# *Mitchell Chiew*

***Art portfolio***

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I am an Australian theoretical physicist who has just finished a PhD at the University of Cambridge. This portfolio contains samples of my scientific artwork which have 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.


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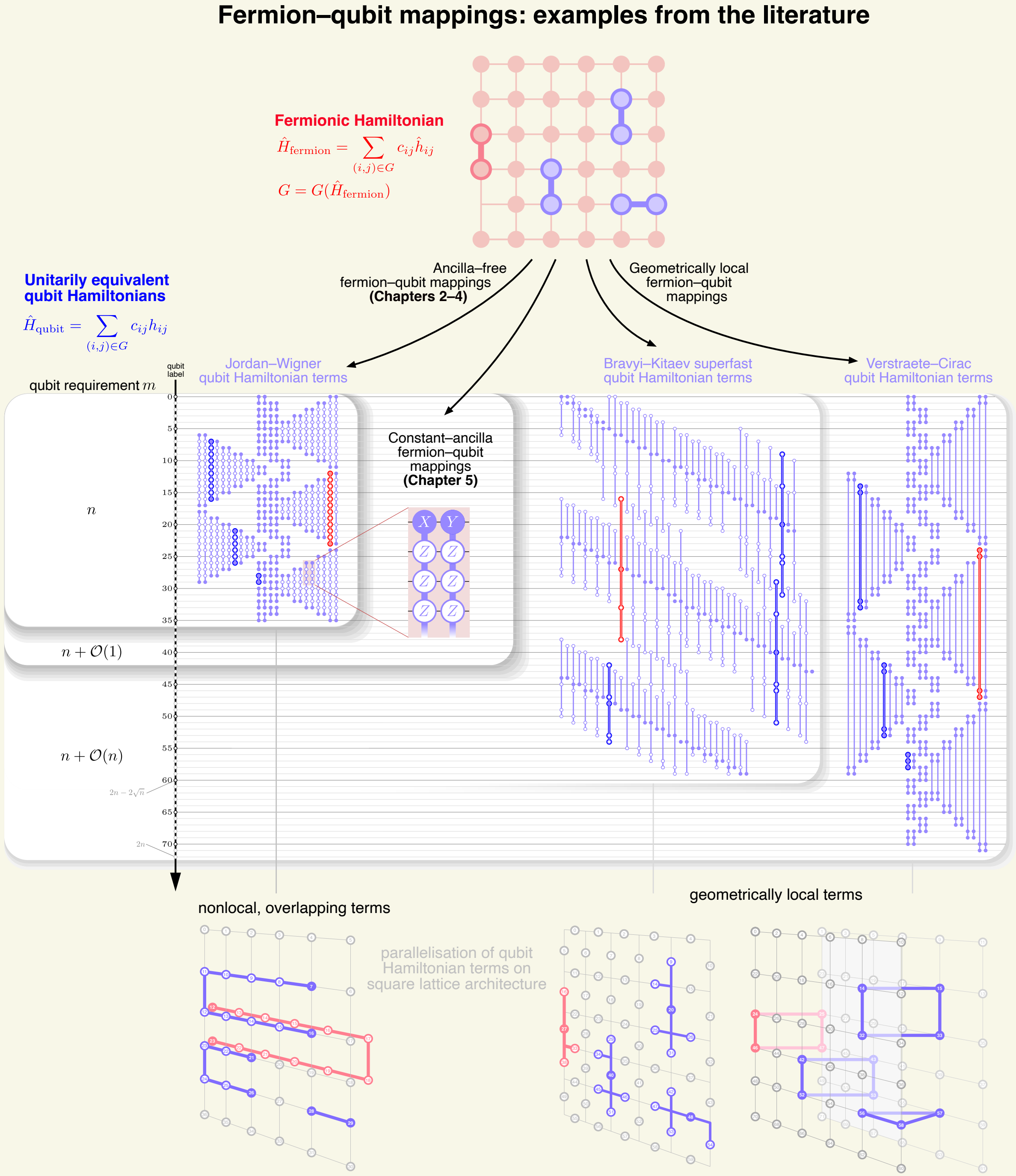
# Samples from theoretical physics

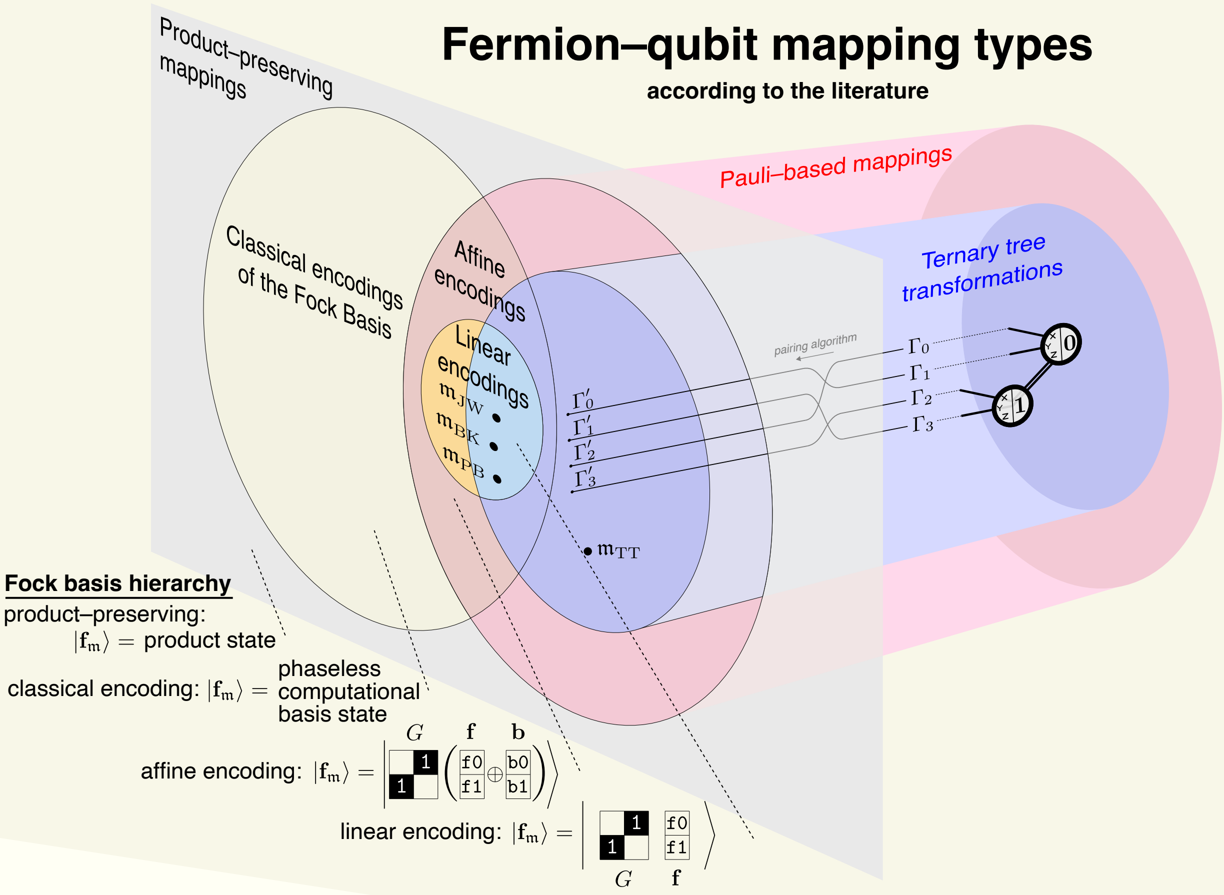
**Detail–oriented design**
*2024*
*PhD thesis*

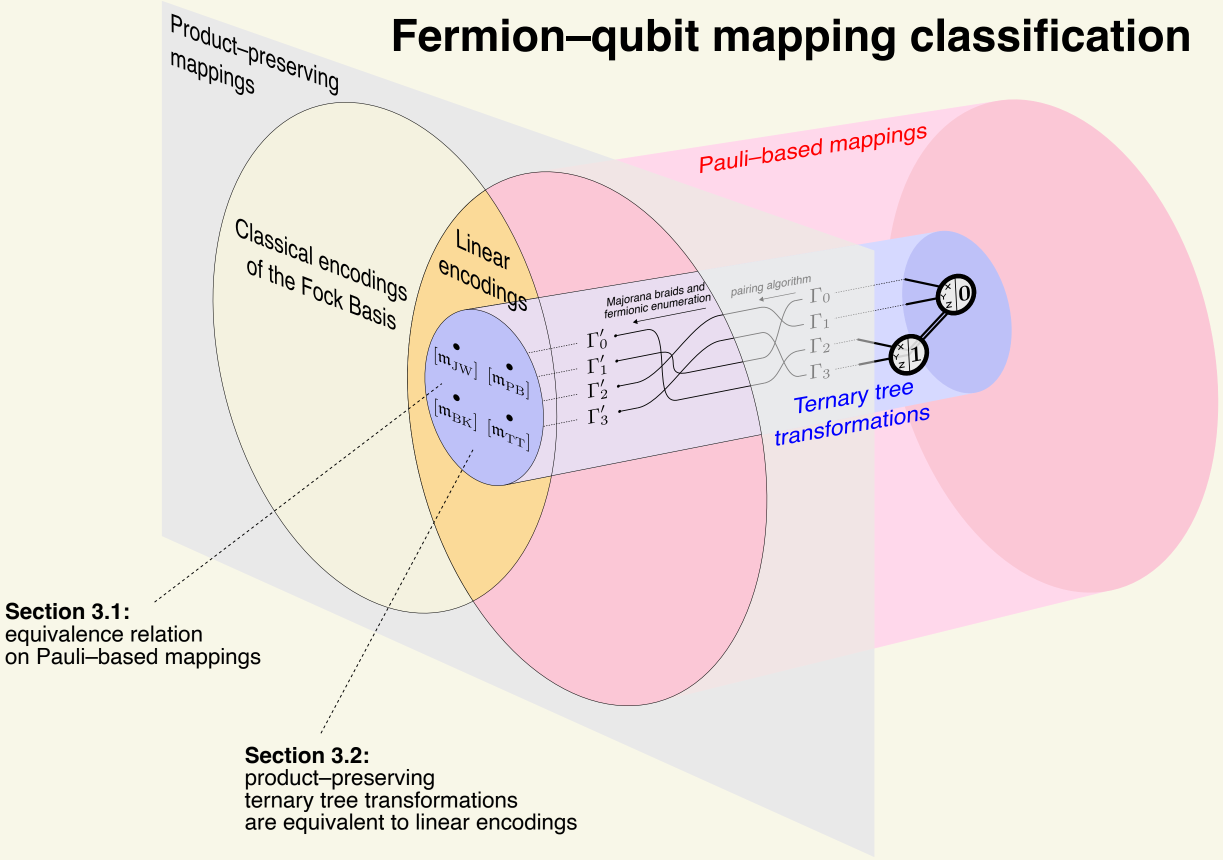
*Inkscape and Ipe*

Visual summary in the literature review of my thesis concerning techniques to translate fermionic problems onto quantum computers.

The image is the first visual representation of the equivalence between three different well-known techniques.






**Illustrating the impact of new research**

*2024*

*PhD thesis*

*Inkscape and Ipe*

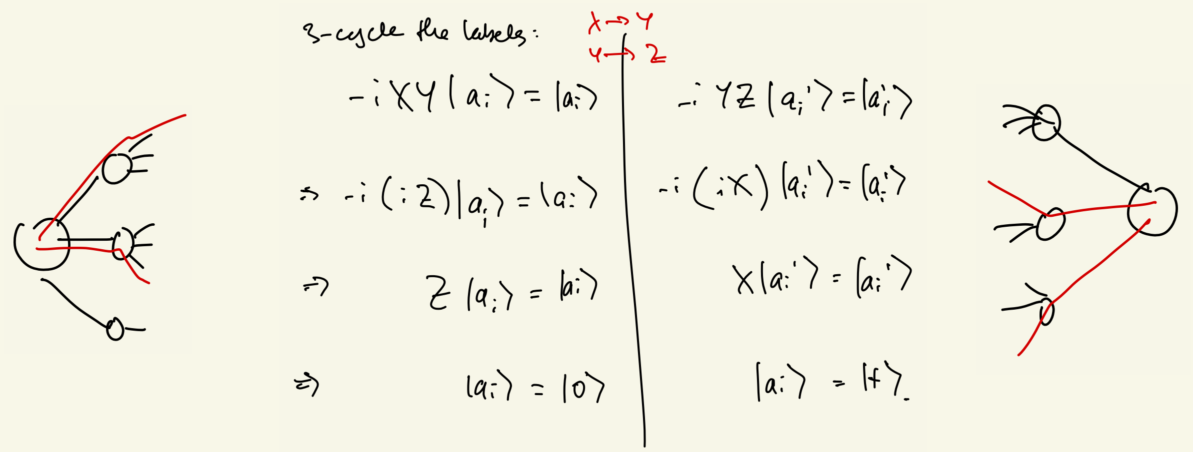
The left figure represents the the literature before the work in my PhD. I chose the 3D Venn diagram format to display overlapping concepts and redundancies in their description. The right figure depicts the simplification of these different concepts, and acts as a visual table of contents for my paper.

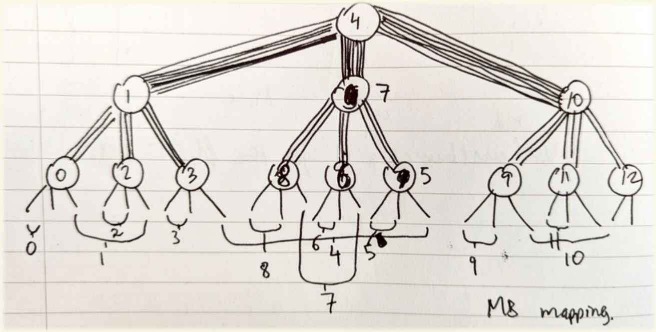
**Vivid imagery from sketches**
*2024*
[preprint](preprint)

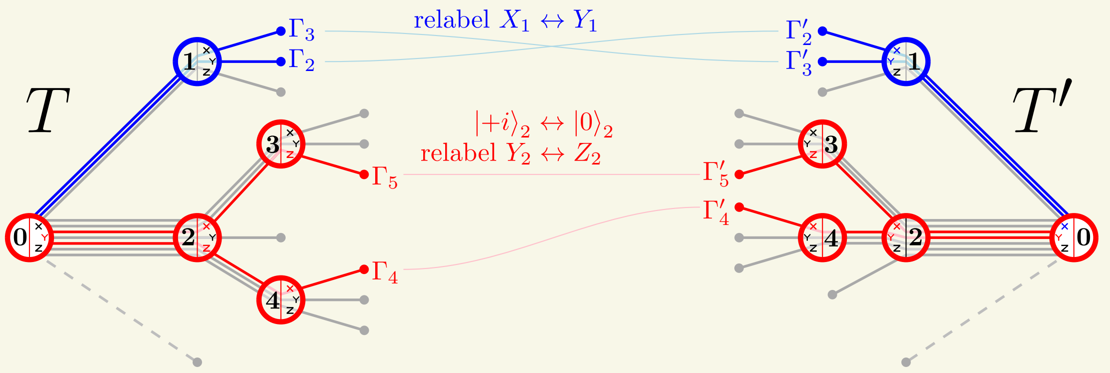
*Top left, top right (sketches): hand–drawn*
*Bottom left, bottom right (final): Ipe*

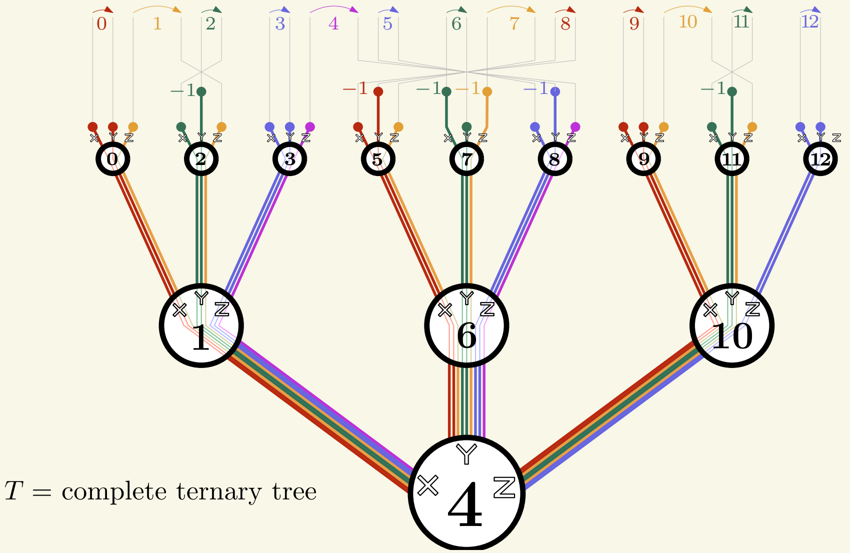
I created these diagrams to illustrate technical concepts in an upcoming preprint in the field of quantum computing, for which I am the lead author. Ternary tree graphs are the mathematical backbone of a popular strategy to encode fundamental particles in quantum computers.

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.



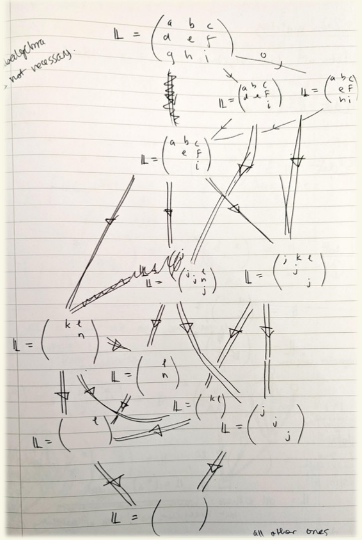



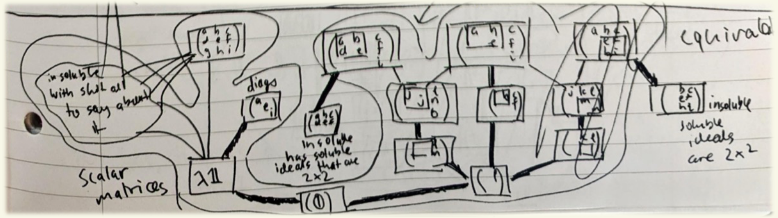
# My design process

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



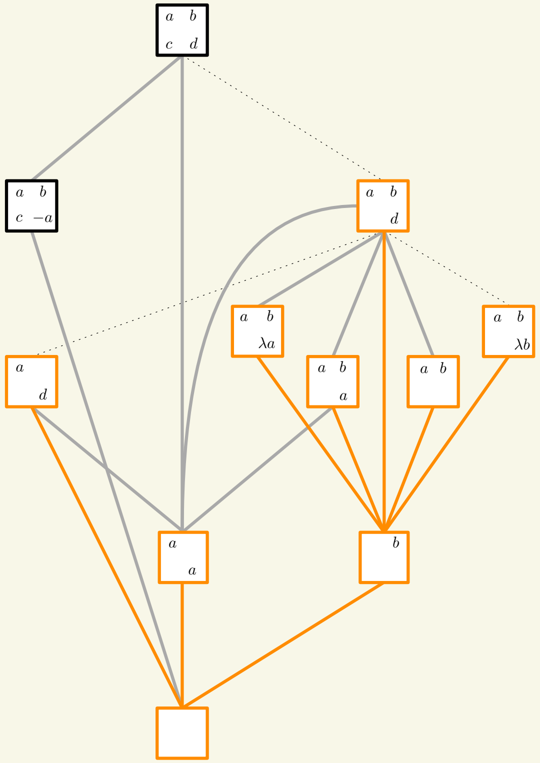
### Refinement


*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.

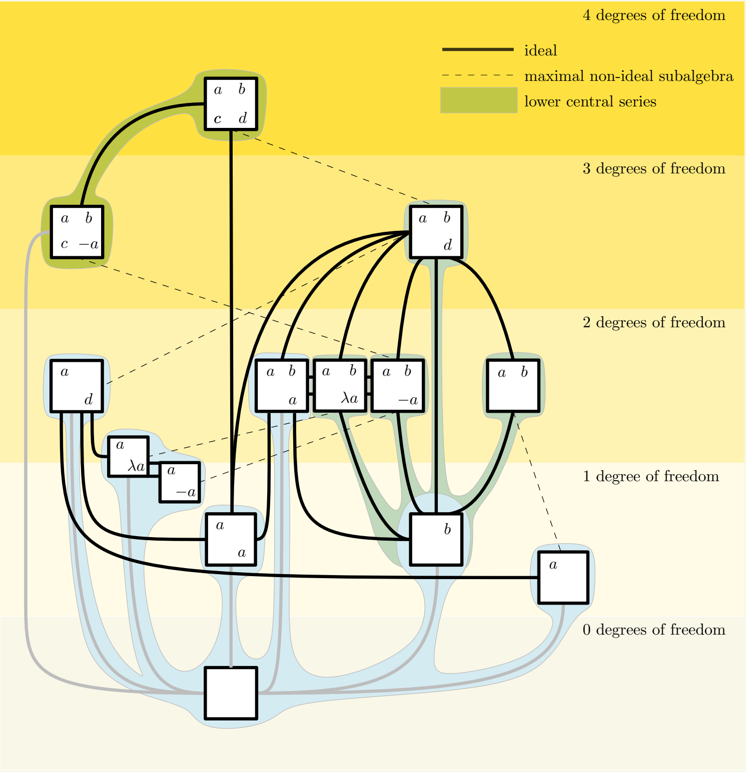
### Scientific accuracy and style



*2020*
*personal notes*
*Ipe*

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

### Final product



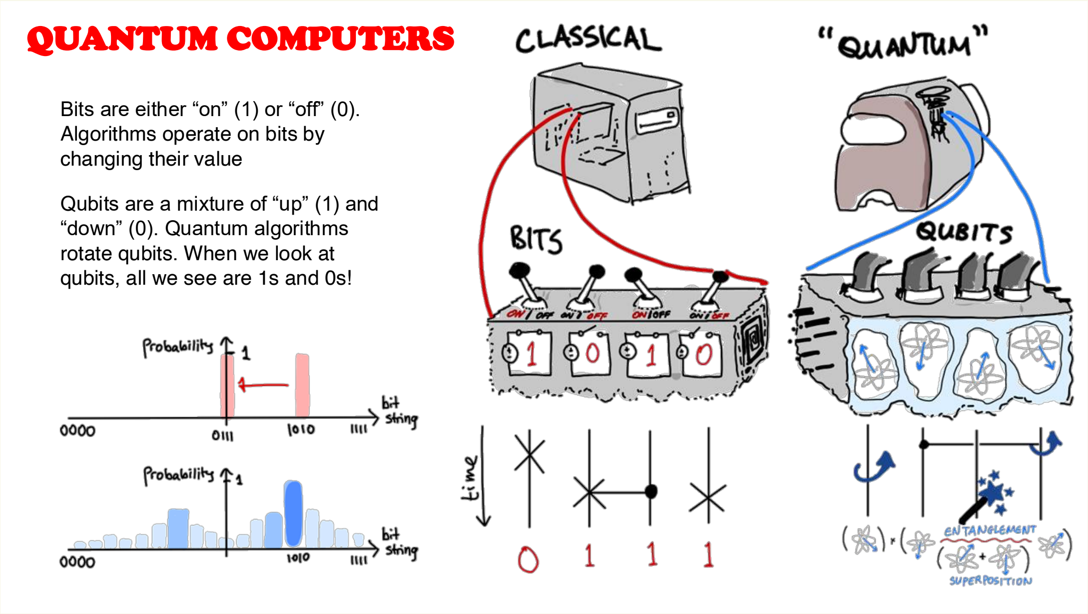

*2020*
*personal notes*
*Ipe*

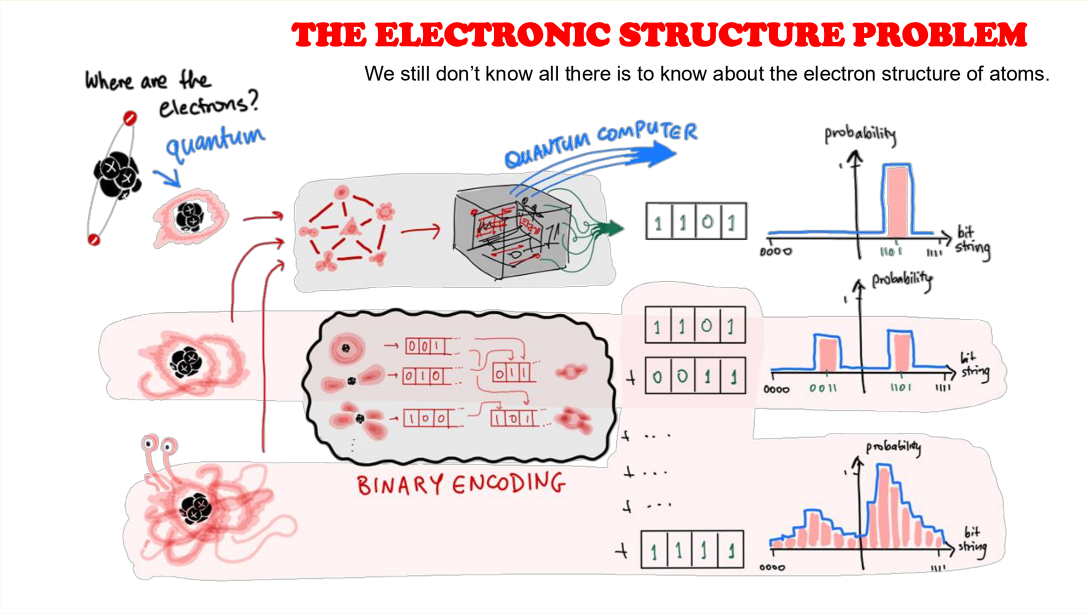
The stylised final product depicts all two–dimensional Lie algebras and uses the colour gradient to distinguish different categories.

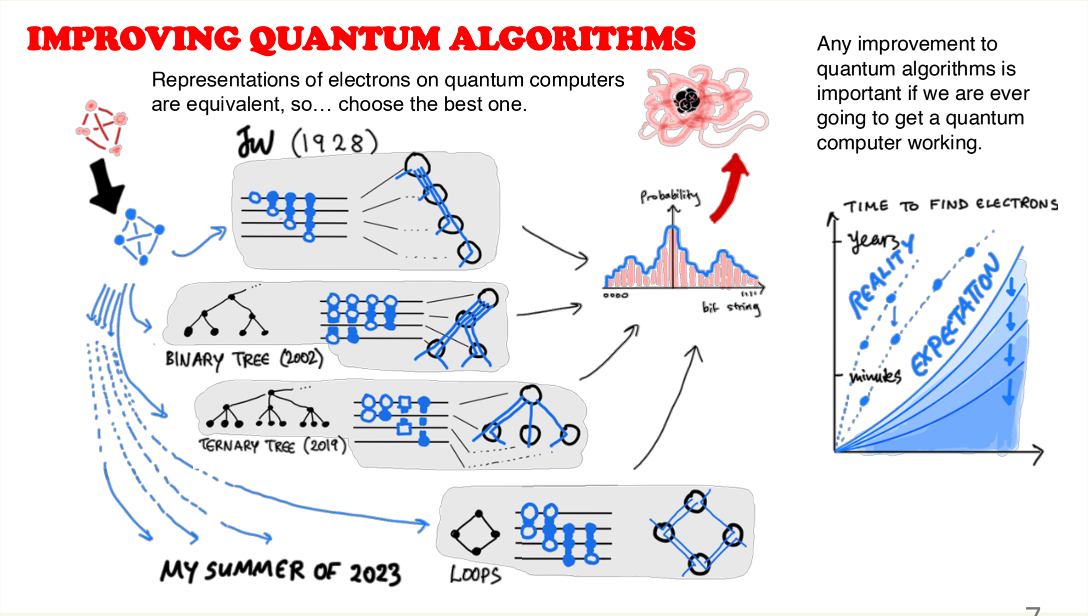
# Reaching broader audiences

**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.

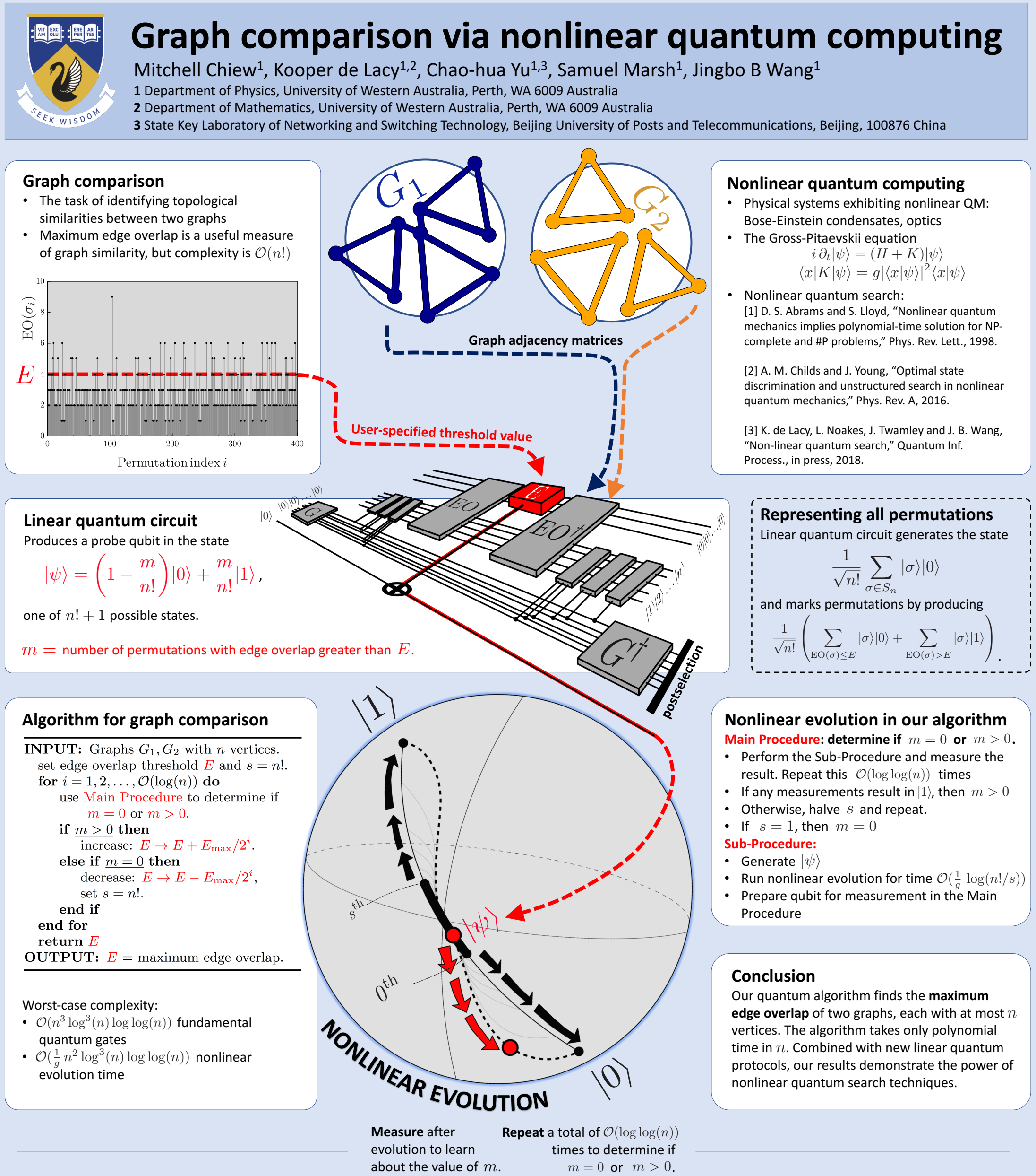
**Masters poster**

*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**

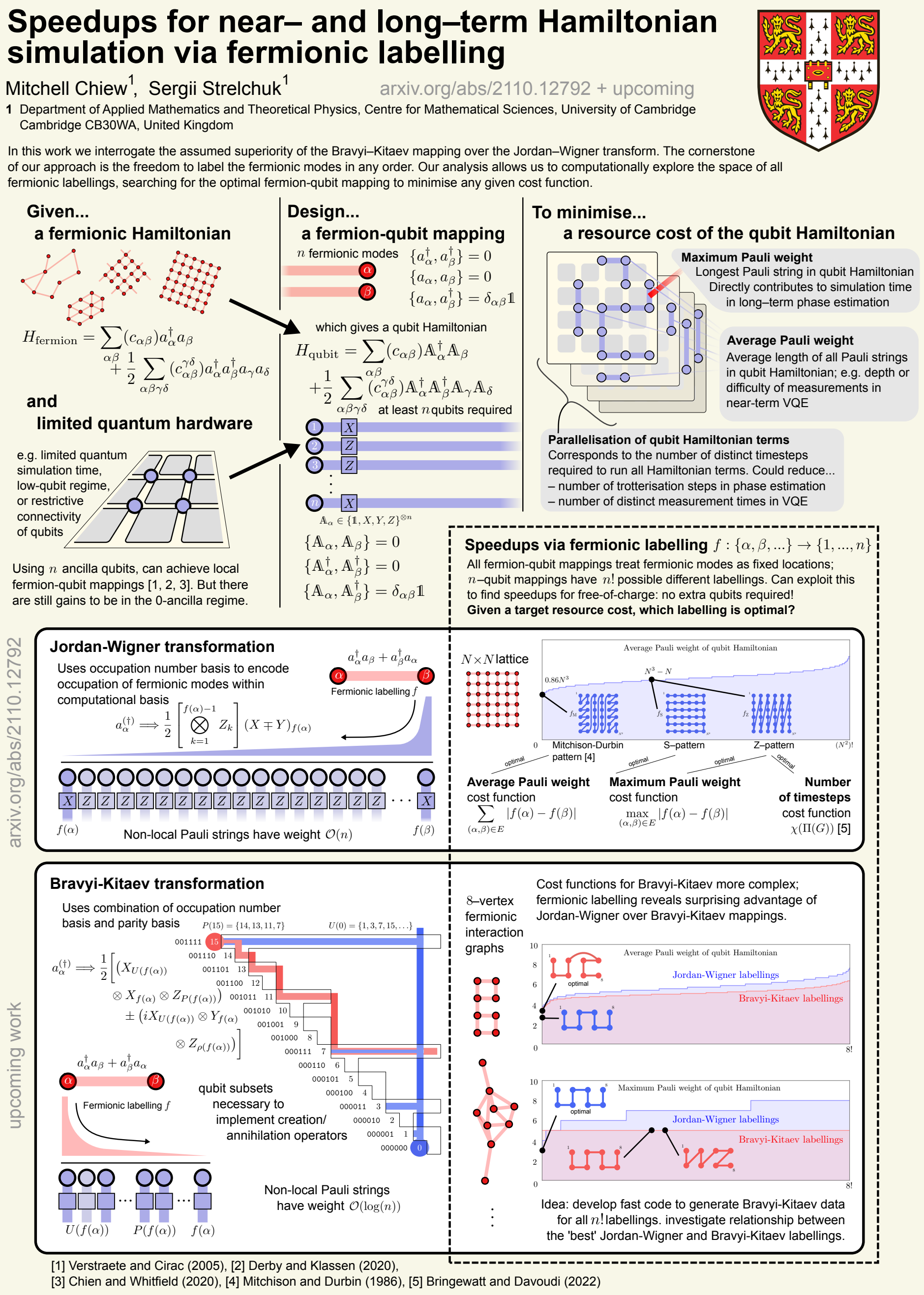
*2023*

*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*

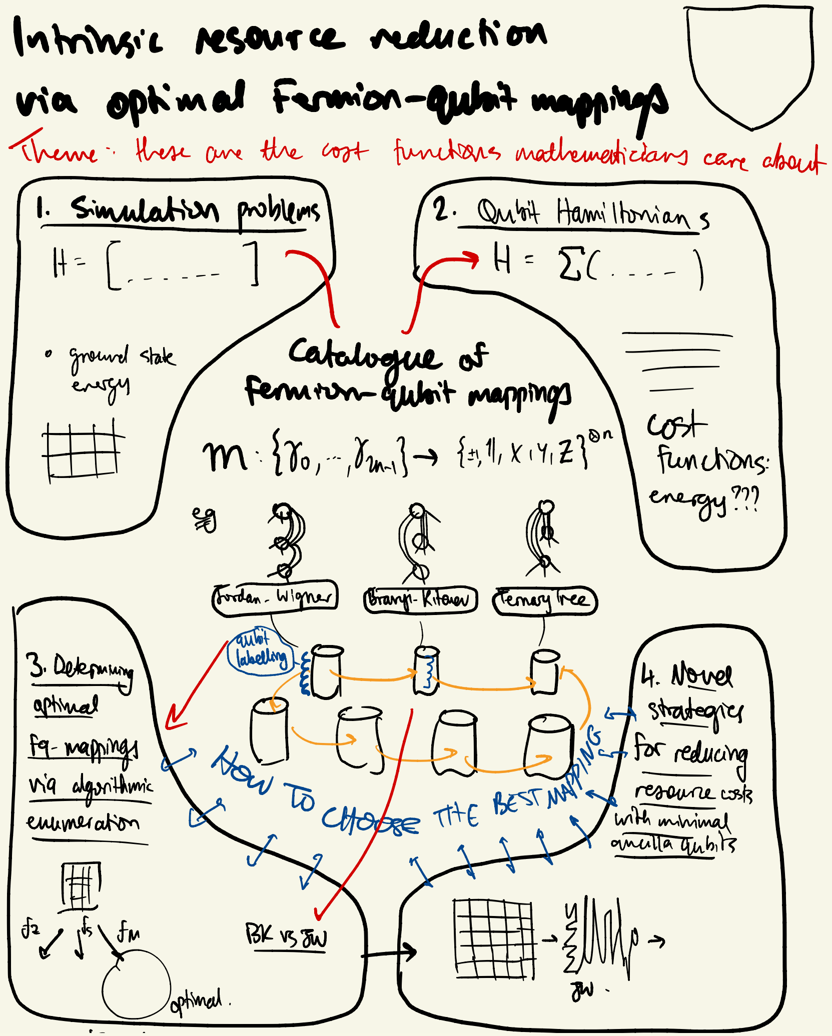
*Presented at the conference Quantum Information Processing in Taiepi, Taiwan*

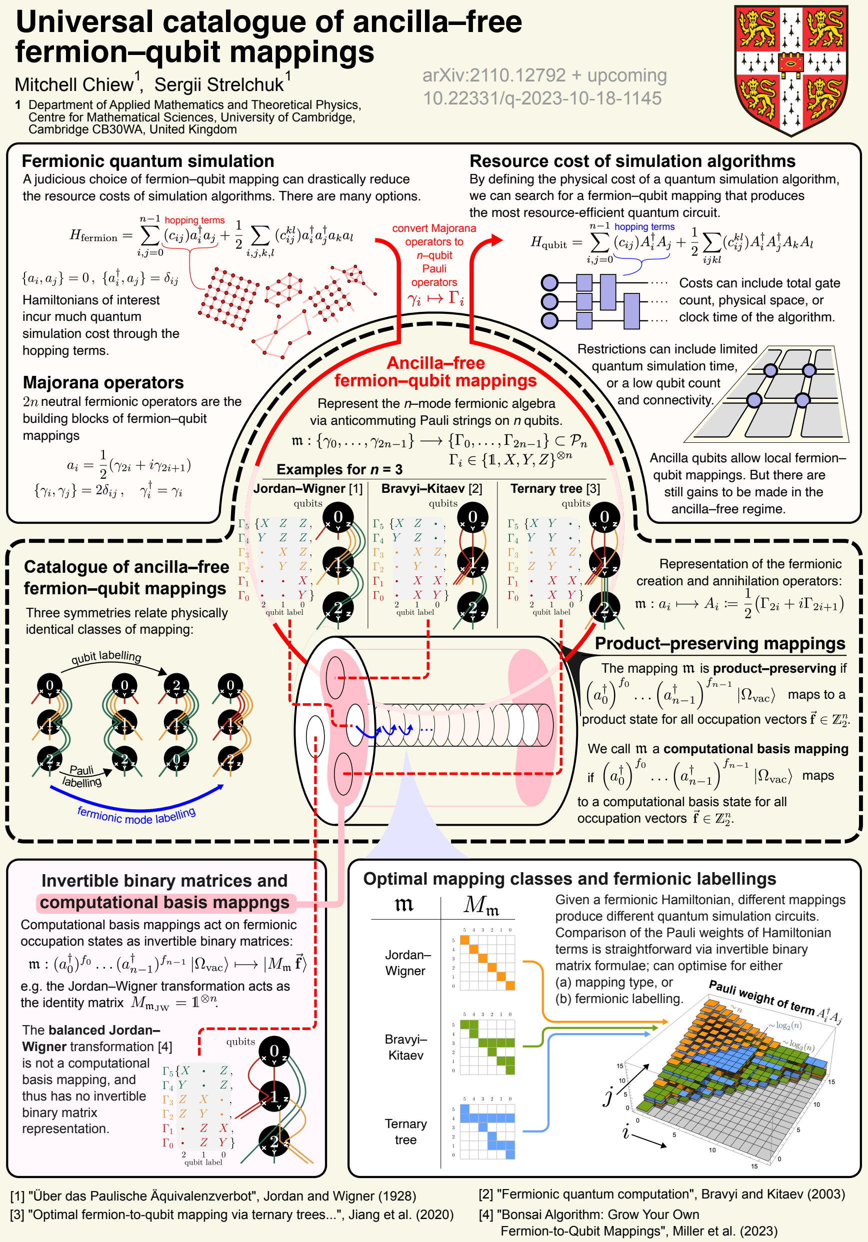
*Left (sketch): hand–drawn*

*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.



# 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.