Title: Navigating the quantum computing field as a high school student

Speakers: Tanisha Bassan

Collection: Machine Learning for Quantum Design

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Navigating the Quantum Computing Field as a High School Student

@tanishabassan

Spark of Curiosity

Glowing Passion

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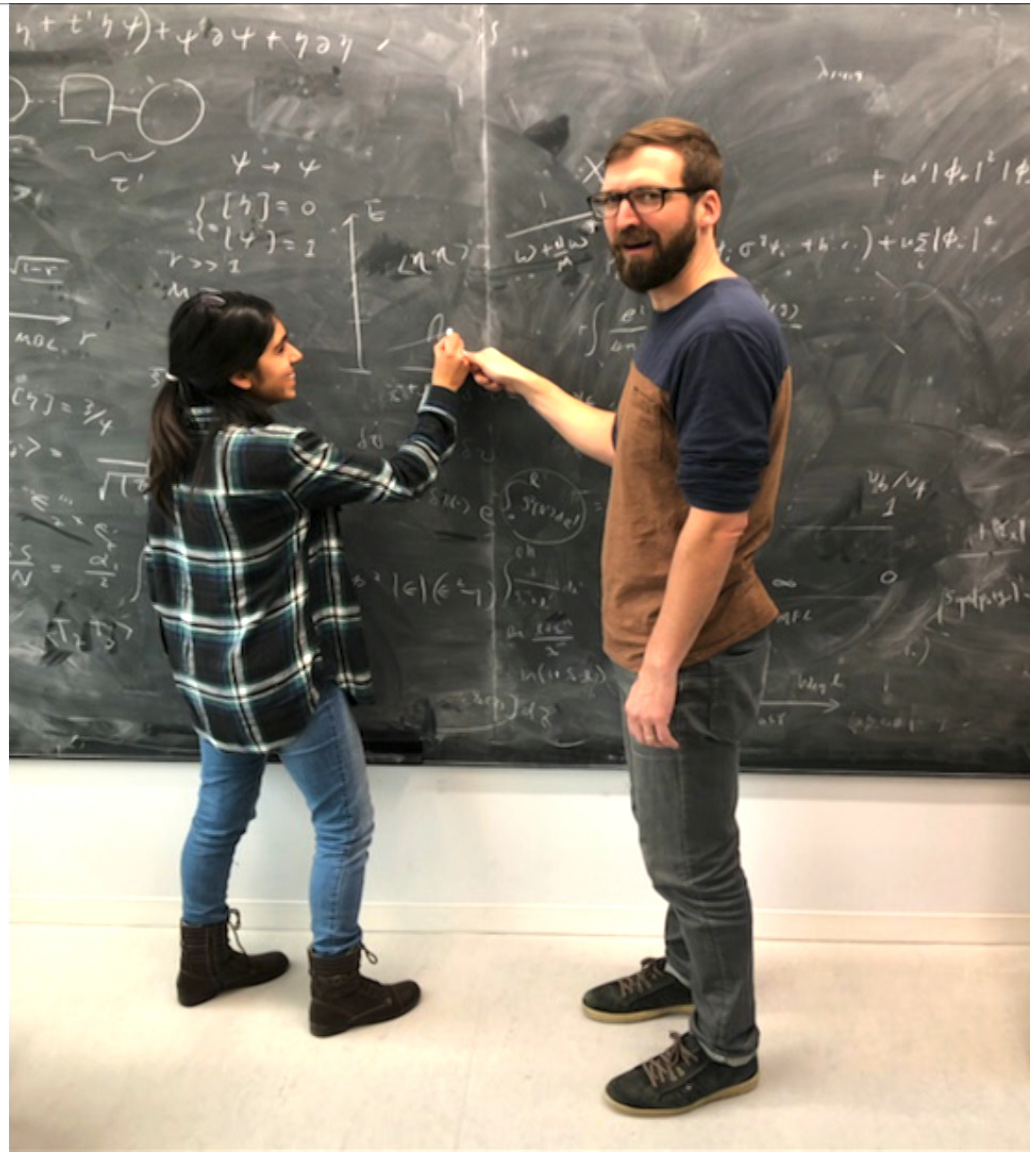
WATERLOO



SCATTERED
WAVE K(1,2)
TIME
SPACE
1st ORDER

Tanisha Bassan in HackerNoon.com
Jun 30, 2018 · 5 min read

Getting Started with Quantum Programming

Quantum Computers are starting to slowly become a common term in the

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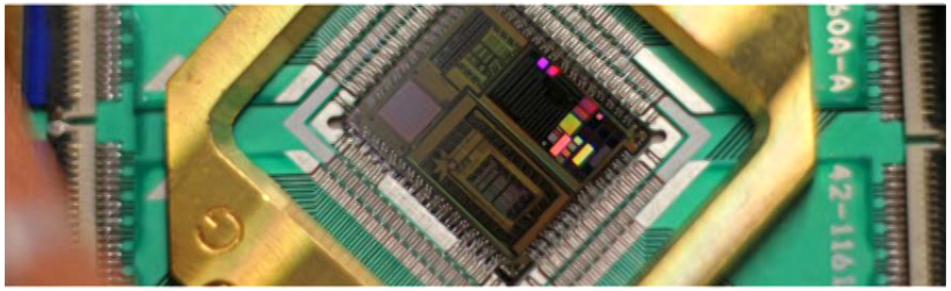

Decoherence: Quantum Computer's Greatest Obstacle

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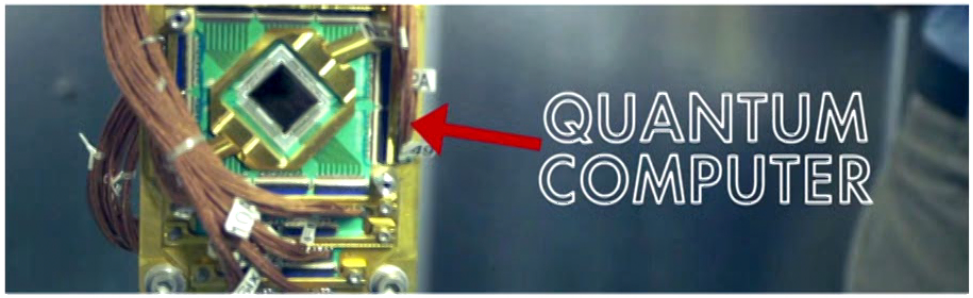
Jan 23, 2018 · 6 min read



A Brief Introduction to Quantum Computing

Quantum physics to me was always this mystifying property which give unreal…

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Nov 27, 2018 · 7 min read ★

Tackling the World's Hardest Problems Using Quantum Machine Learning

rigetti

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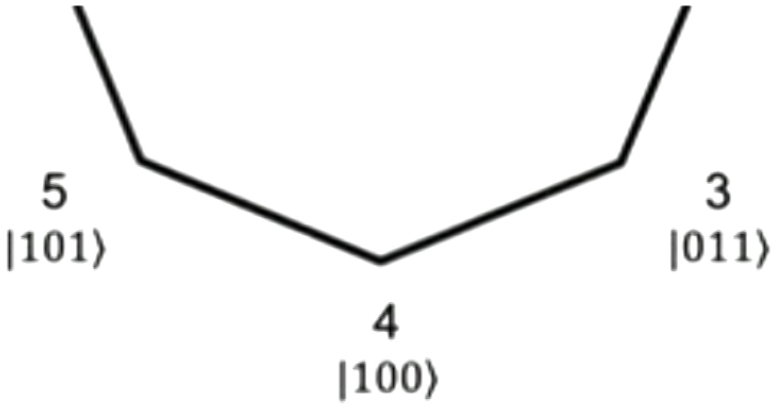
$\Delta x = \frac{\lambda}{4}$
$\Delta x \Delta p = \frac{h}{4}$
$h = 2\pi\hbar$
$p = \frac{h}{\lambda}$

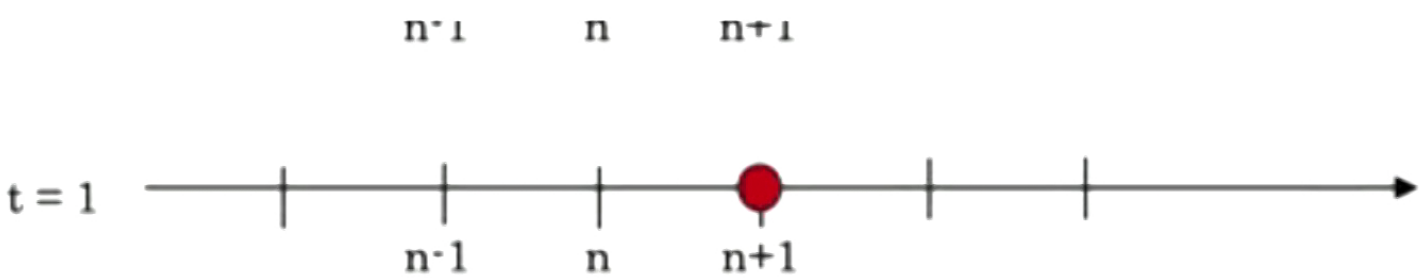
Qiskit



The operations propagate systemically around the graph as each node is a seperate bit-string value in lexicographic order. For 2n graph, n qubits required to encode problem and 1 ancilla qubit for subnodecoin)

```
path_circ = "./images/whole_circuit.jpg"
display(Image.open(path_circ))
```

Qiskit



The dynamics can be regarded as a simple algorithm as shown.

1. There is a n-dimensionin this case, one for simplel space and a walker start at the point $x = 0$
2. take a step either forward (toward $+x$) or backward(toward $-x$) in 2., the choice is to be made randomly(ex: coin-flip). We call this "Coin Operator"

In this system, $p + q = 1$

Quantum walk

Quantum walk is "quantum version" of random walk. This means the function can be Unitary gate($U(2)$) which is non-random and reversible.

$p + q = U \in U(2)$

In these experiments, we use a Hadamard gate for executing the coin function as since it puts our qubits in a state of superposition which is abel to simulate the coin based probability.

$$H = \frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

There are continuous and discrete quantum walks. In our experiment we use the discrete framework. In the discrete walks, unitary operations are made of coin and shift operators $U = SC$

Qiskit

This circuits shows whole process(for 2 flips) of Quantum Walk on cycle graph with 2^3 nodes. The gray square frame is a set of Coin operator and shift operators. In this circuit, q[0] to q[2] represents the state (position) of quantum walker, and q[3] represents the Coin Operator

In this style, a programmer can insert initial position of walker as 3-qubits state. For example, if the input is 110, the position is 6

The coin operator decide whether walker go Clockwise or Counterclockwise

INC is gates that increments the state of walker which is equal to Clockwise rotation in the cycle graph. DEC is gates that decrements the state of walker which is equal to Counterclockwise rotation in cycle graph.

After repeating of the coin operator and the shift operator, we measure the qubits other than the coin qubit, and it is possible to know the position of the walker.

n-qubit Toffoli

```
path_toffoli = "./images/toffoli.png"
display(Image.open(path_toffoli))
```

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$\Delta x \Delta p \geq \frac{h}{2}$
$\Delta x = \frac{\lambda}{4}$
$h = 2\pi\hbar$
$p = \frac{h}{\lambda}$

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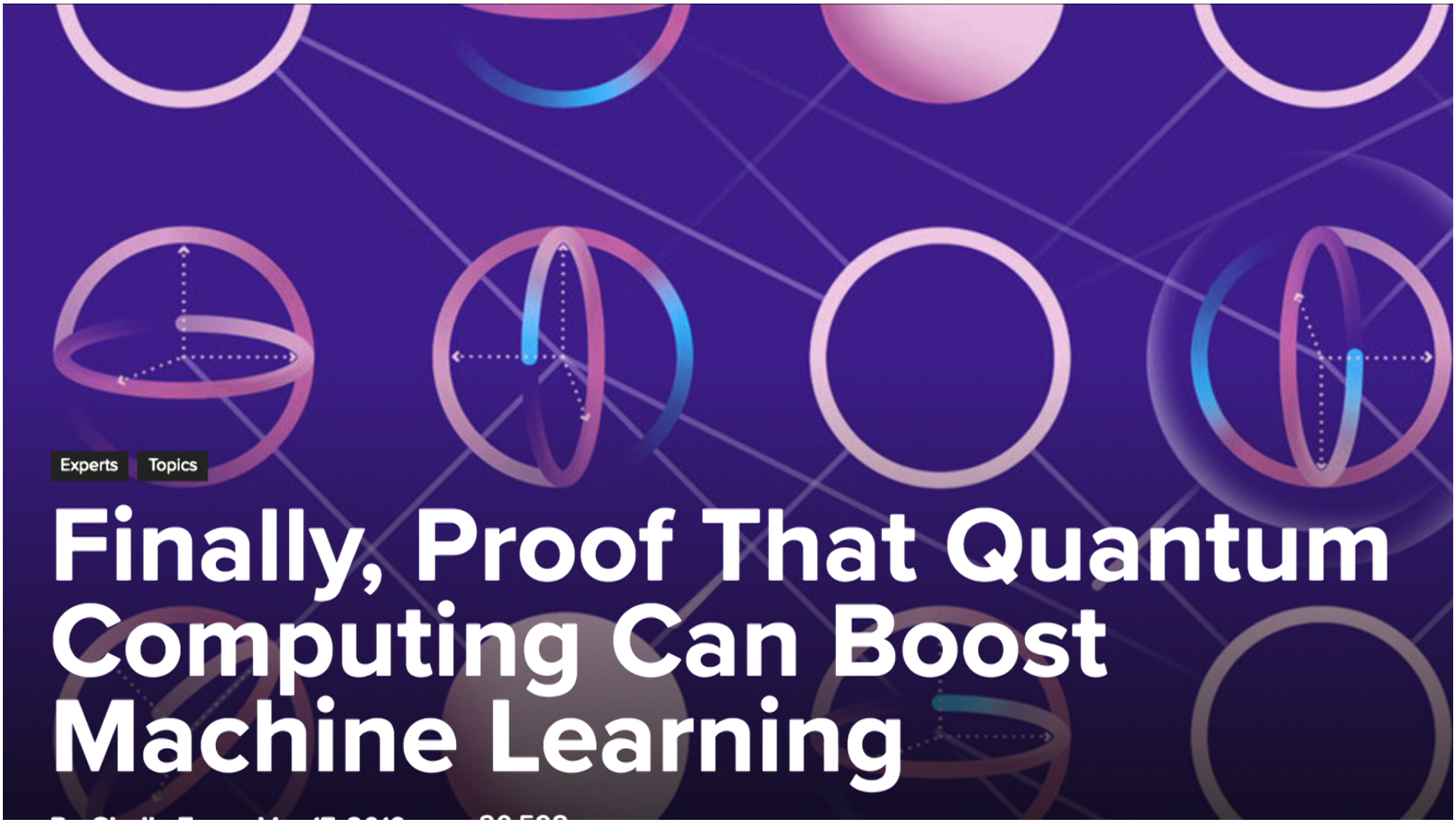
Experts
Topics
Finally, Proof That Quantum Computing Can Boost Machine Learning

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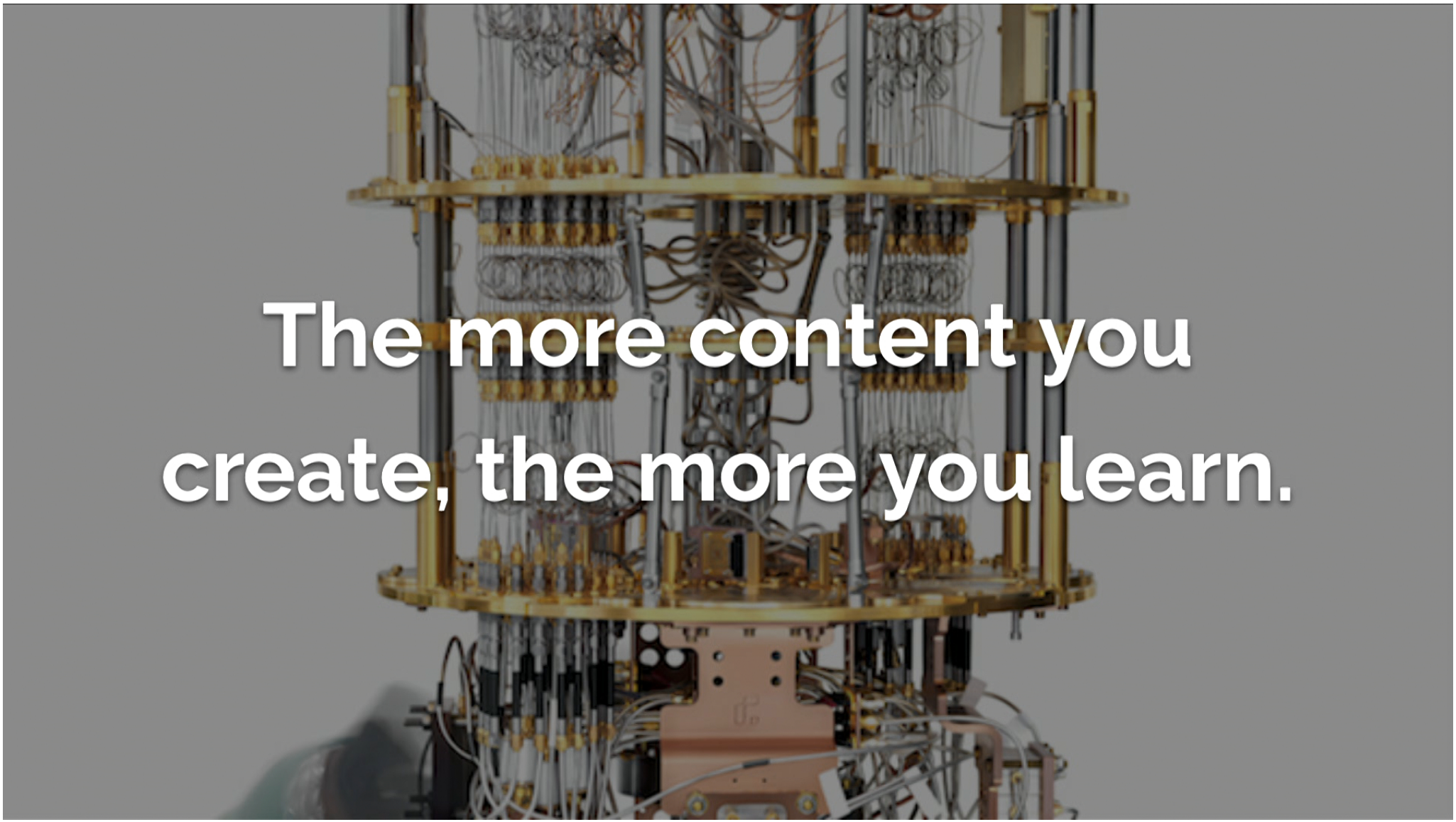
Don’t be afraid being a
beginner.

Find great mentors to
support you.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create, the more you learn.

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ER
Δx Δp ≥ h/2
Δx = λ/4
=2πħ
p = h/λ