

MATTHEW BURKE

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EDUCATION

Macquarie University, Sydney

Doctor of Philosophy in Mathematics 2011-2015

Christ's College, University of Cambridge

Part III Mathematics (MMATH) 2010-2011

Bachelor's degree in Mathematics (BA) 2007-2010

WORK EXPERIENCE

Jan 2020 - Present: Cambridge Quantum

Software developer

- Designed and constructed an authentication system backed by AWS Cognito that provided authentication in a microservices environment.
- Wrote library to run compiler benchmarks in different Python virtual environments to compare package versions and find regressions. Ran automated housekeeping tasks for updating and caching data and presented results and visualisations in a web app.
- Constructed k8s ingress and load balancing for AWS EKS.

Jan 2020 - Jan 2022: Lyryx Learning

Senior software developer (11 months); Director of technology (13 months)

- Designed, developed and distributed a cross-platform mobile and web application to combine existing textbook content with new interactive questions. Used TypeScript, SQLite and Capacitor.
- Created a local development environment for an existing Java web application. Used Docker, NGINX and Firejail to locally develop features that spanned multiple production servers.
- Constructed a Web API for automatically scheduling examinations. Used Java Servlets and MySQL.

Aug 2019: Cybera Data Science Fellowship

Data science fellow

- Collaborated with an industry partner to clean, explore and analyse 7 years of live events data stored in a PostgreSQL database with over 13 million entries.
- Constructed a generalised linear model (GLM) for analysing count data and a log linear model for analysing sales data. Used Python scripts, Jupyter notebooks and the R programming language.

Sep 2017-Sep 2019: University of Calgary

Postdoctoral scholar

- Designed and completed projects in pure mathematics and computer science leading to a publication in a peer-reviewed journal and another paper under review.
- Created a formal proof of a well-known result in category theory using the Coq proof assistant.
- Provided mentoring support for two PhD students and reviewed two papers for mathematics journals.
- Organised the University of Calgary Peripatetic Seminar (Dec 2017-May 2019) and chaired a session of the Alberta Mathematics Dialogue 2018.
- Used Jupyter notebooks to lecture 4 classes of around 230 students each.

Jun 2016-Aug 2017: MathSpire Ltd.

Software engineer (5 months); Chief technology officer (9 months)

- Developed a cross-platform mobile and desktop application to teach A-level mathematics using interactive graphs, videos and integrated testing. Used F#, .NET and Xamarin.
- Created a web front-end and API for teachers to track student progress.
- Showcased the application at the BETT education technology conference.

PROJECTS

- **Fog of war chess:** (<https://github.com/mwpb/fowc>) Library to play a variant of chess in which the players can only see squares to which they can move. Proof of concept at fogofwar chess.com.
- **Advent of code:** (<https://github.com/mwpb/adventOfCode2019>) Java solutions to all problems in the 2019 advent of code.
- **Cryptopals challenges:** (<https://github.com/mwpb/matasano-go>) Solutions written in Go. First three sets completed.

PUBLICATIONS

- A Synthetic Version of Lie's Second Theorem, *Applied Categorical Structures*, 2018.02.06. Available at <https://doi.org/10.1007/s10485-018-9518-2>.
- Connected Lie Groupoids are Internally Connected and Integral Complete in Synthetic Differential Geometry, *Symmetry, Integrability and Geometry: Methods and Applications*, 2016.06.29. Available at <http://www.emis.de/journals/SIGMA/2017/007/>.