Quantum Computing and Demo of Qiskit

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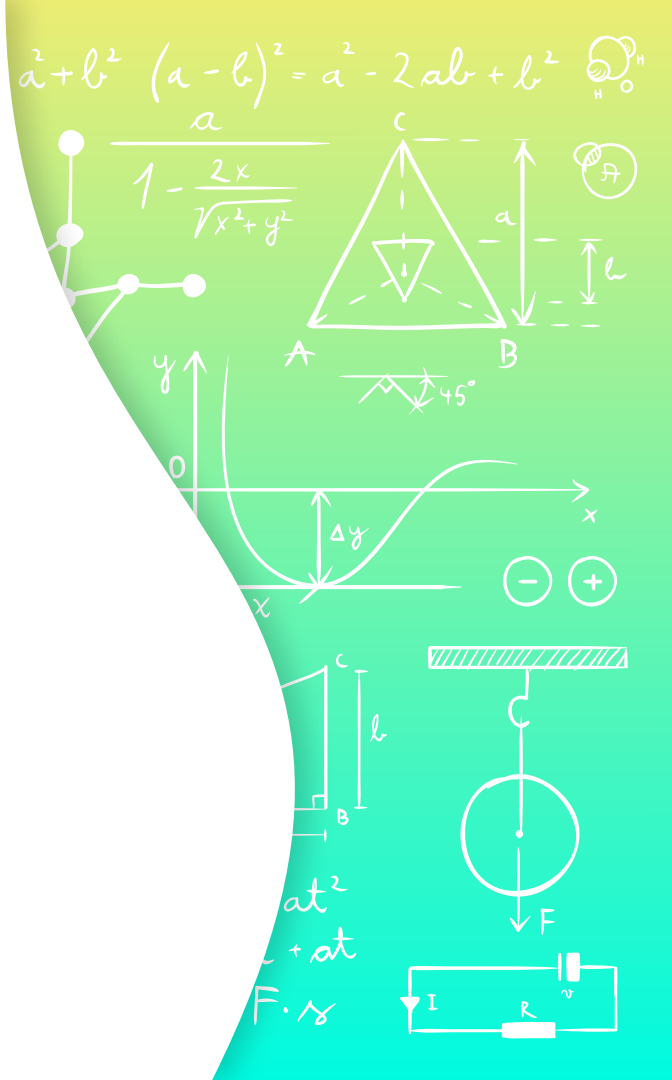
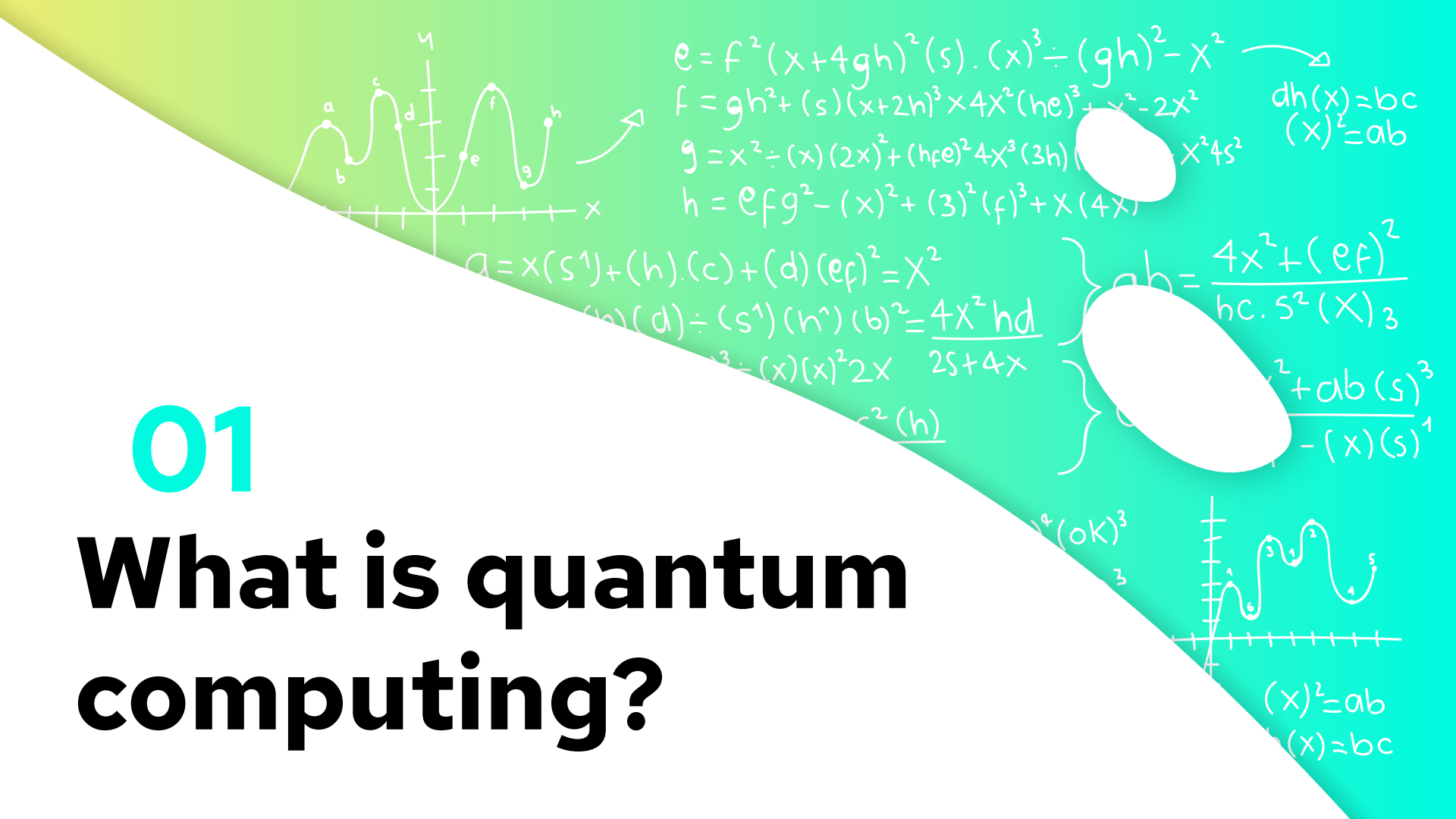


01

What is quantum computing?



Limitations of classical computers

- Classical computers are kind of slow
  - We have complicated problems no supercomputer can solve in the lifetime of the universe
  - Solution?

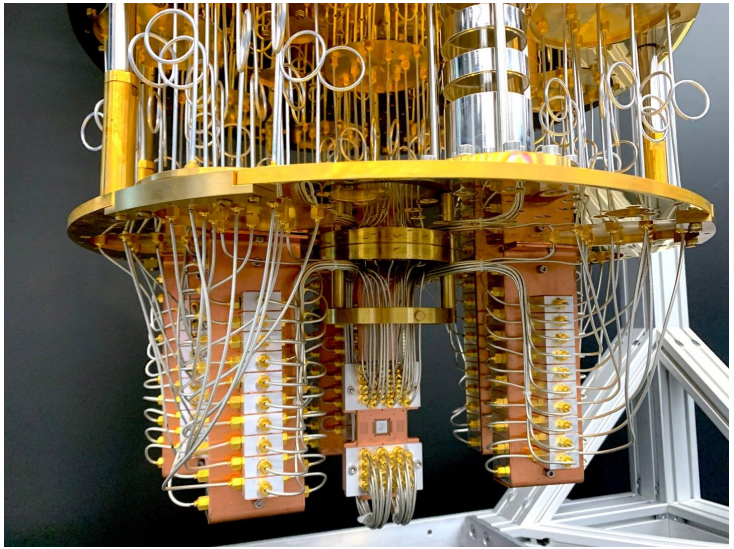
Quantum computer basics

- Based on quantum systems
  - Quantum objects are not like “classical” ones we interact with everyday
    - Superposition: can exist in two ways at once
    - Entanglement: state of one object depends on the state of another far away
  - Qubits (i.e. quantum bits) are quantum objects that store information (superposition of 0s and 1s) and can be entangled with one-another.
- Scientists have devised clever ways to use superposition and entanglement to solve complicated problems at theoretically faster rates.

Viability

- Quantum computers exist!
  - But they’re not very good...
    - Decoherence
- Research going into:
  - Error correcting codes
  - Shielding qubits from decohering processes

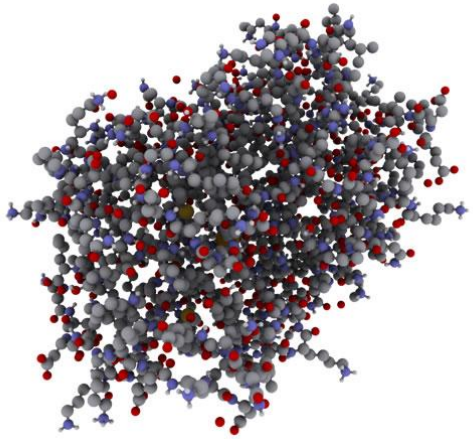
IBM quantum computer - 127 qubits



Applications?

- Quantum computers are best at complex problems

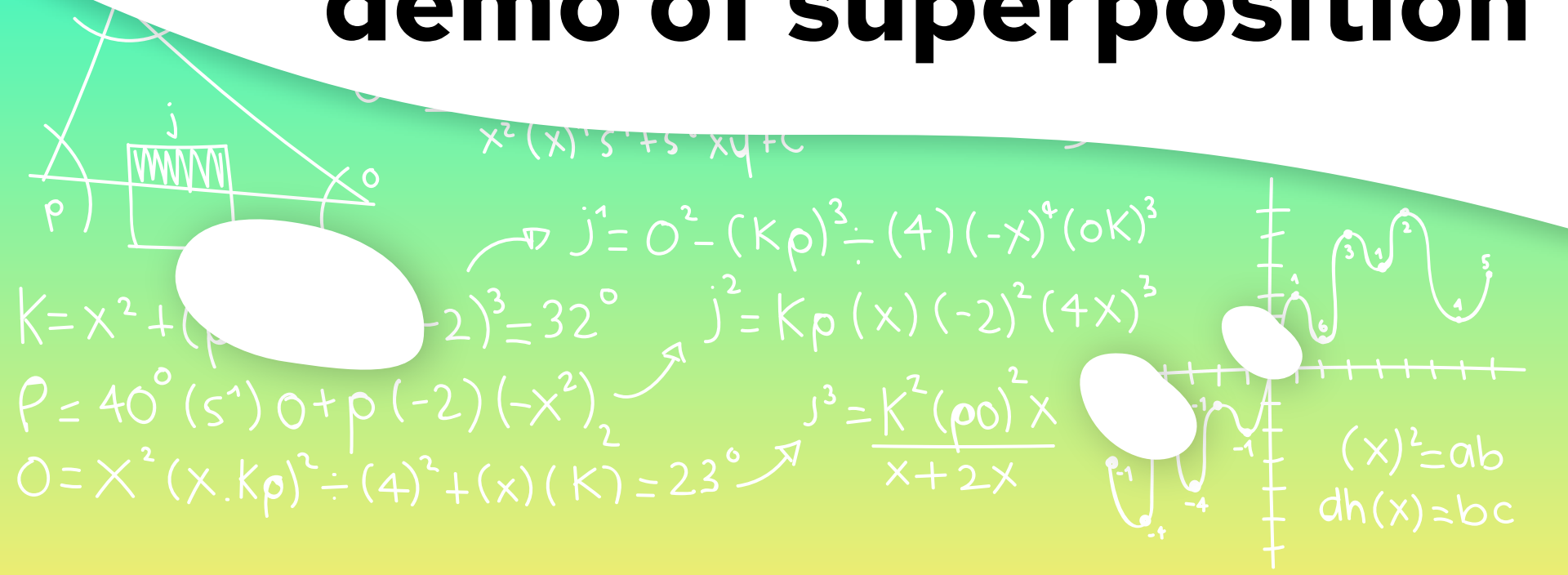
- Determining how large molecules fold
- Optimizing supply-chains



- Decryption
- Military strategy

02 Qiskit

demo of superposition



03

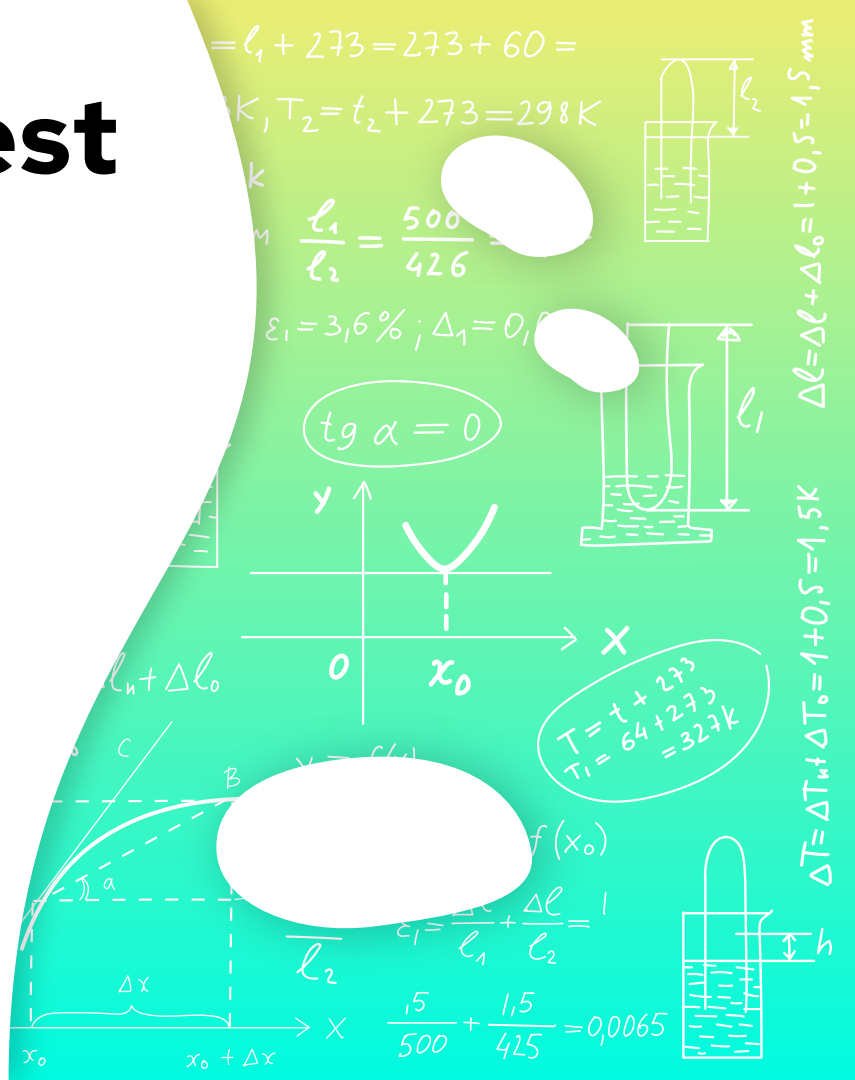
Implications for the future?

Accessibility to knowledge

- Anyone with a computer can code with Qiskit for free
  - Mariana Muzzucato - Ease of access to knowledge lubricates the path to innovation
    - Recruiting minds
    - Serendipitous discoveries

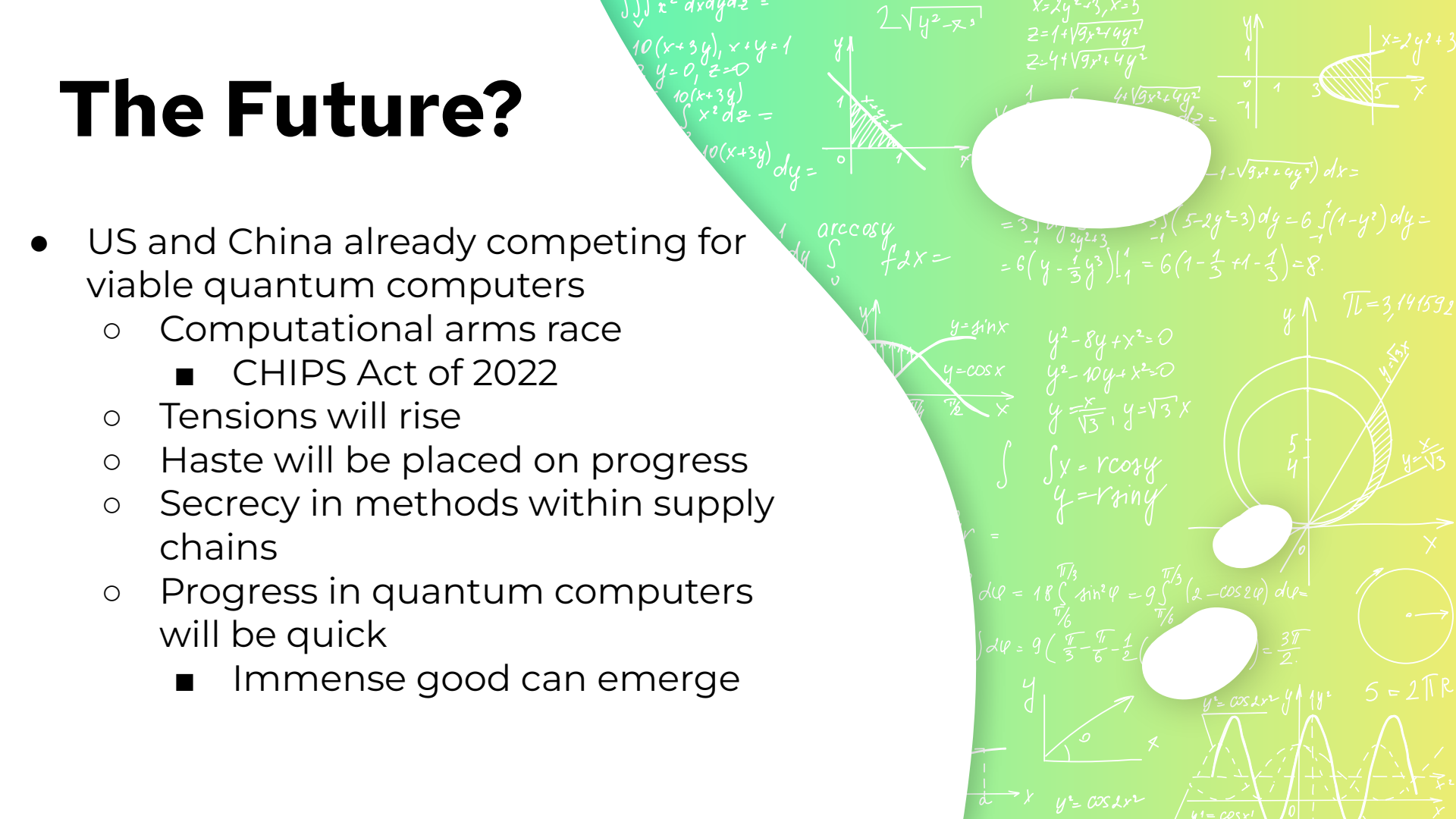
Government interest

- A computational arms race
  - US and China already competing
    - CHIPS Act of 2022
  - Nations seek dominance in computation, and by proxy military dominance
    - Decryption, military strategy by quantum computing



The Future?

- US and China already competing for viable quantum computers
  - Computational arms race
    - CHIPS Act of 2022
  - Tensions will rise
  - Haste will be placed on progress
  - Secrecy in methods within supply chains
  - Progress in quantum computers will be quick
    - Immense good can emerge



Bibliography

Friedman, Thomas L. "We Are Suddenly Taking On China and Russia at the Same Time." The New York Times, 13 Oct. 2022, www.nytimes.com/2022/10/12/opinion/china-semiconductors-exports.html.

Giles, Martin. "Explainer: What is a Quantum Computer?" MIT Technology Review, 29 Jan. 2019,www.technologyreview.com/2019/01/29/66141/what-is-quantum-computing.

Mazzucato, Mariana. The Entrepreneurial State. Demos, 2011, www.demos.co.uk/files/Entrepreneurial_State_-_web.pdf.

Qiskit. "Learn Quantum Computation Using Qiskit." Qiskit, 2020, https://qiskit.org/textbook.