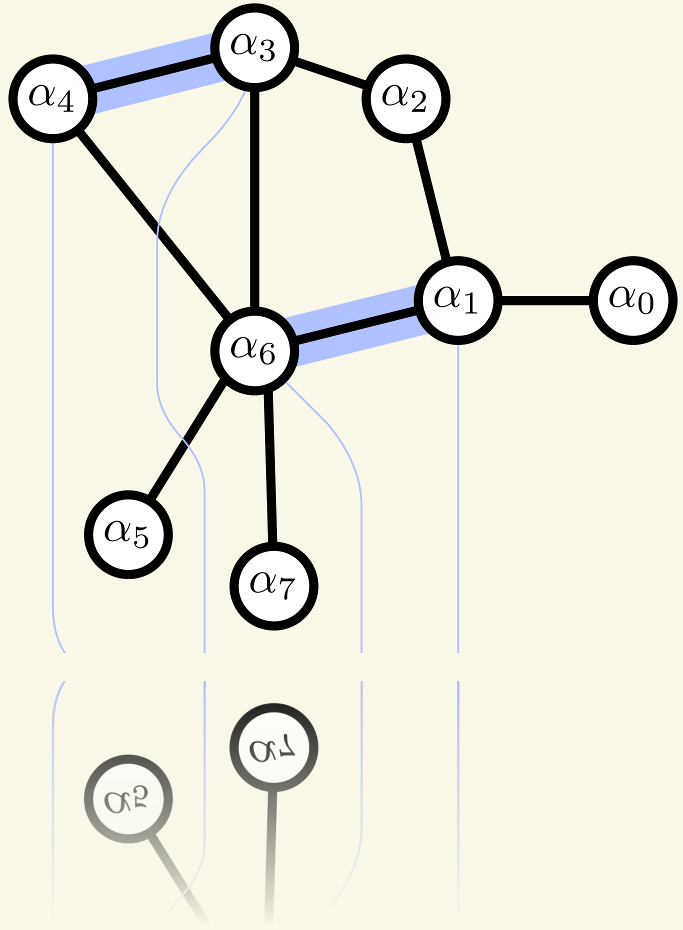
Mitchell Chiew

Portfolio for Springer Nature



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I am an Australian student of theoretical physics currently finishing my PhD at the University of Cambridge. This portfolio contains only my own artwork, much of which has appeared in my academic writing.

Illustration has been integral to my learning process since childhood, and I have incorporated visual reasoning into my scientific writing and collaborative projects.

Through academia, I have developed my scientific art style through image editors that allow me to maintain the freedom of drawing by hand, with the goal of clearly and creatively communicating science.

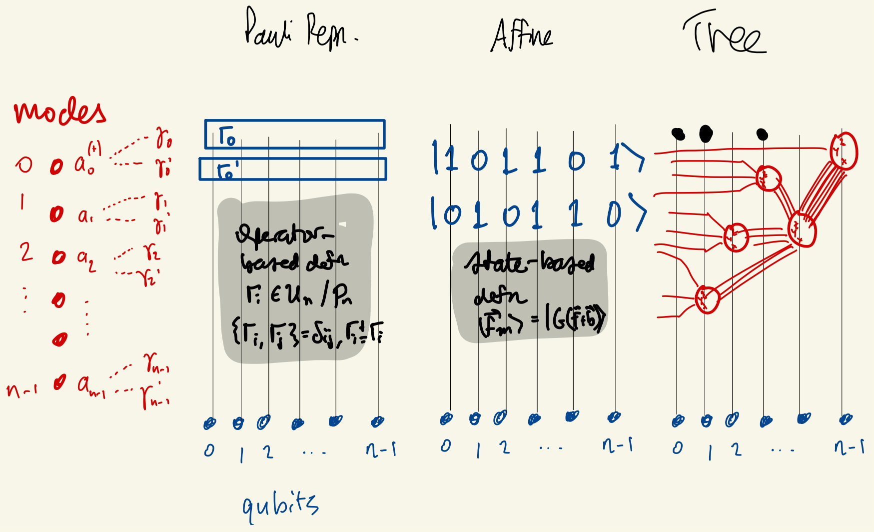
Samples from theoretical physics

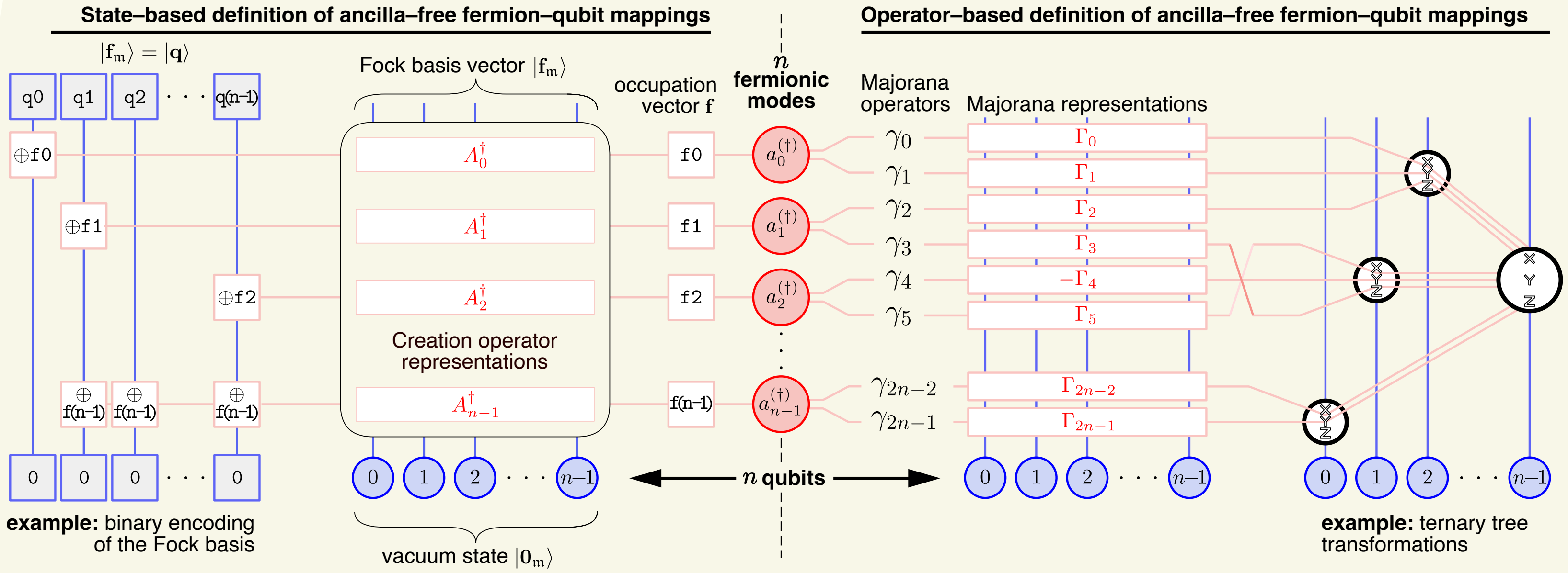
Detail–oriented design
2024
commissioned Nature Reviews Physics article (upcoming)

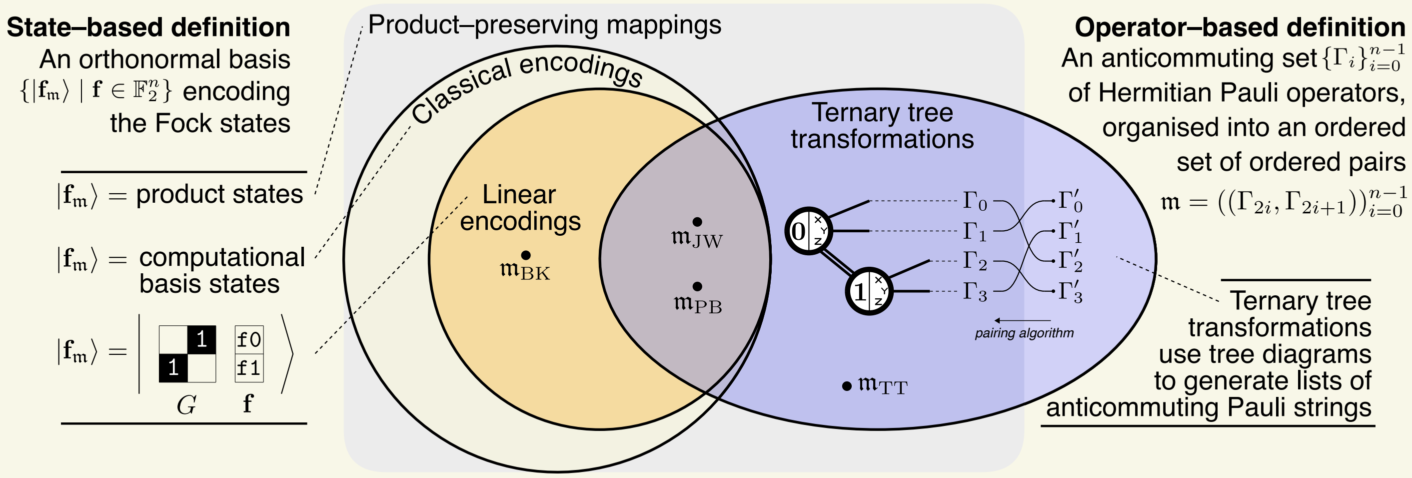
Top (sketch): hand–drawn
Bottom (final): Inkscape and Ipe

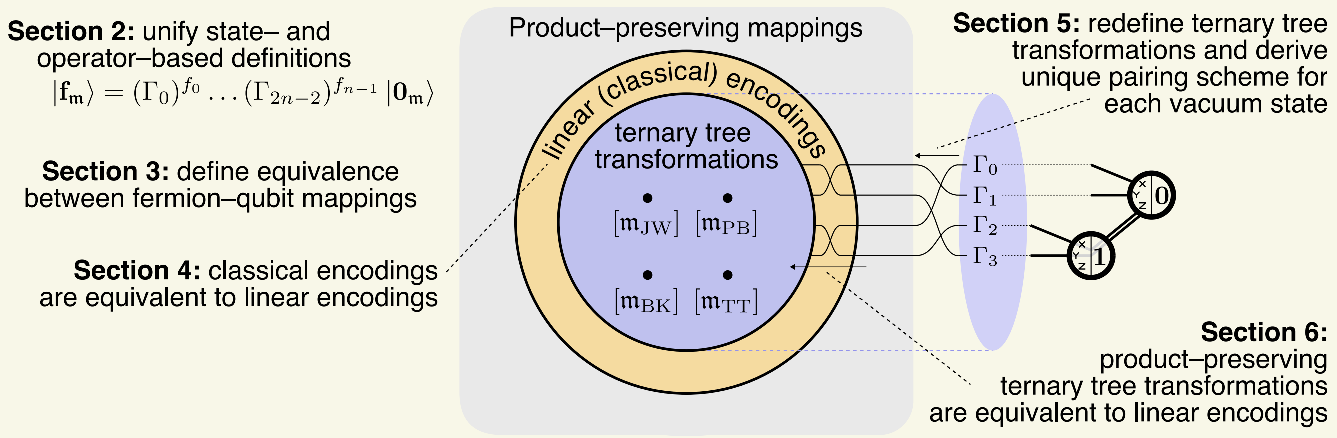
From a collaborative work with researchers from Dartmouth College, USA. I am one of the lead co–authors and the main illustrator for our draft submission to Nature Reviews Physics about fermion–qubit mappings in quantum computing.

The image works with the body text of the paper to provide an accurate numerical example of two parallel concepts.









Illustrating the impact of new research

2024

upcoming preprint

Inkscape and Ipe

These figures come from the introduction section of an upcoming preprint about quantum algorithms, for which I am the lead author.

The top figure represents the state of understanding in the literature before the work in my paper. I chose the Venn diagram format to display overlapping concepts and redundancies in their description.

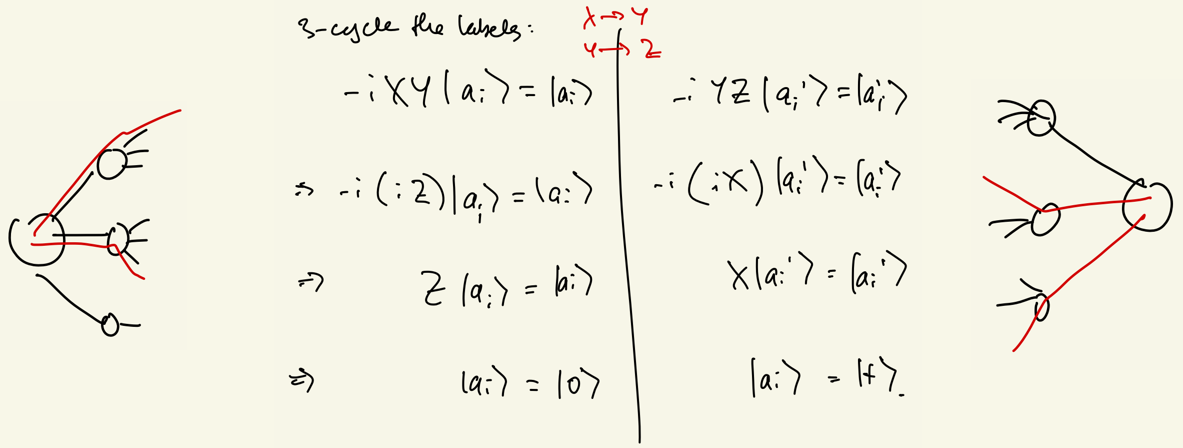
The lower figure depicts the simplification of these different concepts, and acts as a visual table of contents for my paper.

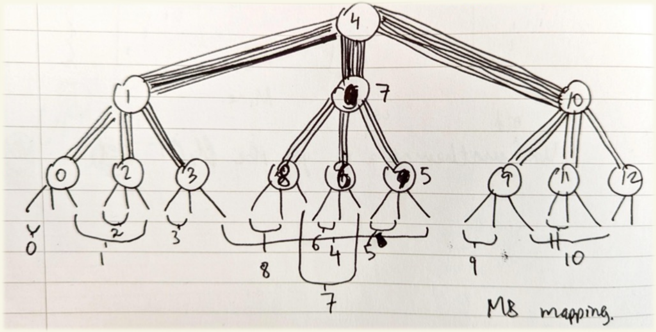
Vivid imagery from sketches
2024
upcoming preprint

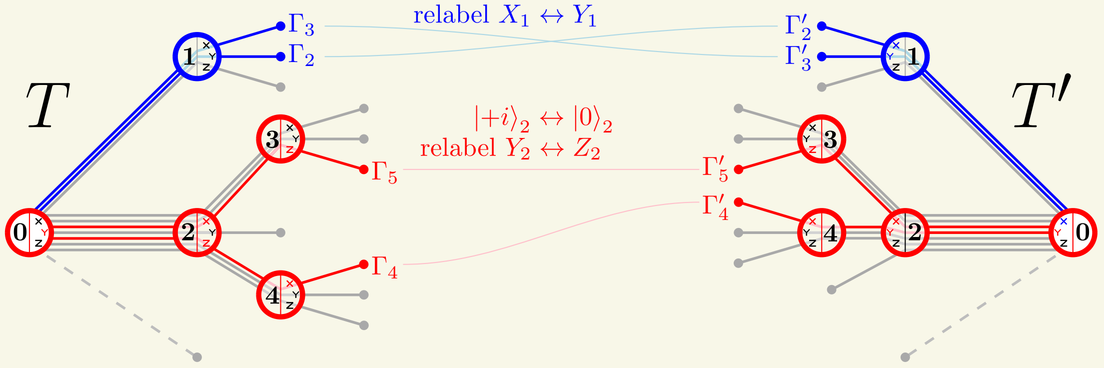
Top left, top right (sketches): hand–drawn
Bottom left, bottom right (final): Ipe

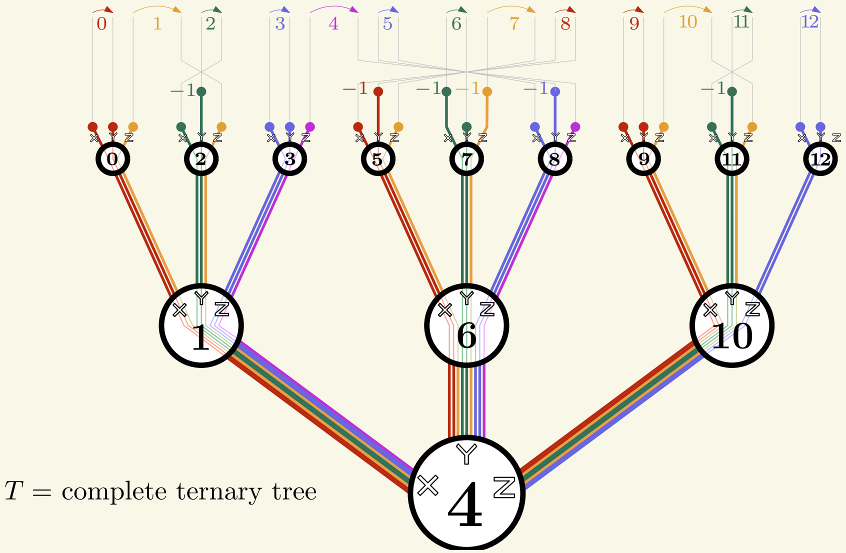
I created these diagrams to illustrate technical concepts in an upcoming preprint in the field of quantum computing, for which I am the lead author. Ternary tree graphs are the mathematical backbone of a popular strategy to encode fundamental particles in quantum computers.

A technical detail that the images highlight are the many distinct paths through the tree, which is a level of detail missing from other illustrations in the literature.





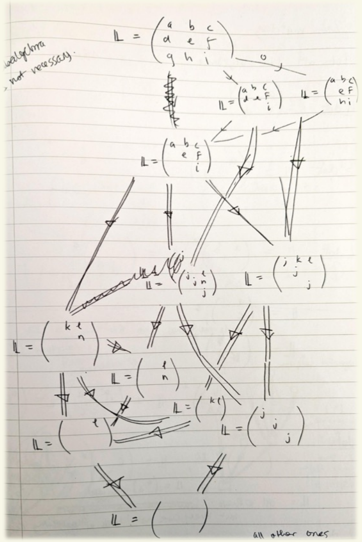


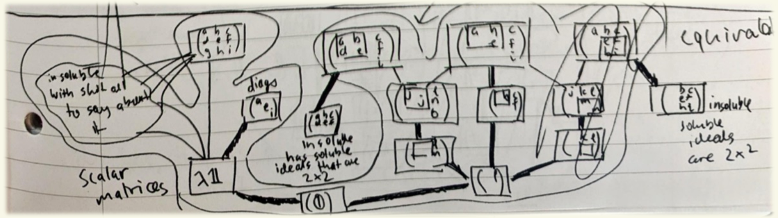


My design process

Scientific imagery is part of my learning process, and I render my understanding through illustration. Through constant refinement of accuracy and style, I converge to a final product that tells the entire story as simply as possible.

Sketches and roughs



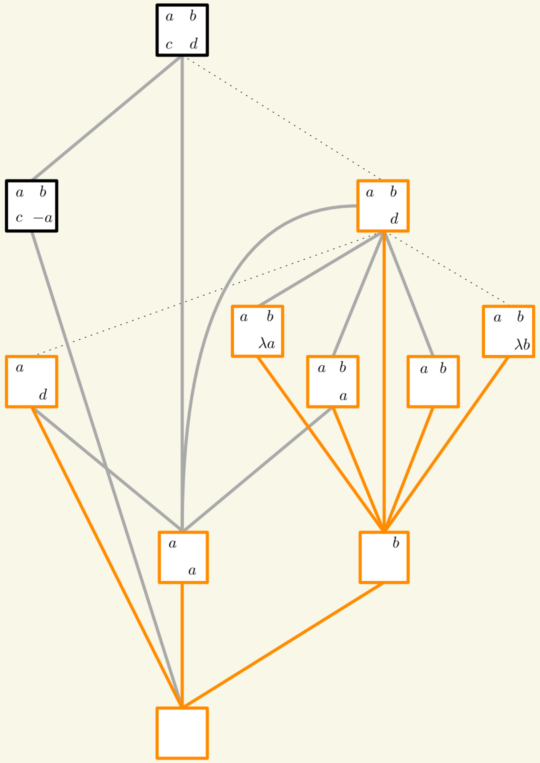


Refinement

2020
personal notes
Left, bottom (sketches): hand–drawn,
Right (annotated sketch): Ipe

Notes I took while attending a virtual lecture course in pure mathematics during the lockdowns in winter 2020.

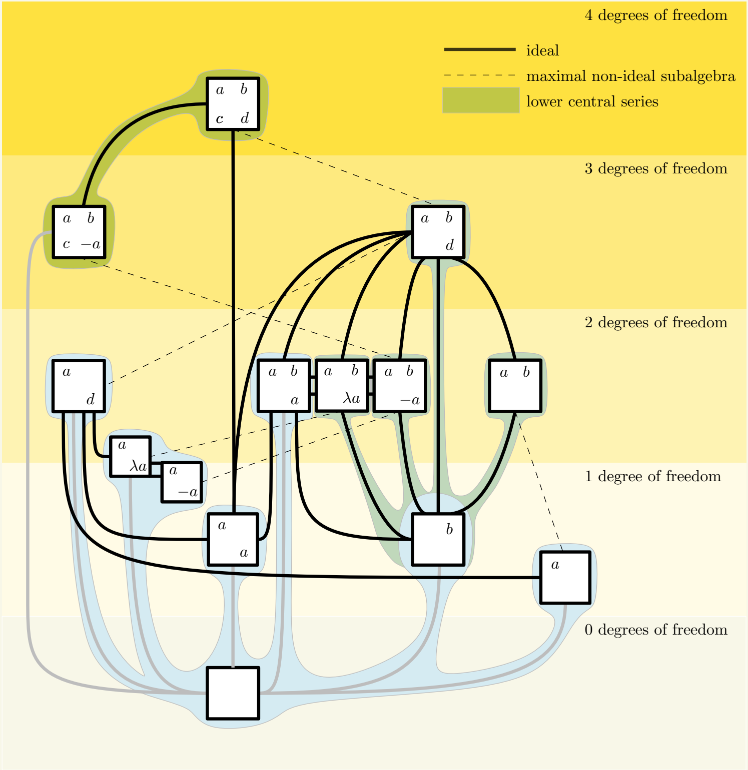
Scientific accuracy and style



2020
personal notes
Ipe

This image was the result of repeatedly refining and simplifying my rough notes.

Final product



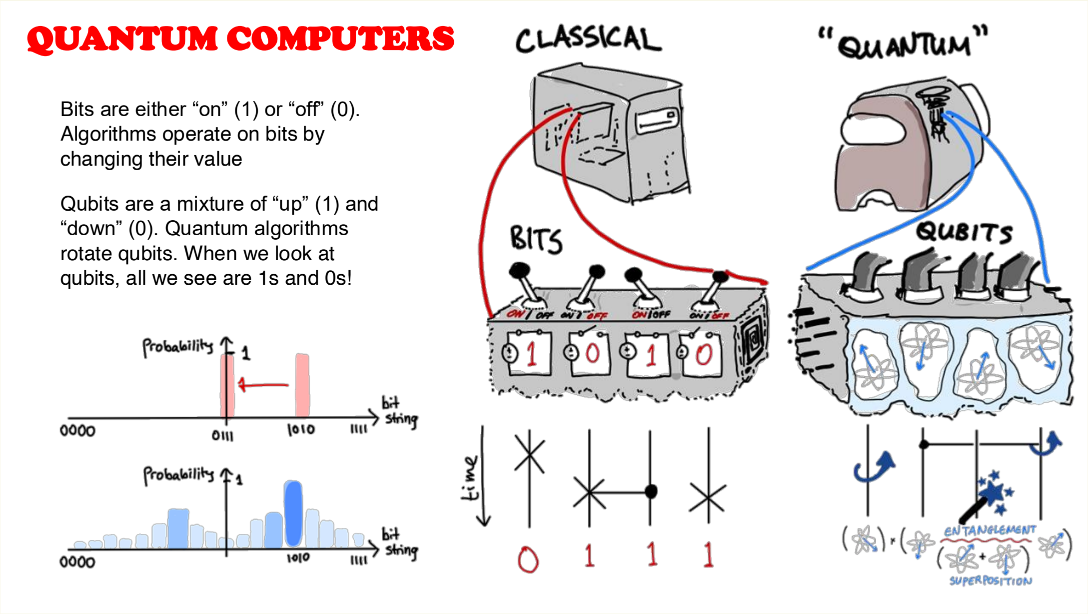
2020
personal notes
Ipe

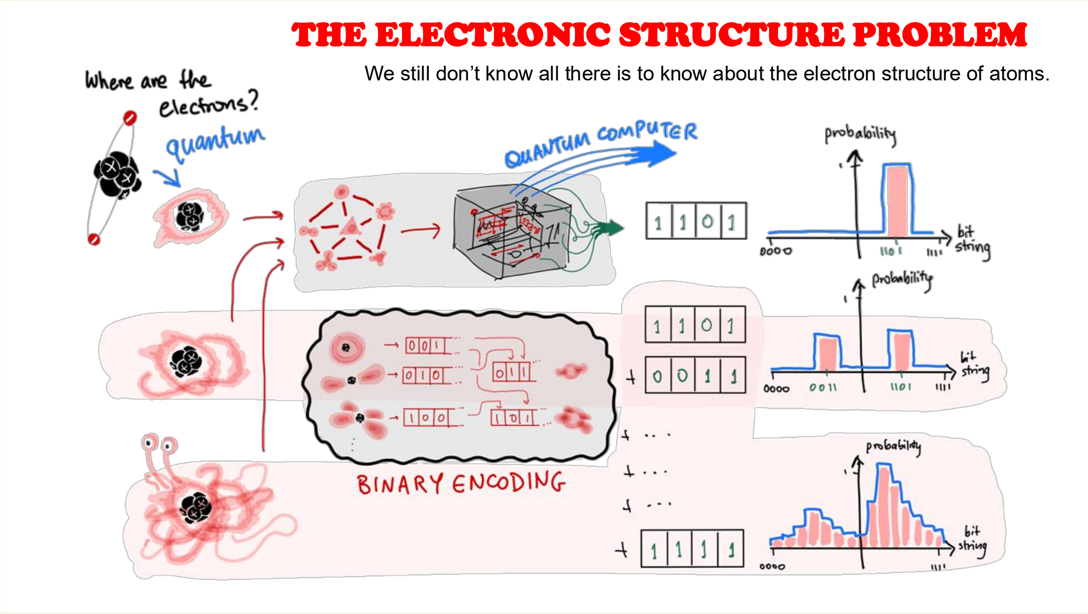
The stylised final product depicts all two–dimensional Lie algebras and uses the colour gradient to distinguish different categories.

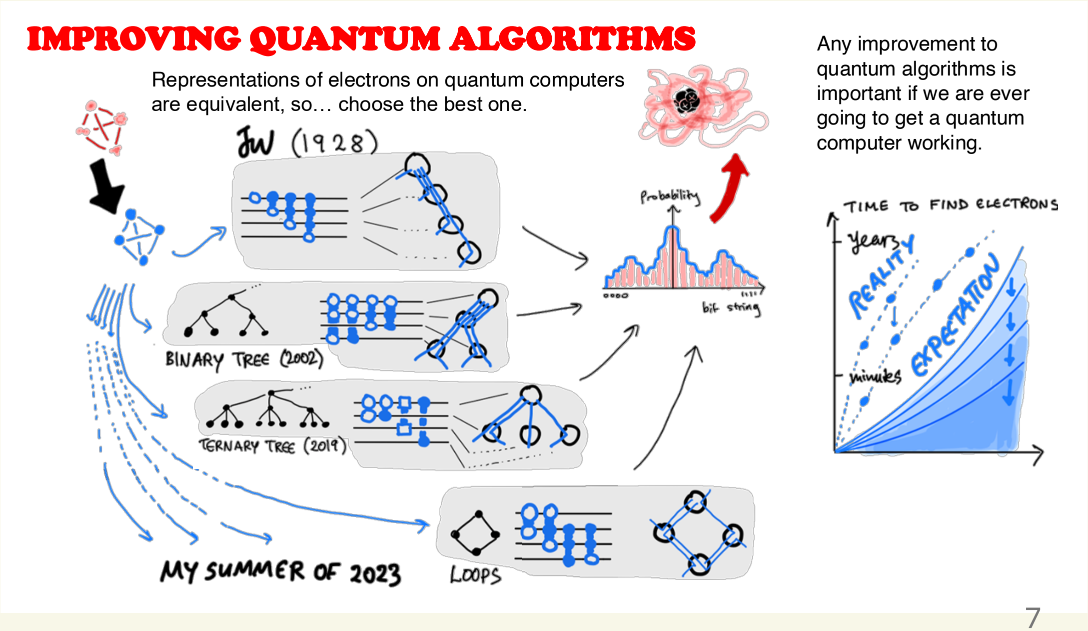
Reaching broader audiences

Hand–drawn slides with no equations
2024
public lecture in Cambridge
Hand–drawn and Powerpoint

These slides come from a presentation about my PhD work which I gave to a general audience. In preparing this work I made a commitment to draw by hand and omit any equations to create a friendly and engaging aesthetic.







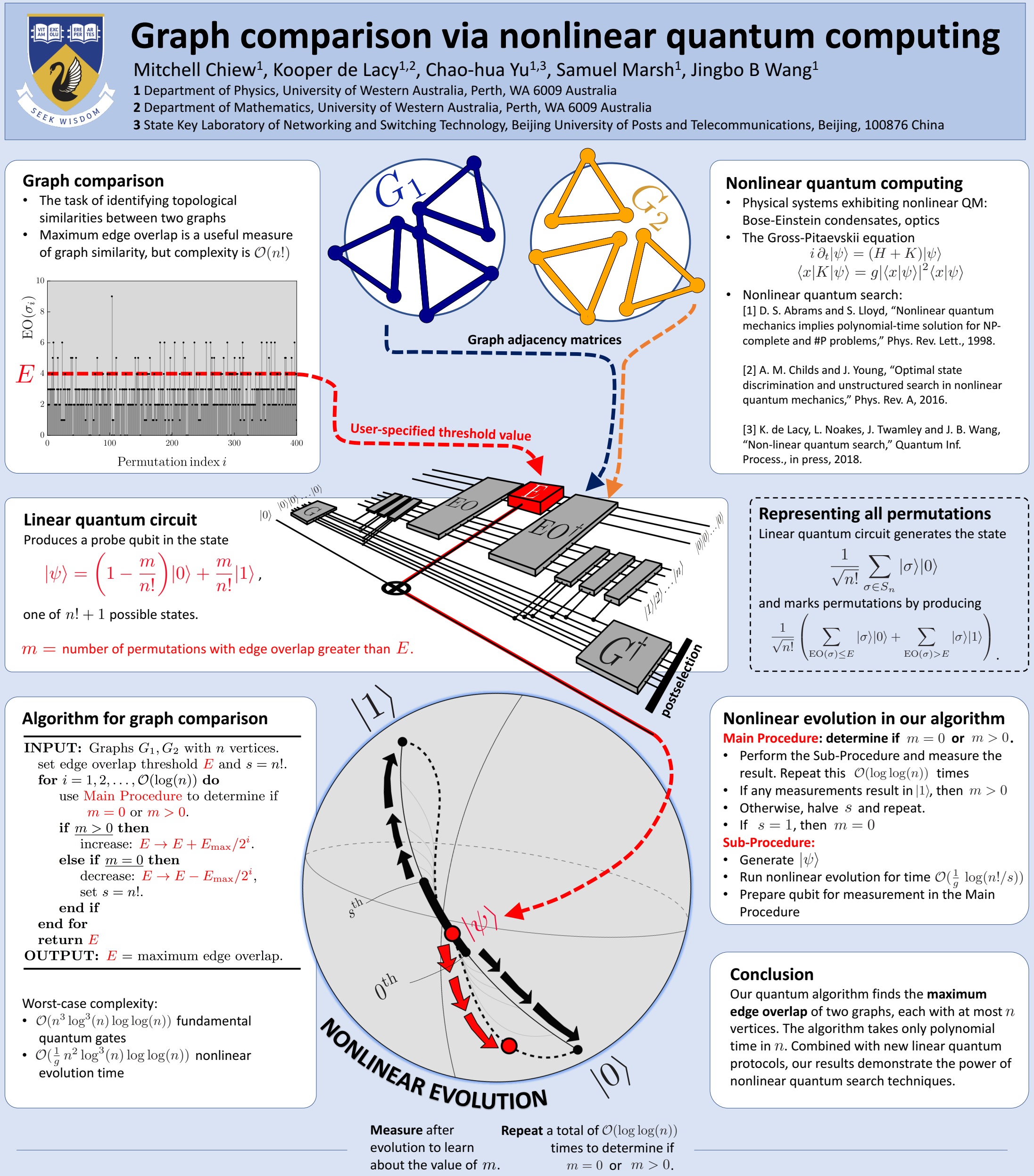
Poster gallery

Posters are an exciting opportunity for me to collate existing bodies of illustrations and refine my research to tell a single clear story while working to a tight deadline.

More than once, creating a poster has cleared a roadblock in my research, allowing me to progress to the next stage of a problem or wrap up a project entirely.

Presenting posters at multiple conferences per year has challenged me to improve my digital illustration skillset and continue to find new ways of incorporating my artistic style into my work.

Pages 8–11 contain examples of my posters and their design process.



Masters poster
2018
presented at the Gordon Research Conference for Quantum Science in Easton, Massachusetts

Ipe, Inkscape and Powerpoint

My first attempt at creating a scientific poster tells the story of the value E, a user-specified parameter for a quantum algorithm. The choice of E (top-left) affects the rest of the algorithm, which the poster visually anchors using the colour red.

PhD poster

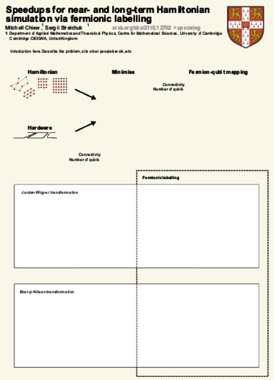
2023

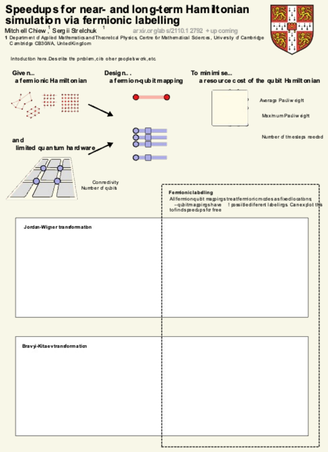
presented at the conference Quantum Information Processing in Ghent, Belgium

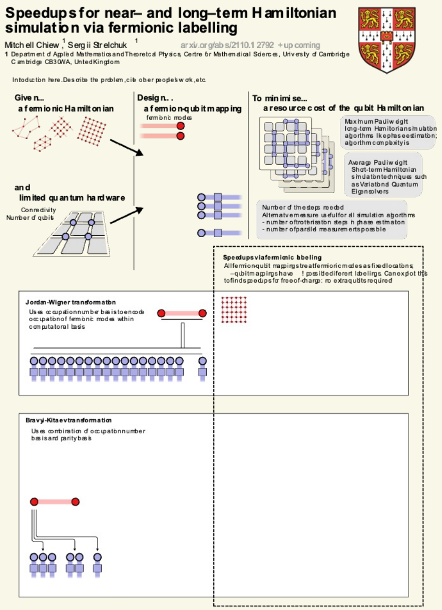
Ipe and Inkscape

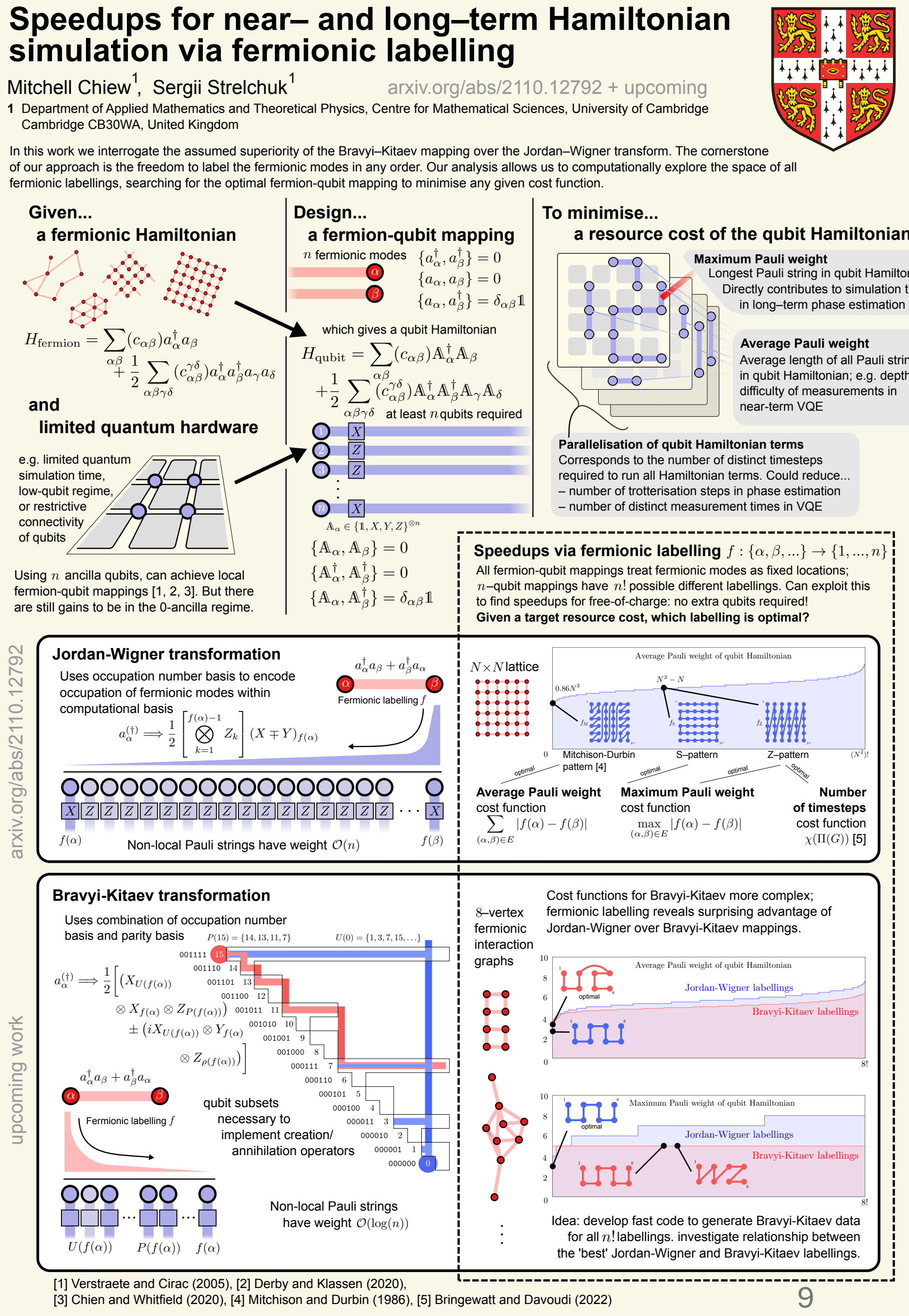
The design principle of the posters for my PhD work is to visually distinguish electrons (red) from the qubits, the information-carrying particles of quantum computers (blue).

This poster collates several disparate strands of my research under one banner. From conception to final product, I produced it in one working day.







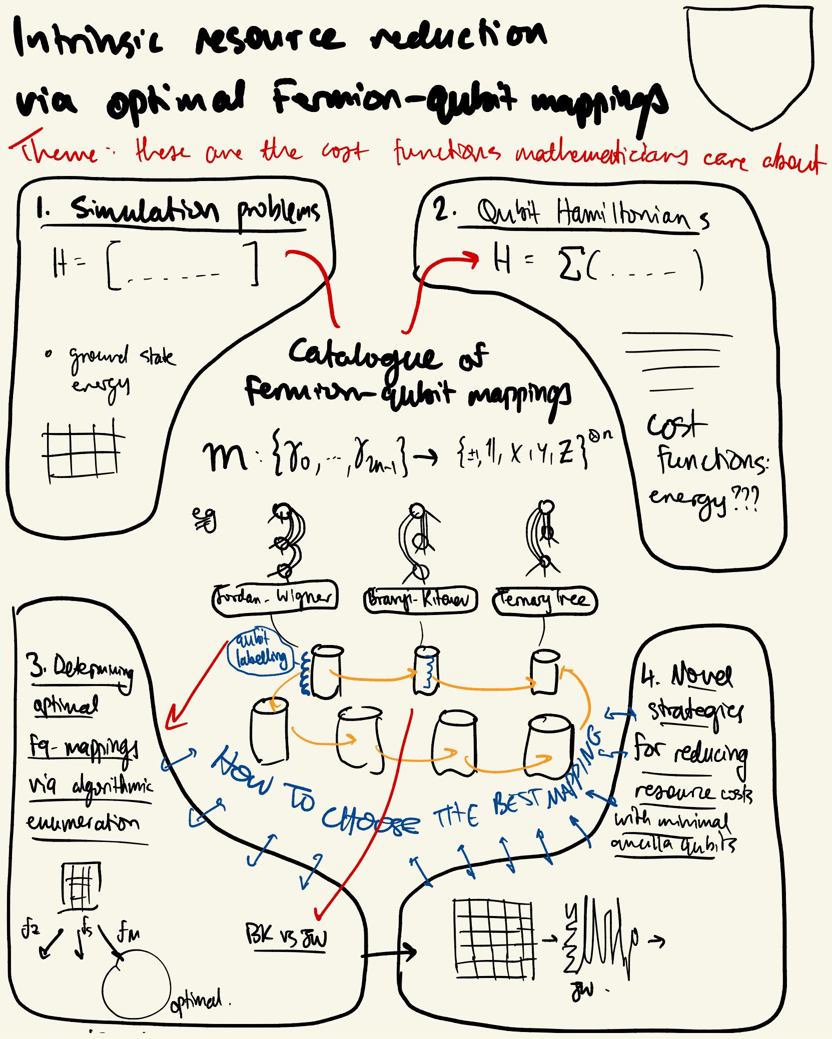


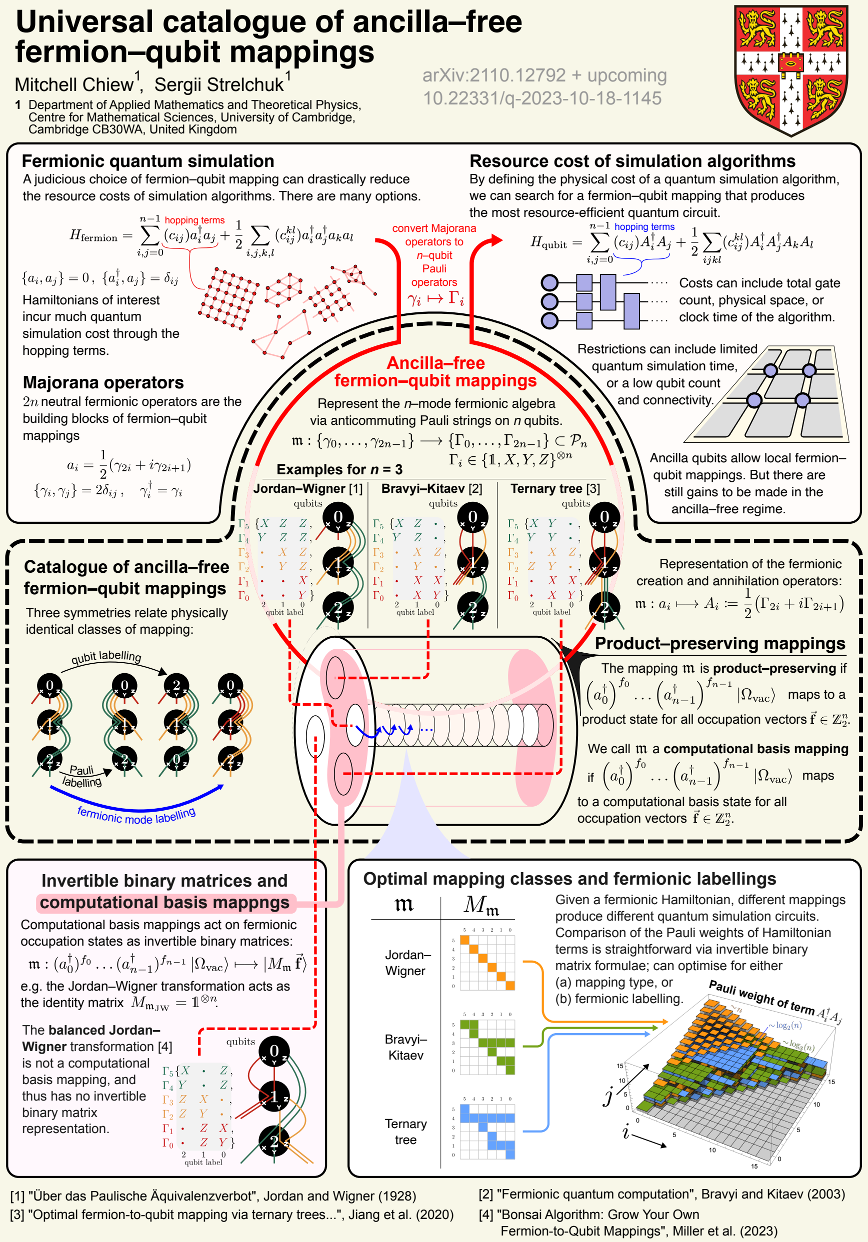
PhD poster before and after
2024
Presented at the conference Quantum Information Processing in Taiepi, Taiwan

Left (sketch): hand–drawn
Right (final): Ipe and Inkscape

For this example, I wanted to visually anchor the idea that there are many equally valid ways to map electronic behaviour onto quantum computers. This manifests in the central, circular piece of the poster, defining and cataloguing the many ways to perform this mapping.

The red arrow shows the motivating application of converting electronic systems into information on a quantum computer.





PhD poster before and after

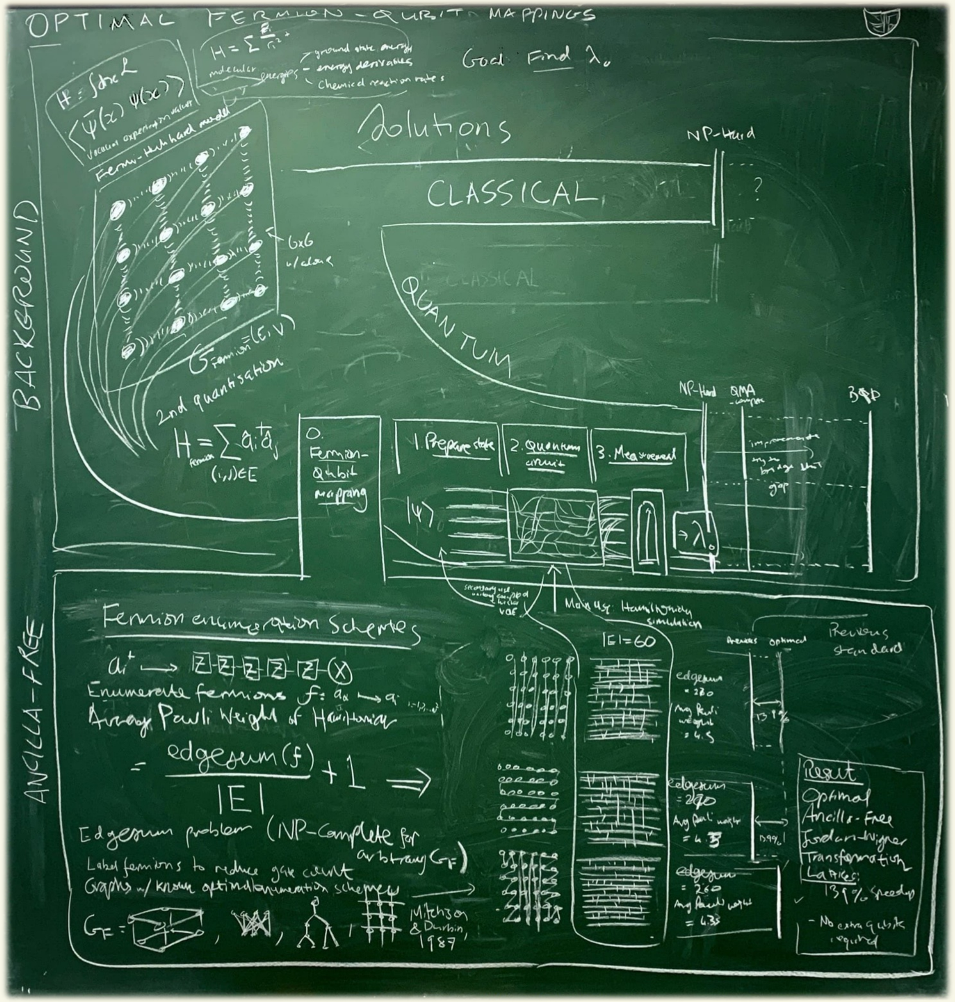
2022

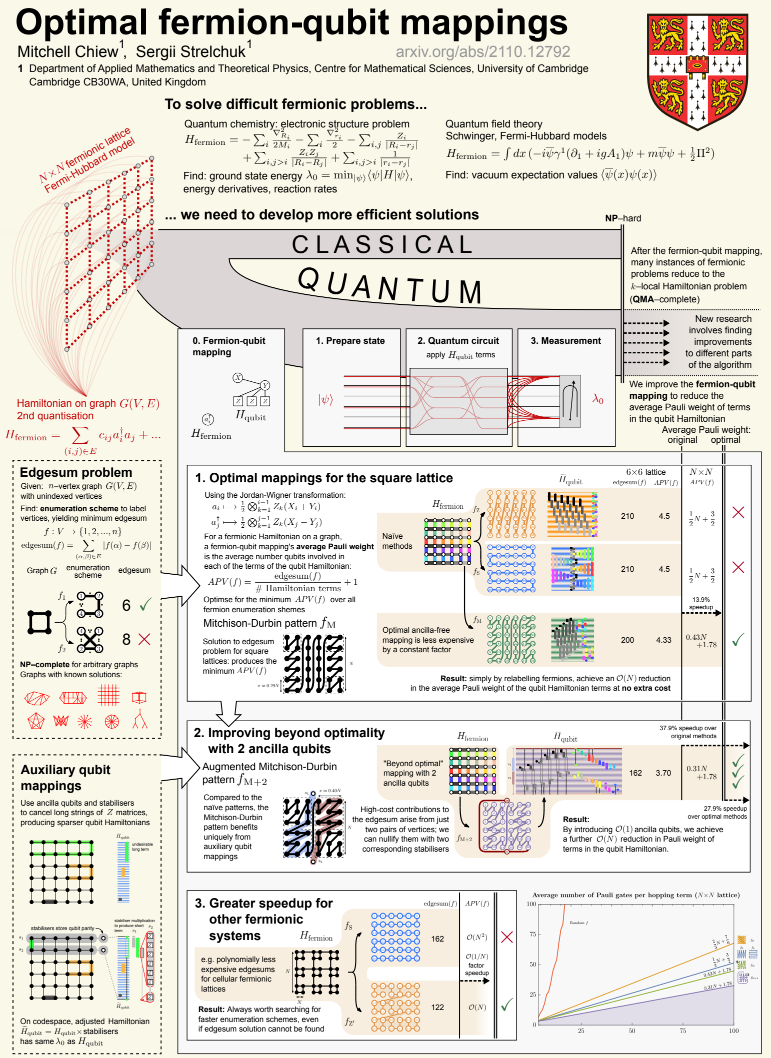
presented at the conference Quantum Information Processing in Los Angeles, USA

Left (sketch): hand–drawn, chalk on blackboard

Right (final): Ipe and Inkscape

The visual anchor for the first poster of my PhD was the advantage of quantum computing over classical methods. I sketched my idea on a blackboard first. The stylistic separation between classical and quantum computing ended up faithfully represented in the final product.





Other samples

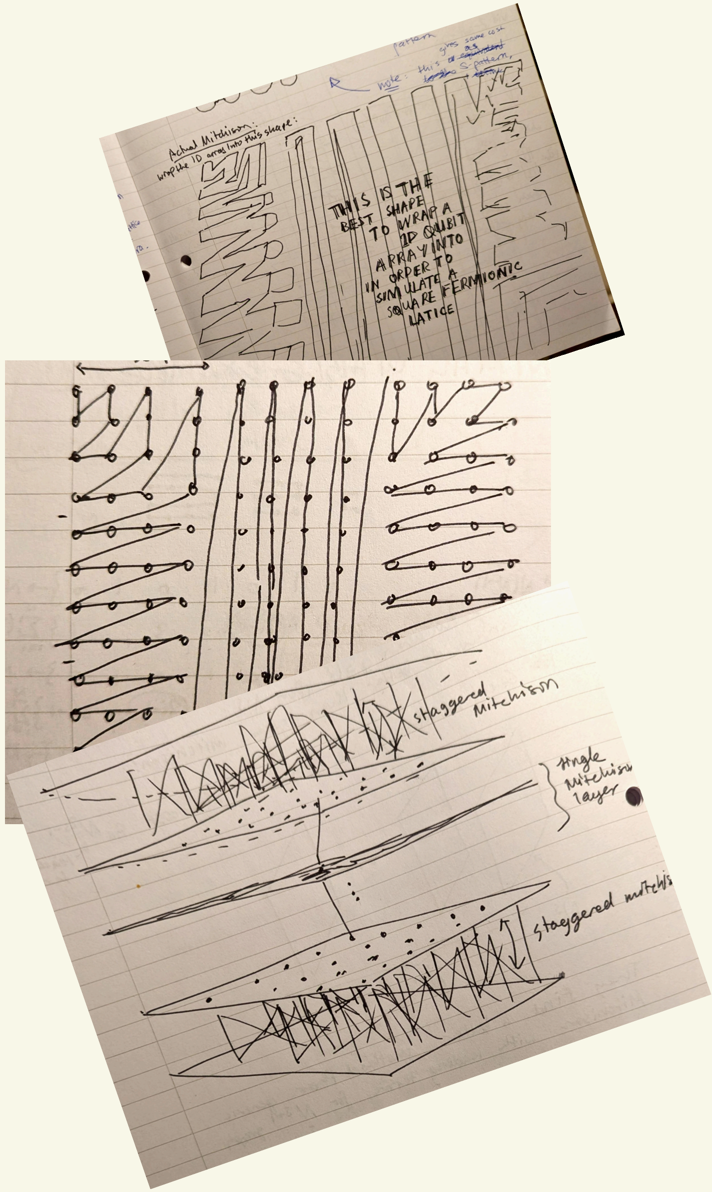
The Mitchison–Durbin pattern

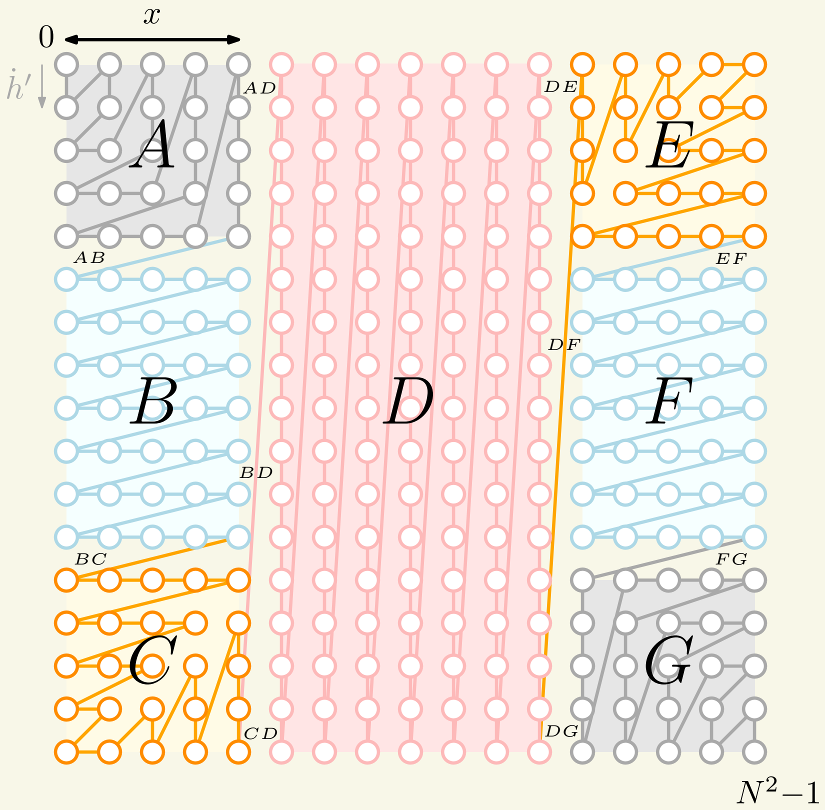
2020–2021

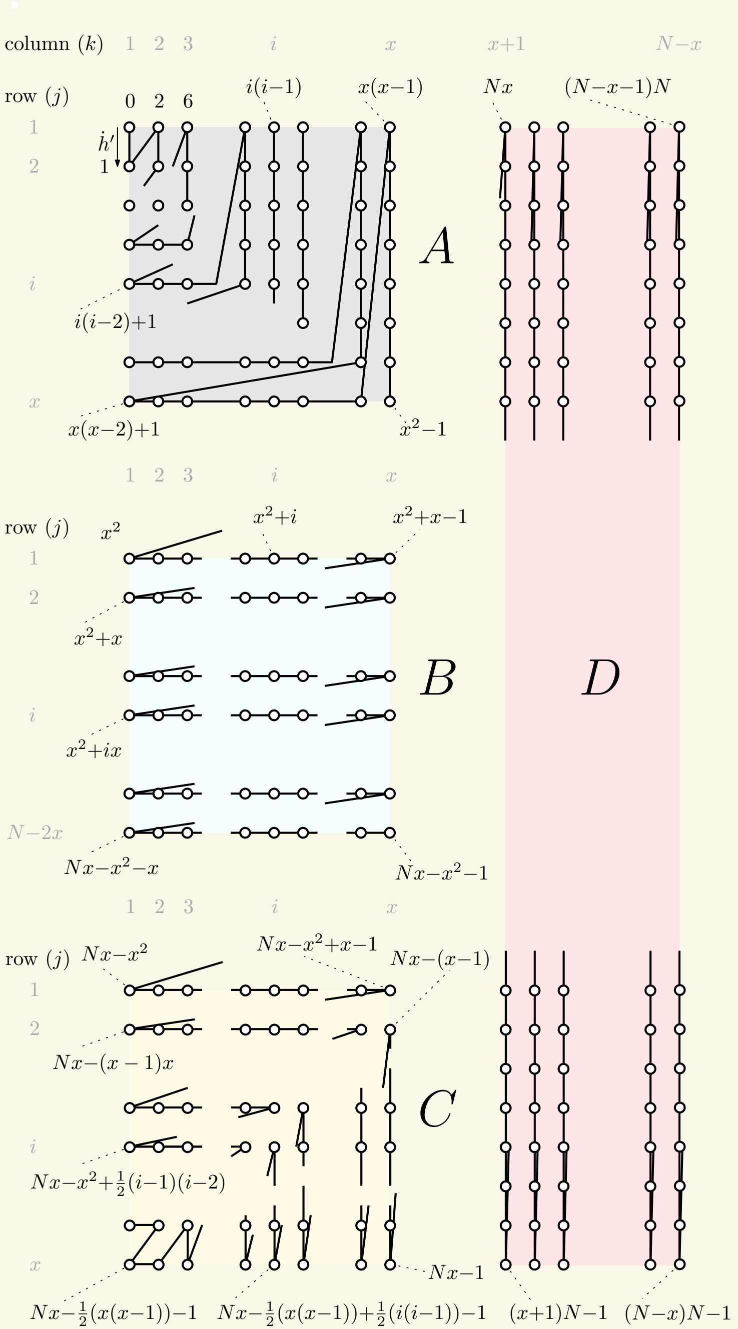
appears in Discovering optimal fermion-qubit mappings through algorithmic enumeration

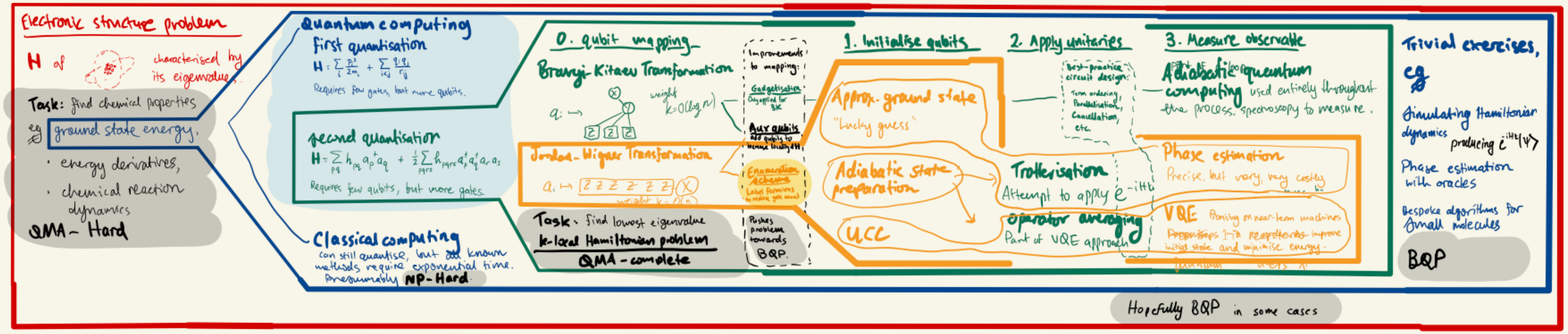
Left: (sketches): hand–drawn, chalk on blackboard
Centre and right (final): Ipe

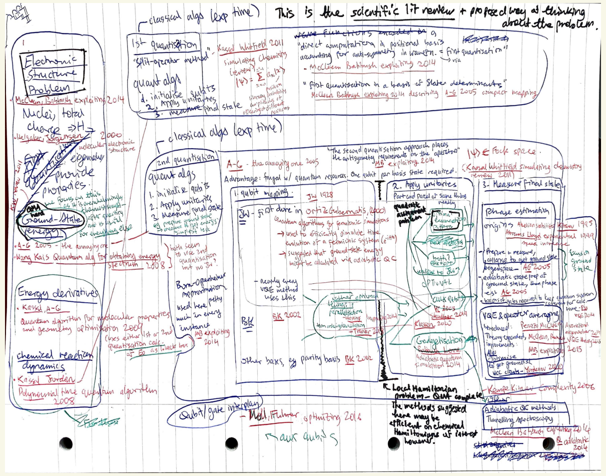
The first project in my PhD involved studying this pattern for labelling the vertices in a square lattice. The centre image depicts a vivid visual example, while the right image gives the explicit formula for all vertex labels.

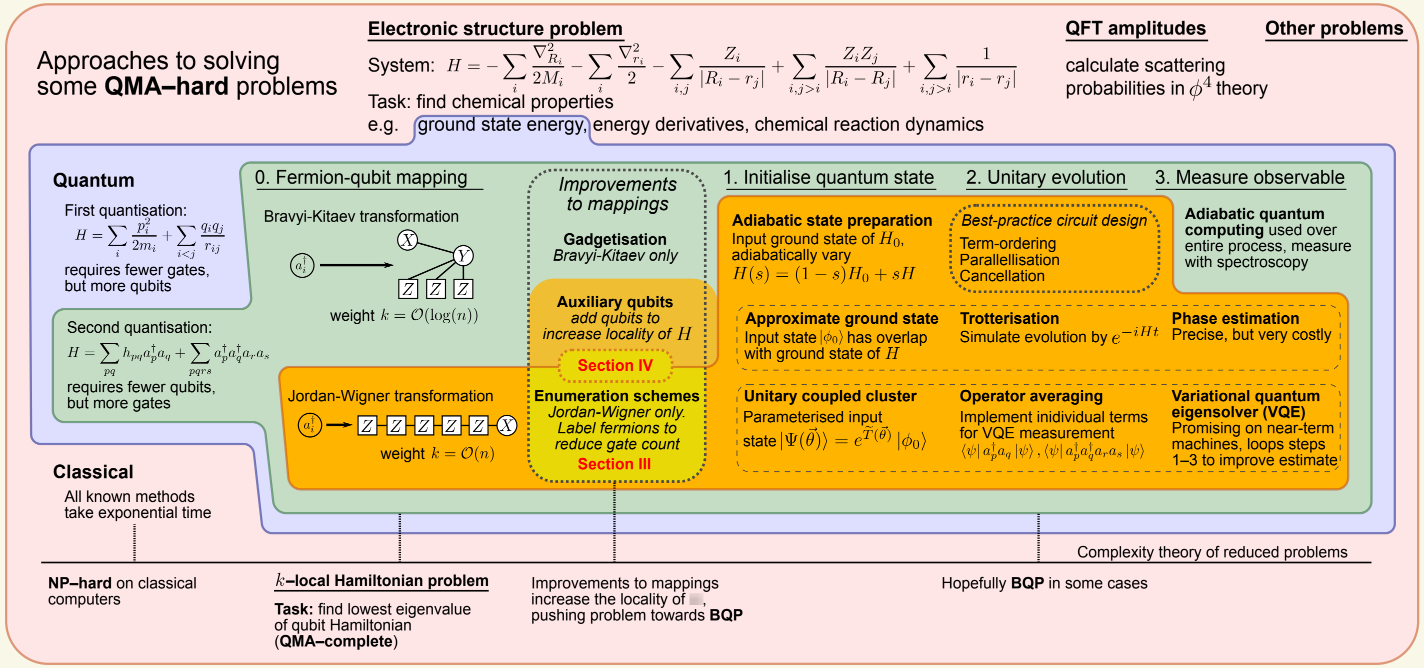












Quantum simulation algorithm survey
2020–2021
Left and top (sketches): hand–drawn
Right (final): Inkscape

The evolution of my literature review about quantum simulation algorithms,
from its inception as a mind map, the final hand-drawn sketch, and its complete diagram.