied, *Vectors and Matrices* (Selwyn, 2 pairs, 8 hours)
- Lent 2020 Part IA Pure, *Probability* (Corpus Christi, King's and Selwyn, 9 pairs and 1 singleton, 40 hours)
 Part IA Pure, *Analysis I* (Sidney Sussex, 3 pairs and 1 singleton, 16 hours)
- Easter 2020 (online) Part IA Applied, *Vectors and Matrices* (Selwyn, 4 singletons, 4 hours)
 Part IA Pure, *Probability* (Corpus Christi, King's and Selwyn, 7 pairs and 3 singletons, 11 hours)
 Part IA Pure, *Analysis I* (Sidney Sussex, 3 pairs and 1 singleton, 4 hours)
- Michaelmas 2020 (online) Part IA Applied, *Vectors and Matrices* (Selwyn, 2 pairs, 8 hours)
 Part IB Applied, *Methods* (Selwyn, 2 pairs, 8 hours)
- Lent 2021 (online) Part IA Pure, *Analysis I* (Sidney Sussex, 3 pairs, 12 hours)
 Part IA Pure, *Probability* (King's, Selwyn, 7 pairs and 1 singleton, 32 hours)
 Part IB Pure, *Complex Analysis* (Robinson and Murray Edwards, 1 pair and 1 singleton, 6 hours)
- Easter 2021 (online) Part IA Applied, *Vectors and Matrices* (Selwyn, 2 pairs, 2 hours)
 Part IB Applied, *Methods* (Selwyn, 1 singleton, 1 hour)
 Part IA Pure, *Probability* (King's and Selwyn, 7 pairs, 7 hours)
 Part IA Pure, *Analysis I* (Sidney Sussex, 3 pairs, 3 hours)
 Part IB Pure, *Complex Analysis* (Robinson, 1 pair, 1 hour)
- Michaelmas 2021 (online) Part IA Applied, *Vectors and Matrices* (Selwyn and Murray Edwards, 4 pairs and 3 singletons, 28 hours)
 Part IA Applied, *Differential Equations* (Selwyn, 2 pairs and 1 singleton, 12 hours)
 Part IB Applied, *Methods* (Selwyn and Jesus, 2 pairs and 1 singleton, 11 hours)
- Lent 2022 (online) Part IA Pure, *Analysis I* (Sidney Sussex, 3 pairs and 1 singleton, 16 hours)
 Part IA Pure, *Probability* (King's, Murray Edwards and Selwyn, 9 pairs and 1 singleton, 40 hours)
- Easter 2022 (online) Part IA Applied, *Vectors and Matrices* (Selwyn and Murray Edwards, 5 pairs and 1 singleton, 6 hours)
 Part IA Applied, *Differential Equations* (Selwyn, 2 pairs and 1 singleton, 3 hours)
 Part IB Applied, *Methods* (Selwyn and Jesus, 2 pairs and 1 singleton, 3 hours)
 Part IA Pure, *Analysis I* (Christ's and Sidney Sussex, 8 pairs and 1 singleton, 9 hours)
 Part IA Pure, *Probability* (King's, Murray Edwards and Selwyn, 9 pairs and 1 singleton, 10 hours)
- Michaelmas 2022 (online) Part IA Applied, *Vectors and Matrices* (Selwyn and Murray Edwards, 5 pairs, 20 hours)
 Part IA Applied, *Differential Equations* (Selwyn, 2 pairs, 8 hours)
 Part IB Applied, *Methods* (Selwyn and Murray Edwards, 3 pairs and 4 singletons, 28 hours)
- Lent 2023 (online) Part IA Pure, *Analysis I* (Sidney Sussex, 3 pairs, 12 hours)
 Part IA Pure, *Probability* (King's and Selwyn, 5 pairs, 20 hours)
 Part IB Pure, *Complex Analysis* (King's, 2 pairs and 1 singleton, 9 hours)
 Part IB Applied, *Complex Methods* (King's and Selwyn, 3 pairs and 1 singleton, 12 hours)
- Easter 2023 (online) Part IA Applied, *Vectors and Matrices* (Selwyn and Murray Edwards, 5 pairs, 5 hours)
 Part IA Applied, *Differential Equations* (Selwyn, 2 pairs, 2 hours)
 Part IB Applied, *Methods* (Selwyn and Murray Edwards, 3 pairs and 2 singletons, 5 hours)
 Part IA Pure, *Analysis I* (Sidney Sussex, 3 pairs, 3 hours)
 Part IA Pure, *Probability* (King's and Selwyn, 5 pairs, 5 hours)

	Part IB Pure, <i>Complex Analysis</i> (King's, 1 singleton, 1 hour)
	Part IB Applied, <i>Complex Methods</i> (King's and Selwyn, 2 pairs and 1 triple, 3 hours)
Michaelmas 2023	Part IA Applied, <i>Vectors and Matrices</i> (Selwyn, 2 pairs, 8 hours)
	Part IA Applied, <i>Differential Equations</i> (Selwyn, St. Catharine's and Sidney Sussex, 11 pairs and 3 singletons, 56 hours)
	Part IB Applied, <i>Methods</i> (Selwyn, 2 pairs, 8 hours)
Lent 2024	Part IA Pure, <i>Analysis I</i> (Sidney Sussex, 4 pairs and 1 singleton, 20 hours)
	Part IA Pure, <i>Probability</i> (Selwyn, 2 pairs, 8 hours)
	Part IB Applied, <i>Complex Methods</i> (Selwyn and Newnham, 5 pairs, 20 hours)
	Part II Applied, <i>Further Complex Methods</i> (Downing, Girton, Homerton and Queens', 5 pairs, 20 hours)
Easter 2024	Part IA Applied, <i>Vectors and Matrices</i> (Selwyn, 4 students, 2 hours)
	Part IA Applied, <i>Differential Equations</i> (Selwyn, St. Catharine's and Sidney Sussex, 25 students, 10.5 hours)
	Part IB Applied, <i>Methods</i> (Selwyn, 4 students, 2 hours) Part IA Pure, <i>Analysis I</i> (Sidney Sussex, 9 students, 5 hours)
	Part IA Pure, <i>Probability</i> (Selwyn, 4 students, 2 hours)
	Part IB Applied, <i>Complex Methods</i> (Selwyn and Newnham, 8 students, 4 hours)
	Part II Applied, <i>Further Complex Methods</i> (Downing, Girton, Homerton and Queens', 9 students, 5 hours)
Other teaching:	
Lent 2016	Catch-up lectures in Part II course, <i>Asymptotic Methods</i> [2 lectures, one examples class]
Michaelmas 2017	Tutoring, preparation for Cambridge Computer Science entrance examinations [25 hours, one-on-one teaching]
Easter 2020	Introductory tutoring in university Mathematics [10 hours, one-on-one teaching, online via Zoom]
Michaelmas–Lent 2021	A-level tutoring in mechanics and pure [50 hours, one-on-one teaching, online via Zoom]
Summer 2021	Tutoring in A-level calculus, vectors, statistics in preparation for computational linguistics postgraduate work [9 hours, one-on-one teaching, online via Zoom].
Michaelmas 2022–present	Tutoring in university Mathematics (Linear Algebra, Analysis) in preparation for Machine Learning course [one-on-one teaching, online via Zoom]
Lent 2023	A-level mechanics tutoring [6 hours, one-on-one, online via Zoom]

Publications

Published

- *Asymptotics of Certain Sums Required in Loop Regularisation*
Mod. Phys. Lett. A Vol. **31**, No. 4 (2016) 1650030
Preprint: arXiv:1601.04966
- *A Hypergeometric Integral with Applications to the Fundamental Solution of Laplace's Equation on Hyperspheres*
SIGMA **12** (2016), 079
Eprint: arXiv:1508.06689

Forthcoming

- *Bound States of the One-Dimensional Maxwell–Schrödinger Equations*
Preprint: arXiv:1608.02637
- *Elliptic Functions on the Wallpaper Groups*
Preprint: arXiv:1608.05677

Preprints

- *Note on Exact Forms for Irreducible Loop Integrals*
arXiv:1608.05311
- *Symmetric Potentials Beget Symmetric Ground States*
arXiv:1611.01813

In Preparation

- *Consistent Maxwell–Schrödinger Bound States on Compact Manifolds*
- *The Two-Dimensional Maxwell–Schrödinger Equations*
- *Mean Value Theorems and Their Generalisations*
Book, first draft 60% complete.

Talks

2014/05/30	Existence of Solutions to the Maxwell–Schrödinger Equations with a Background Electric Charge (DAMTP, University of Cambridge)
2015/05	The Life and Work of Bernhard Riemann (History of Mathematics Seminar, University of Cambridge) [Two lecture series]
2016/05	So What Did Riemann Actually do? (History of Mathematics Seminar, University of Cambridge) [Two lecture series]
2016/11/11	Symmetric Potentials Beget Symmetric Ground States (London Mathematical Society Graduate Student Meeting)
2018/05	Everything you should know about Riemann in an hour ($+\epsilon$) (History of Mathematics Seminar, University of Cambridge)
2019/02/23	G. H. Hardy, the leading mathematician in England (Trinity Mathematical Society Centenary Symposium, Trinity College, Cambridge)
2019/05/10	The roots of group theory: solving equations using permutations (History of Mathematics Seminar, University of Cambridge)
2019/05/17	We are all Riemannians now: how Riemann changed mathematics forever (History of Mathematics Seminar, University of Cambridge)
2020/05/27	Riemann and his geometries (History of Mathematics Seminar, University of Cambridge) [via Zoom]
2020/06/05	What the hell Galois was doing, and why it isn't Group Theory (History of Mathematics Seminar, University of Cambridge) [via Zoom]
2021/04/30	Reading and Misreading Riemann's geometry: the <i>Habilitationsvortrag</i> , the <i>Commentatio</i> , and who read them, History of Mathematics Invited Easter Talks, University of Cambridge. [via Zoom]
2021/04/30	Making a fuss about not making a fuss about Galois: significance, insignificance, and misappropriation, History of Mathematics Invited Easter Talks, University of Cambridge. [via Zoom]

Conferences Attended

2014/03	Cosmology and the Constants of Nature (Cambridge)
2015/04	South East Mathematical Physics Seminar 4 (Hertfordshire)
2016/04	South East Mathematical Physics Seminar 4 (Cambridge)
2016/11	LMS Graduate Student Meeting (London)
2019/02	Trinity Mathematics Society Centenary Symposium (Trinity College Cambridge)
2020/07	TUG 2020 online
2021/07	TUG 2021 online
2022/07	TUG 2022 online

Employment

July 2013,'14,'15,'17,'24	Cambridge Assessment: Marking of Sixth Term Examination Papers (STEP I, II, III)
Easter 2015,'16	Trinity College, Cambridge: Invigilator for University Examinations
February 2021	University of Cambridge: Marking CATAM IB Core projects, CATAM feedback sessions
May 2022	University of Cambridge: Marking CATAM IB Additional projects
February 2023	University of Cambridge: Marking CATAM IB Core projects
May 2024	University of Cambridge: Marking CATAM IB Additional projects

June 2024 University of Cambridge: Invigilator for University Examinations under Reasonable Adjustments

Other Research Experience

2012/06–07 Summer Research Internship with Dr Piers Bursill-Hall, investigating the importance of Robert Woodhouse in Mathematics at Cambridge in the early Nineteenth Century. Also, independent research on *An Approach to Combinatorial Conjectures in Quantum Field Theory Using Integrals* (subsequently published as part of first Loop Regularisation paper).

Languages

English (native)
Japanese (basic, equivalent to CEF A2)
Italian (basic, equivalent to CEF A2)
Latin (reading)
French (basic)

Programming experience

November 2020–present Research on legacy systems by interpreting and reconstructing algorithms from machine code, achieving identical results.

December 2021–present Lead on an open-source reverse-engineering project with international contributors

Helped to rewrite and maintain the build system for the large (thousands of heterogeneous files) project

Wrote tutorials to aid first-time contributors

Designed and implemented scripts and programs to streamline the development process.

Mentored new contributors in basic C, assembly code, git, and other software.

Programming languages

Mathematica (over 15 years experience)
C (2 years experience)
MIPS assembly
Python (intermediate)
Rust (basic)
LaTeX
HTML, CSS

Software experience

Microsoft Word, Excel, Sharepoint
Google Docs, especially Google Sheets
Moodle
Zoom
Visual Studio Code

Last updated: 17 October 2024