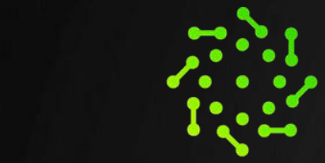

PASQAL

QUANTUM DISCOVERY

Quantum speedup

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91300 Massy
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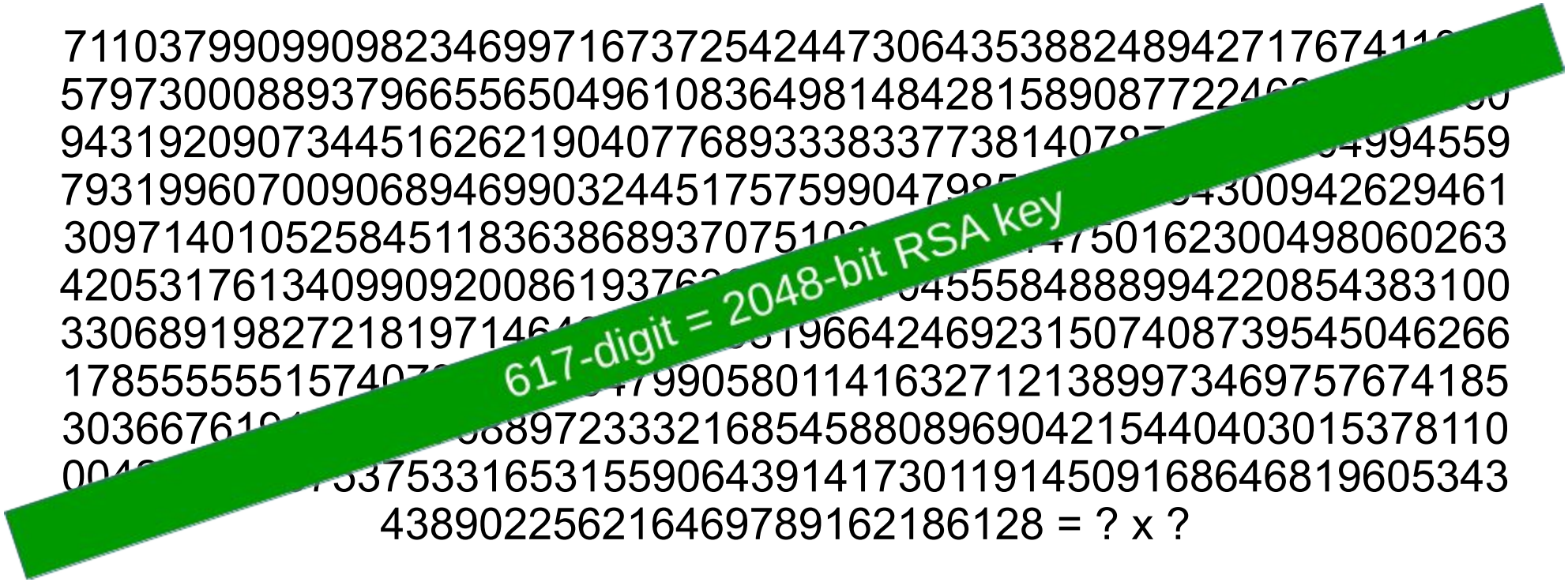
A first example

The problem of integer factorization

$$15 = 3 \times 5$$

A first example

The problem of integer factorization



438902256216469789162186128 = ? x ?

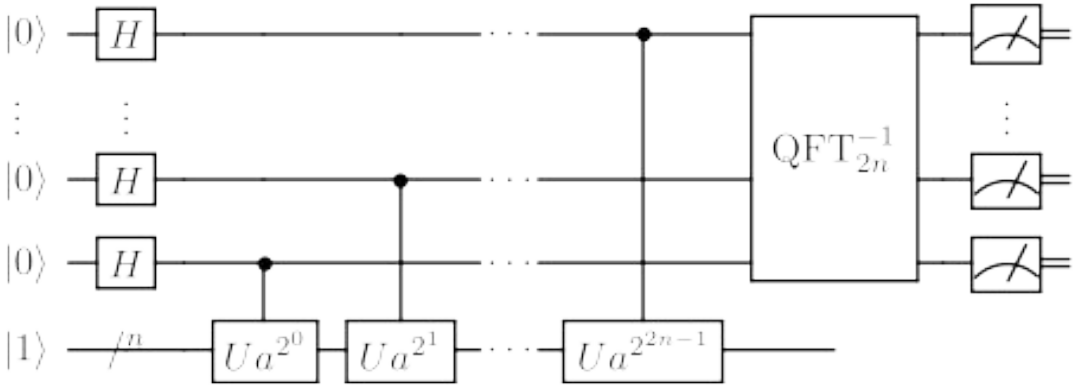
A first example

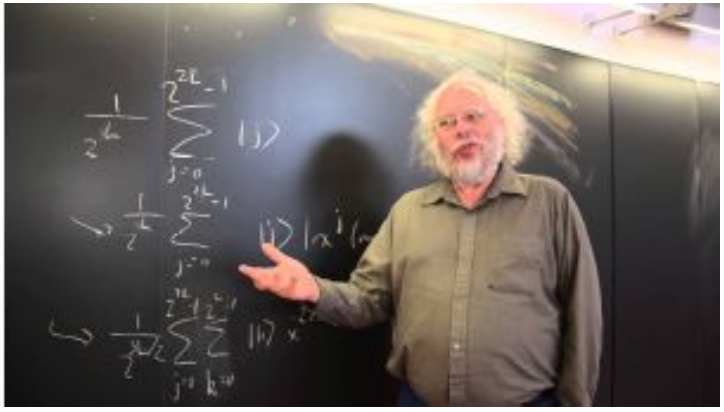
The problem of integer factorization

Finding the prime factors of a 2048-bit sequence:

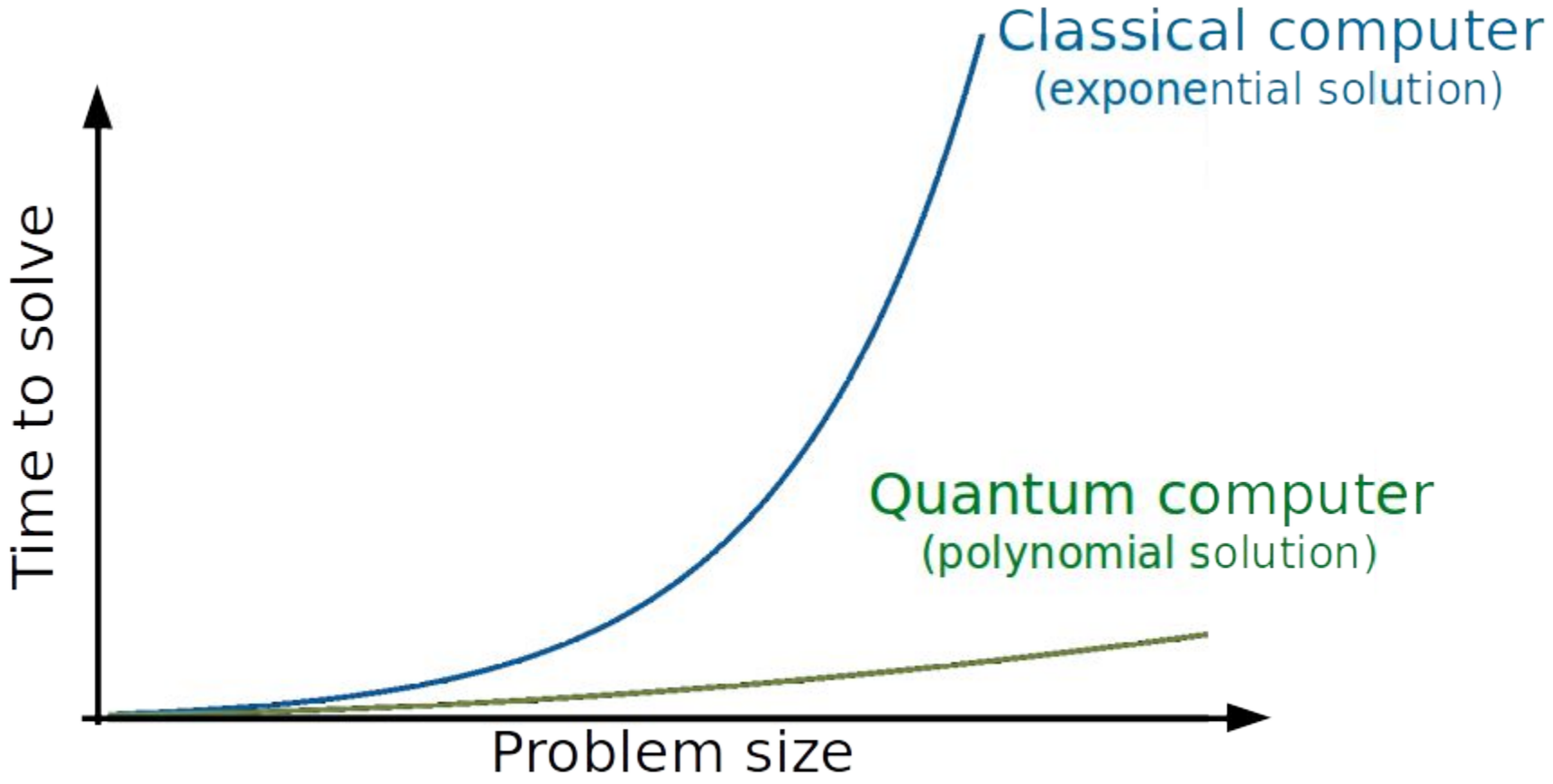
- Classical computer (GHz clock rate): ~10^14 years
- Quantum computer (MHz clock rate, 4096 logical qubits): ~10 seconds

→ Shor's algorithm provides an **exponential speedup** !

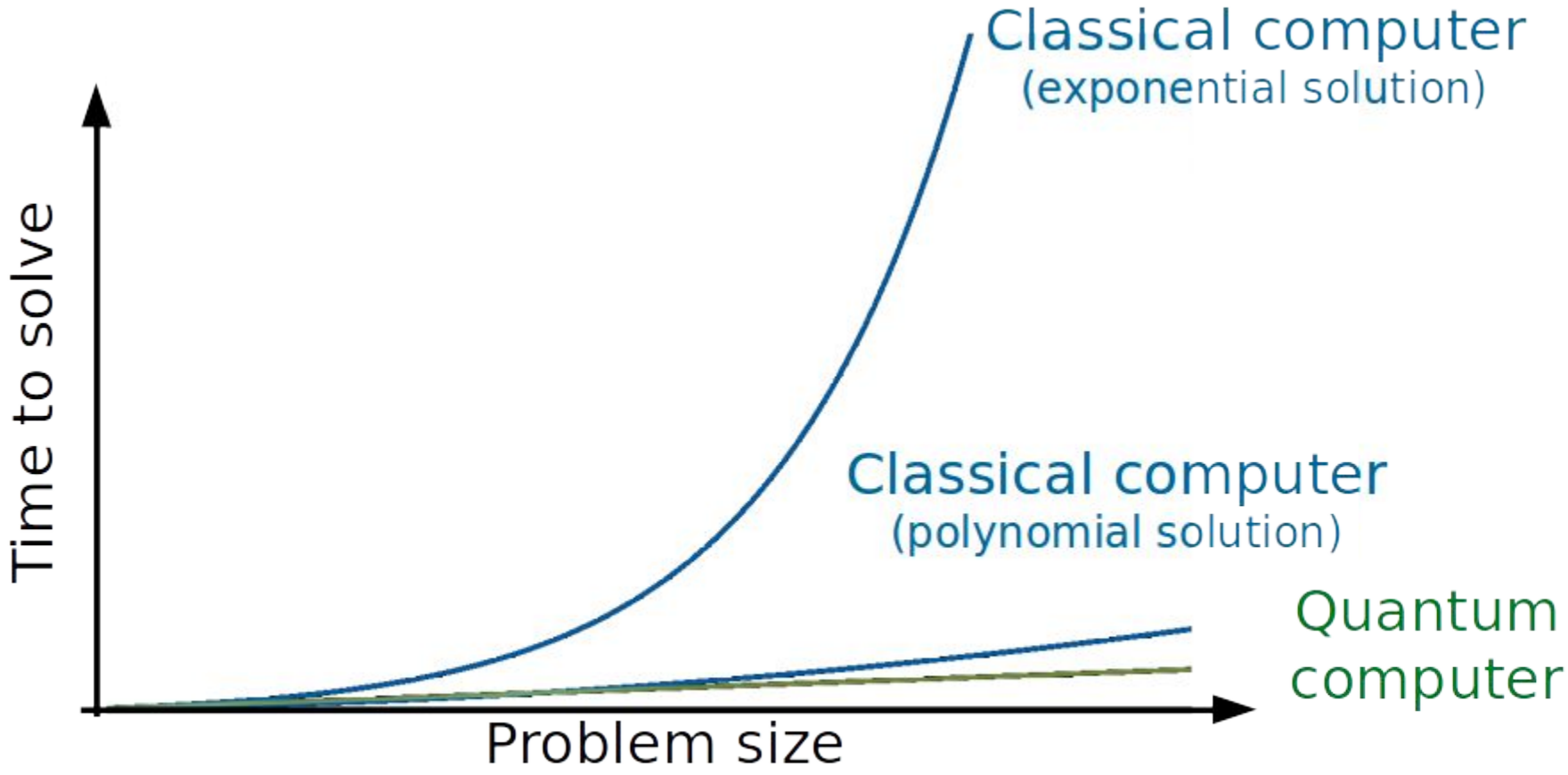




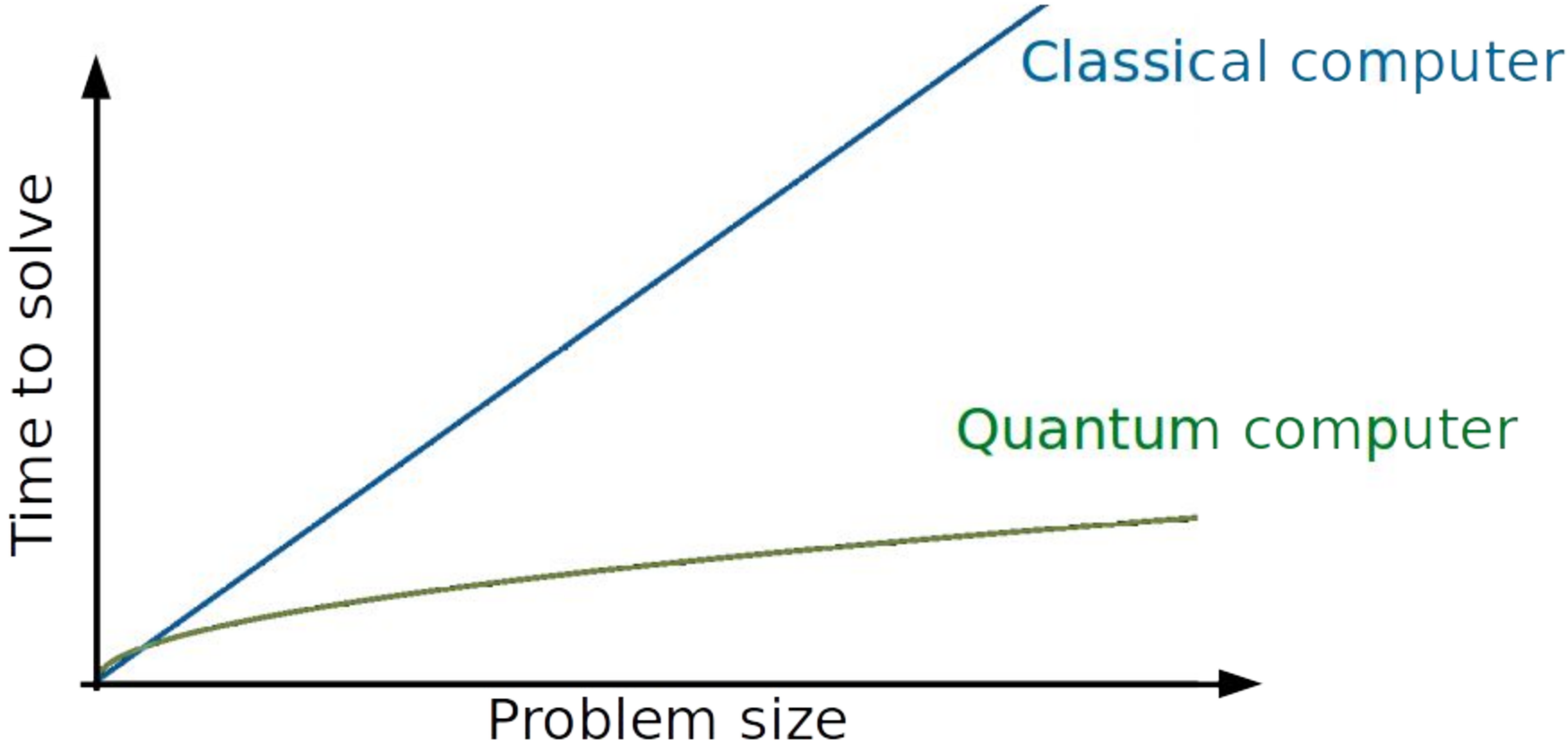
Exponential speedup



Quadratic speedup



Quadratic speedup



Conclusion

- ➔ Quantum computers will offer the possibility of performing certain computations much faster than classical devices
- ➔ Quantum speedup is the measure of this improved performance by quantum computers
- ➔ Some quantum algorithms provide an exponential speedup versus classical solutions, such as Shor's factoring algorithm
- ➔ While some other quantum algorithms provide a quadratic speedup, such as Grover's search algorithm
- ➔ A quadratic speedup is less significant than an exponential speedup
- ➔ The case of hybrid quantum-classical algorithms will be discussed in next videos as there is no clear view on their algorithmic complexity