

Fall Fest 2025, Half-way There!

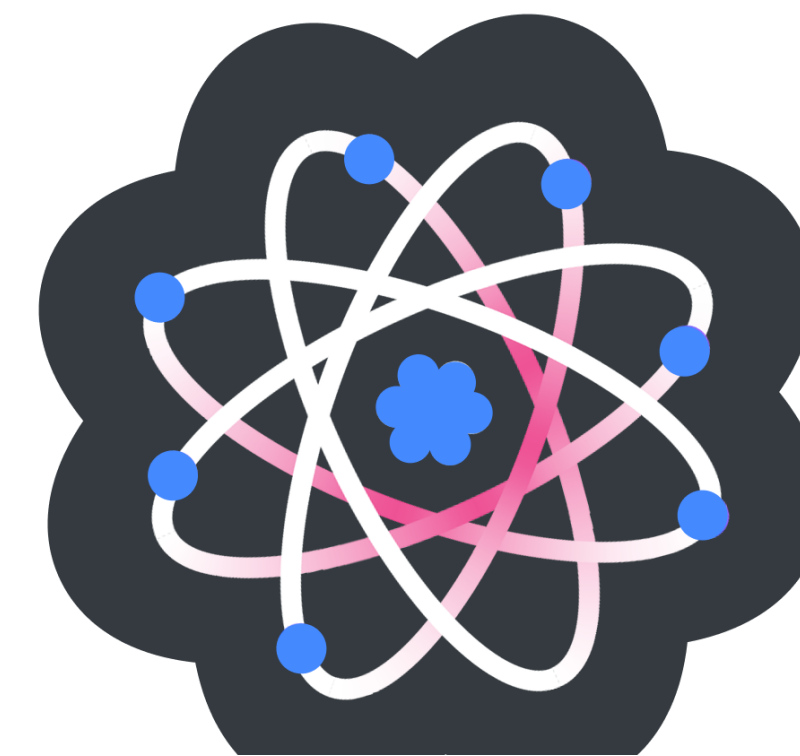
Natalie Hawkins

Qiskit Advocate, Tier 1

Seattle Quantum Computing Meetup, Founder



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Today's Agenda

- SQCM's FF25 Materials

https://github.com/SeattleQuantumComputingMeetup/qiskit_fall_fest_2025/tree/main

- Who else is hosting?

<https://www.ibm.com/quantum/events/fall-fest-2025>

- What is the International Year of Quantum Science and Technology (IYQ)?

- Why does this Year's Nobel Prize in Physics Matter for Quantum Computing?

- Real world interactions:
HowTo with Qiskit and Quantum Computers



International Year of Quantum Science and Technology, IYQ

- Declared by the UN
- year-long, world-wide initiative
- will “be observed through activities at all levels aimed at increasing public awareness of the importance of quantum science and applications”.
- 1925: significant progress was made in quantum mechanics, with [Wolfgang Pauli](#) announcing the [exclusion principle](#) and [Werner Heisenberg](#) developing [matrix mechanics](#) (Google AI Overview)



<https://quantum2025.org/>

100
Years of Quantum Mechanics

Nobel Prize in Physics, 2025

Clarke, Devoret, Martinis

"for the discovery of macroscopic quantum mechanical tunnelling & energy quantisation in an electric circuit"



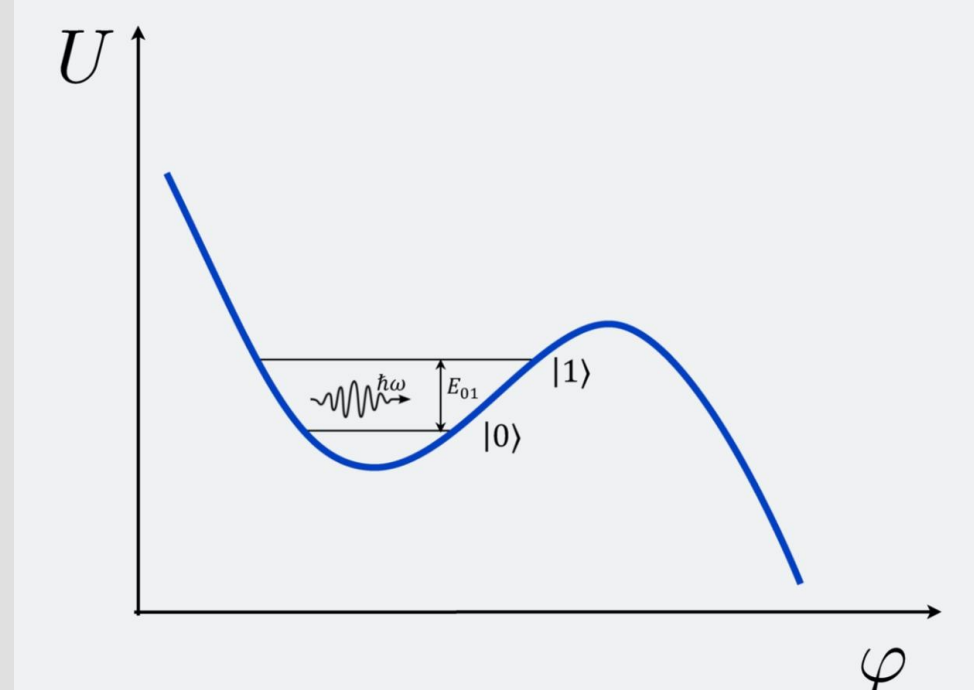
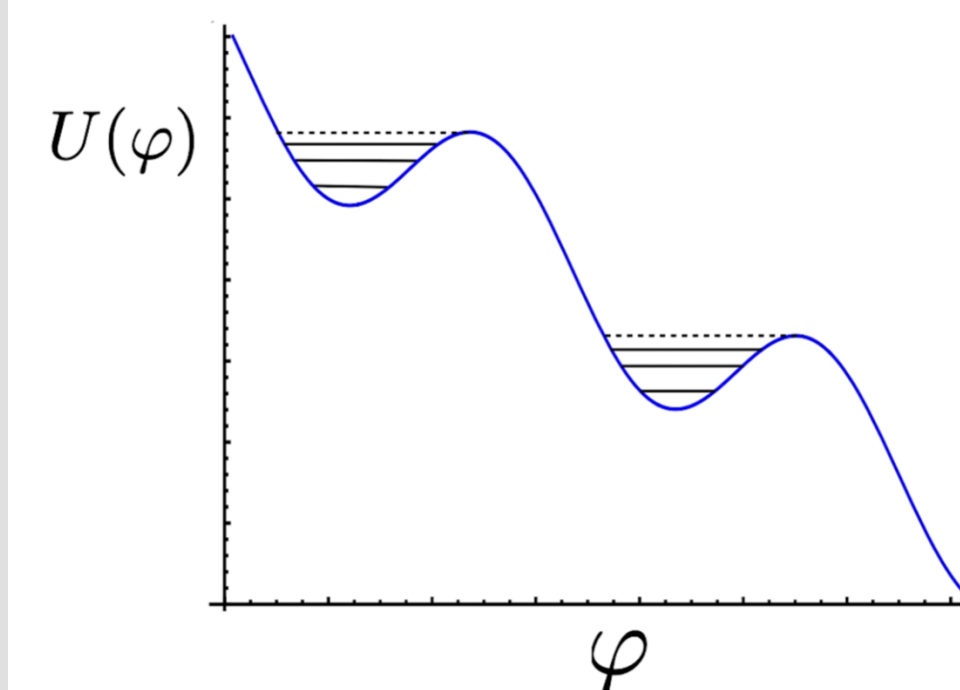
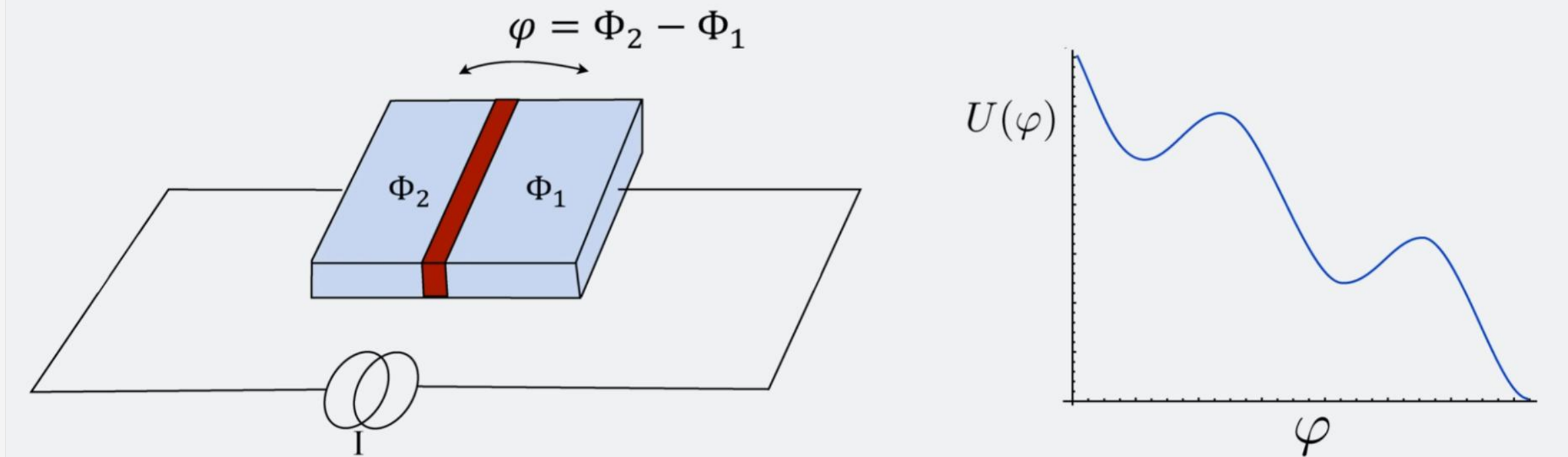
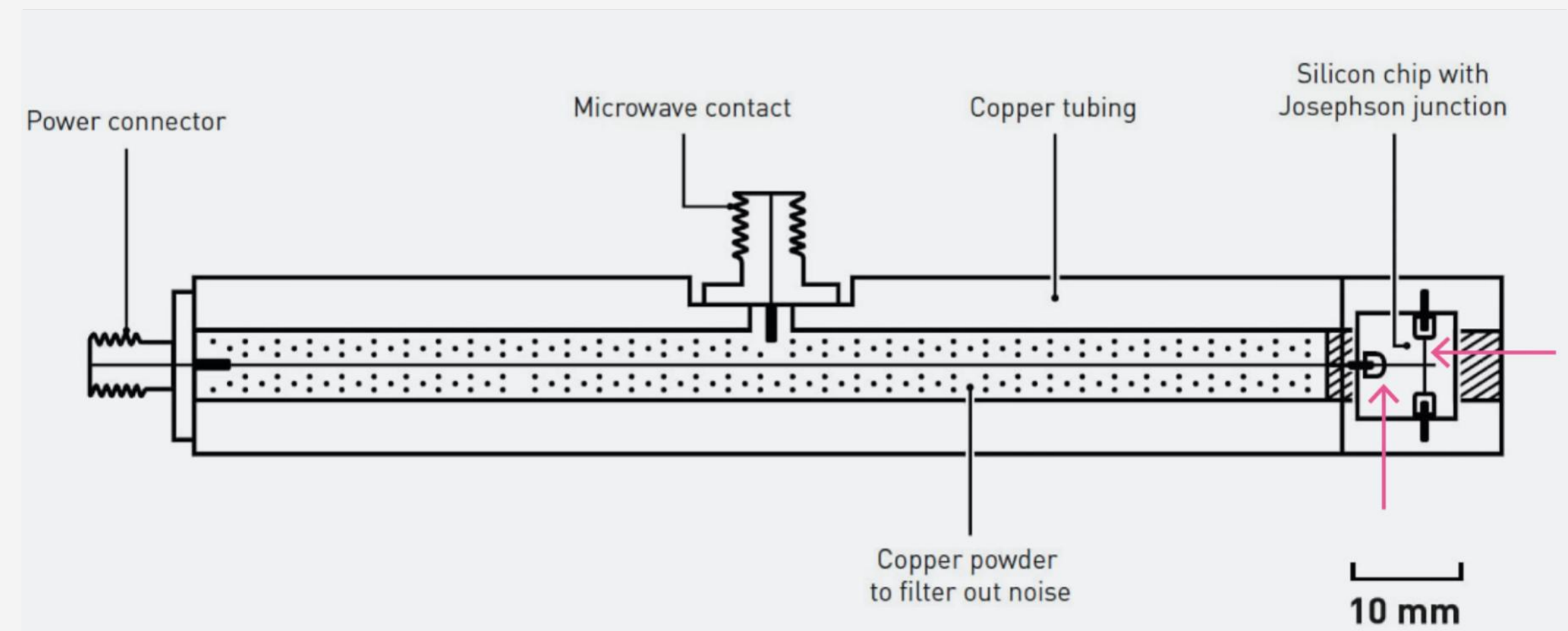
Why This Year's Nobel Prize Matters for Quantum Computing,

Qiskit Channel, Christopher Porter

<https://www.youtube.com/watch?v=N4zxJ5iJRhg>

Macroscopic Tunnelling, Energy Quantization in an Electric Circuit

- **Josephson Junction** = 2 superconductors separated by a thin barrier (red), and the current going through it can be controlled; i.e. biased; each superconductor is a macroscopic superfluid (of Cooper pair electrons)
- **Energy** – curve of the junction is a function of the phase difference, ϕ , of the phases of the two superconductors
- **Valley** – of the energy curve represents a qubit; when the bias current is below a critical value and at zero temp, the system sits in a valley; energy quantization of electrical circuits is observed in the valley, and energy can tunnel out of the valley
- **Application** = superconducting qubits, which are engineered to maximize coherence, minimize noise, and allow precise control, such as the ones used by IBM Quantum
- We can design the energy gap between $|0\rangle$ and $|1\rangle$, and use microwaves to control their quantum state on demand



Why This Year's Nobel Prize Matters for Quantum Computing
<https://www.youtube.com/watch?v=N4zxJ5iJRhg>

Real World Interactions w/Quantum Computing

Parts of Qiskit

<https://www.ibm.com/quantum/qiskit#ecosystem>



Open Source Software Development

Extend the Power of Qiskit - the Qiskit ecosystem is a collection of tools created by researchers and developers who use Qiskit every day.

<https://www.ibm.com/quantum/ecosystem>

Tools for heterogeneous orchestration

- Qiskit quantum hardware plugins, backend-agnostic
- QRMI: Quantum resource management interface
- Slurm workload manager
- Qiskit Serverless for multi-cloud and supercomputer use cases

Tools for algorithm development

- Qiskit Addons – combine to build algorithms; exist for mapping, optimizing and post-processing steps
- Qiskit Function templates – realistic code examples utilizing Qiskit and Qiskit Addons

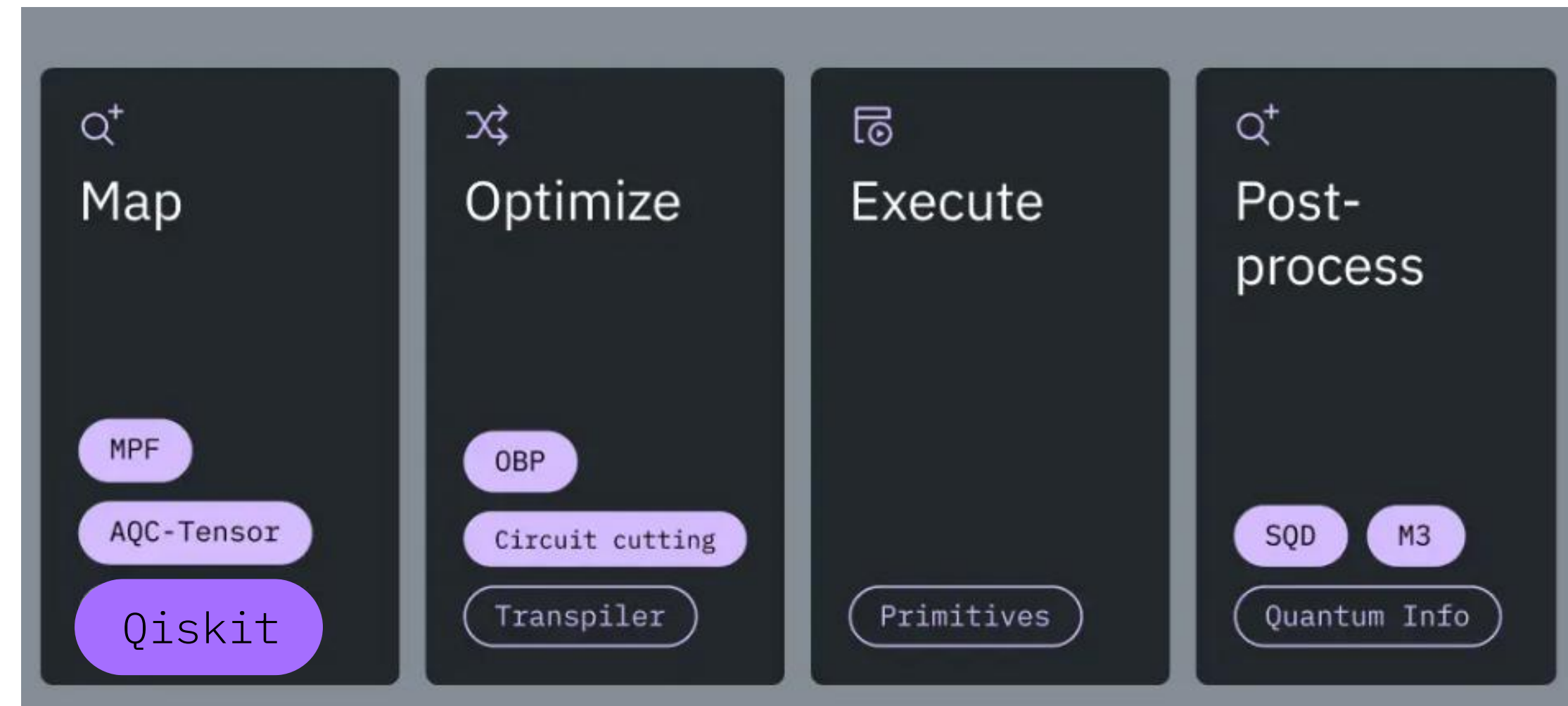
Use Cases

- Optimization: combinatorial problems
- Simulate complex systems in nature across physics and chemistry domains
- Quantum Machine Learning, leverage quantum kernels
- Partial differential equations, simulate nonlinear dynamical systems

Some Examples

Qiskit Tutorials

<https://quantum.cloud.ibm.com/docs/en/tutorials>



1

Combine addons to build an algorithm – as in the graphic above for a Hamiltonian simulation. The addons used are: MPF (multi-product formulas), AQC-Tensor, OBP, Circuit cutting, SQD, and M3.

2

Create your own addon. One example, could be an addon for loading classical data into the quantum computer.

3

Create a game.

Examples:

- *Qpong*,
<https://kirais.itch.io/qpong>
- *DOOM*,
<https://github.com/Lumorti/Quandoom>

4

Use the QAOA algorithm to solve an optimization problem.

Thanks for coming!!

Submissions Due: Nov 3, 10 am, PT

Next Event(s):

- Possibly a Zoom
- Possibly a Speaker on the UW Campus



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