

An abstract graphic on the left side of the page, resembling a circuit board or a network diagram. It consists of several vertical lines of varying heights, some of which are connected by horizontal and diagonal lines to small circles. The lines and circles are colored in a gradient from dark blue at the top to light blue at the bottom. The overall shape is roughly rectangular, with the lines and circles extending from the top and bottom edges towards the center.

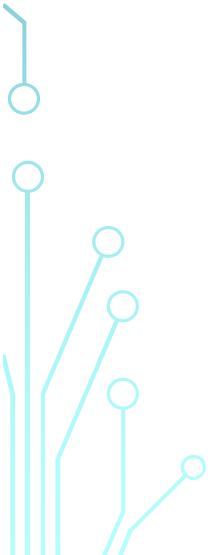

QUANTUM COMPUTING

A SURVEY



OPEN SOURCE



- LIQUID(<http://stationq.github.io/Liquid/>)
 - ProjectQ(<https://projectq.ch/>)
 - QBSolv(<https://github.com/dwavesystems/qbsolv>)
 - Quantum Experience (<http://www.research.ibm.com/quantum/>)
 - QCEngine(<http://machinelevel.com/qc/>)
 - Probably a number of others I've missed
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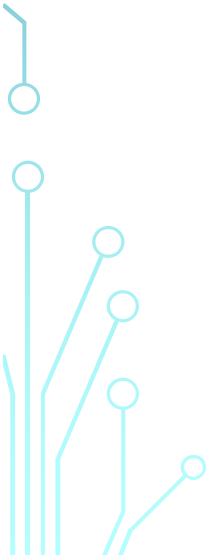

The slide features decorative circuit-like line art in dark blue and light blue. On the left, there are two vertical clusters of lines with circular nodes. On the right, there are two smaller, more sparse line structures. The central text is in a large, bold, black sans-serif font.

VENDORS

- D-WAVE
 - Focused on
 - Optimization problems that can be solved via quantum annealing
 - Training of Boltzman machines and other probabilistic graph based machine learning models
 - Specialized qubit topology "chimera graph"
 - 2K Qubit machine
- IBM
 - Focused on general purpose quantum computing algorithms
 - Gates include Pauli,Hadamard,Conditional,Phase,etc
 - 5 Qubit machine and Simulator
- Rigetti
 - Focused on general purpose quantum computing algorithms
 - Gates include Pauli,Hadamard,Phase,etc
 - Simulator
- Microsoft





PROBLEM DOMAINS IN QUANT FINANCE

- Discrete Optimization Problems using Quantum Annealing
 - Portfolio Construction
 - Balance Sheet Management
 - Machine Learning Problems, leveraging interconnected qubits as probabilistic graphs
 - Stat-Arb/Dispersion
 - Trading Pattern Detection (Iceberg, etc)
 - Market Disruption Detection (ie Flash Crash)
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A TEN THOUSAND FOOT VIEW




- Quantum Computing leverages the simplest 2-level quantum mechanics model.
 - A 2-level quantum mechanics model, generally can be realized in a number of physical mediums (electrons, photon, atomic nucleus, etc)
 - Any collection of electrons, photons, nucleus can be used as “qubits”, quantum bits, which are like classical bits
 - Except, unlike classical bits, which are in either of two states (ie 0 or 1), qubits are in both states, until the quantum mechanics model is measured. After measurement the qubit collapses into one of two states
 - A mathematical description of the system before measurement is built by describing qubit states in probabilistic terms
 - Quantum Gates are then defined, also in the context of probabilistic terms.
 - Algorithms are written as sets of base settings and then quantum gates applied to qubits.
 - Mapping of the theoretical quantum mechanics model onto physical hardware is dependent on vendor implementation
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POSSIBLE NEXT STEPS



- A tutorial on linear algebra and complex vector spaces
 - A tutorial on basics of quantum mechanics
 - Basic systems of qubits
 - Quantum Gates
 - Review of Quantum Algorithms (<http://math.nist.gov/quantum/zoo/>)
 - Deep dives into vendor implementations and APIs
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