

The Future

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Physics and Noise

- Better qubit implementations
 - Circuit depth and width beyond NISQ
 - More environmental tolerance
 - Parallel quantum systems
- Better coding and syndrome processing
- Qubit calibration by frequency binary search
<https://arxiv.org/abs/2501.05386>

Programming

- NSF-funded EpiQC

<https://www.epiqc.cs.uchicago.edu/>

- Fred Chong's ISCA 2018 talk

https://www.youtube.com/watch?v=ZQ_NE-E91aU

- Margaret Martonosi's ISCA 2018 talk

<https://www.youtube.com/watch?v=ELqFkmq4jts>

- Things are now more standardized at the level of assembly code, but not much higher...
that **must** change!

Communication

- Center for quantum networks

<https://cqn-erc.arizona.edu/>

- Quantum Internet 2023

<https://www.youtube.com/watch?v=40TcmAc6SCY>

Models

- Quantum circuit (gate) model
- Quantum annealing (adiabatic)
- Topological quantum (Majorana)

https://en.wikipedia.org/wiki/Topological_quantum_computer

- One-way / measurement-based (MBQC)

<https://arxiv.org/abs/0910.1116>

https://en.wikipedia.org/wiki/One-way_quantum_computer

- What else? QRAM? Customized models of specific physical systems?

What You've Learned

- Now you understand what QPUs can/might do
 - Quantum models and algorithms
 - NISQ issues, what might be next
- Quantum-inspired methods
- Quantum computer architecture issues
 - Basics of attached quantum processing units
 - Hybrid parallel and quantum systems

And none of us really understand quantum.