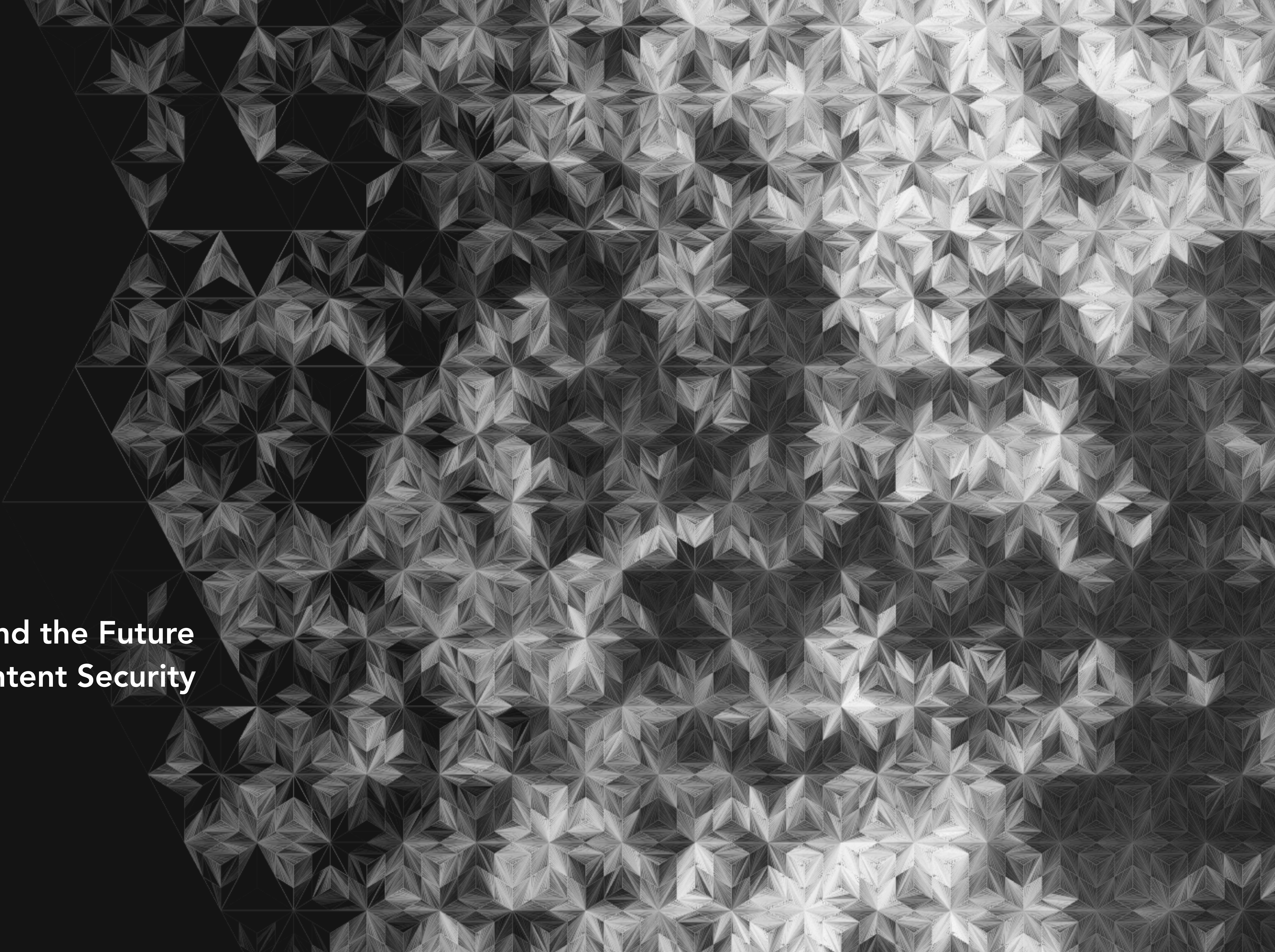
HITS SPRING

CQC
Cambridge
Quantum
Computing

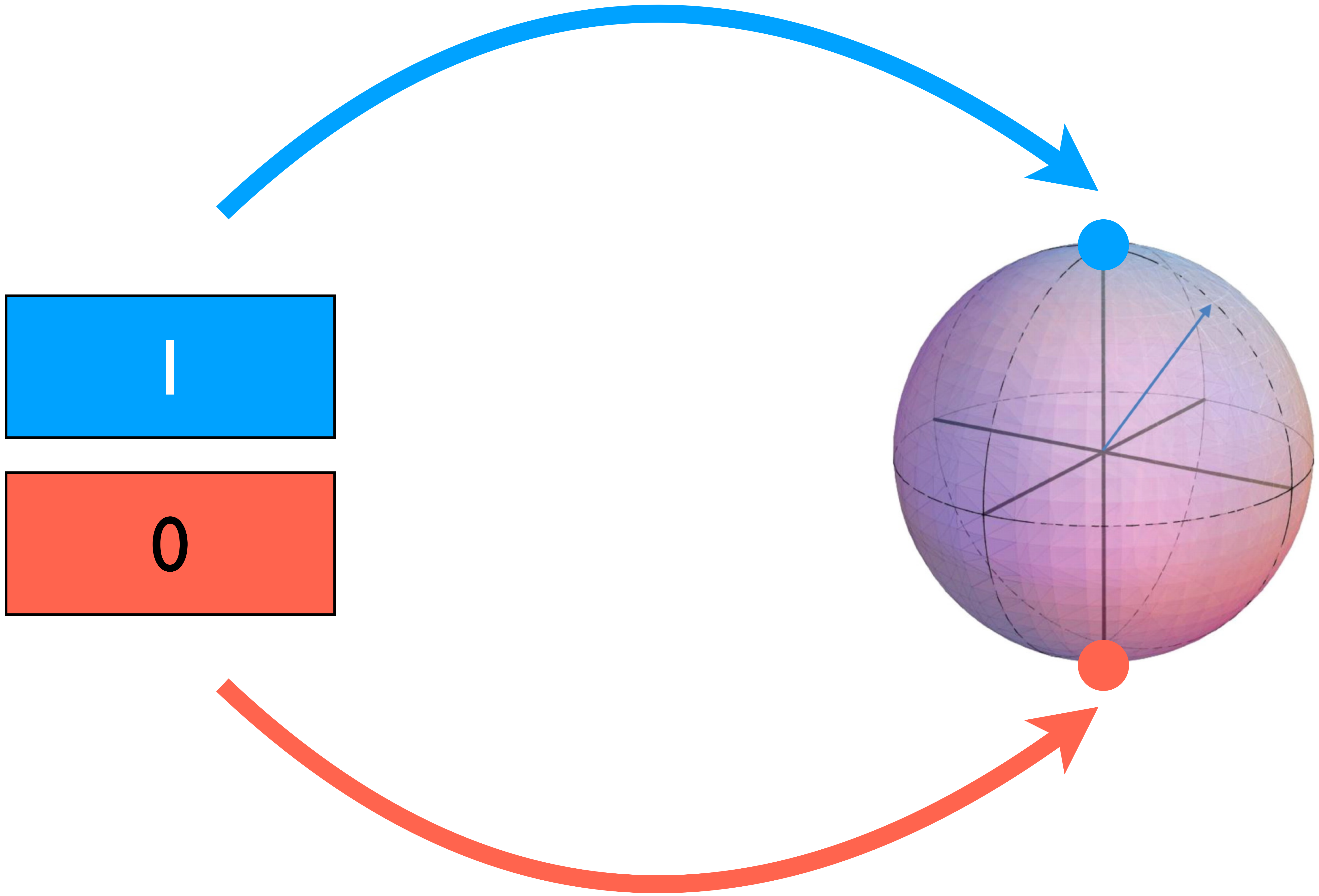
Quantum Computing and the Future of Entertainment & Content Security

Mark Jackson, Ph.D.

23 May 2019



Bit becomes Quantum Bit

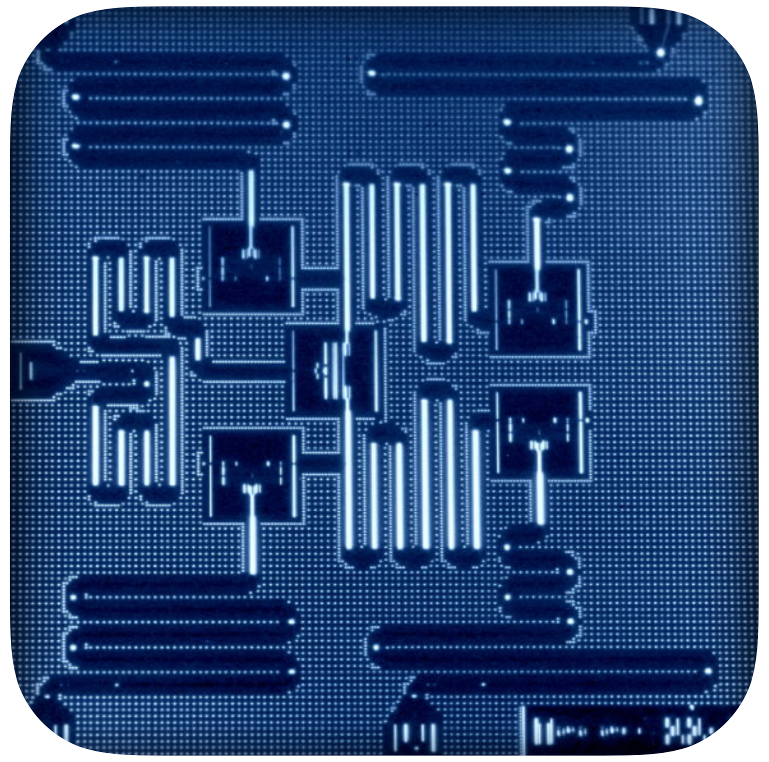


1

0

Currently 80+ Quantum Computing Hardware Groups

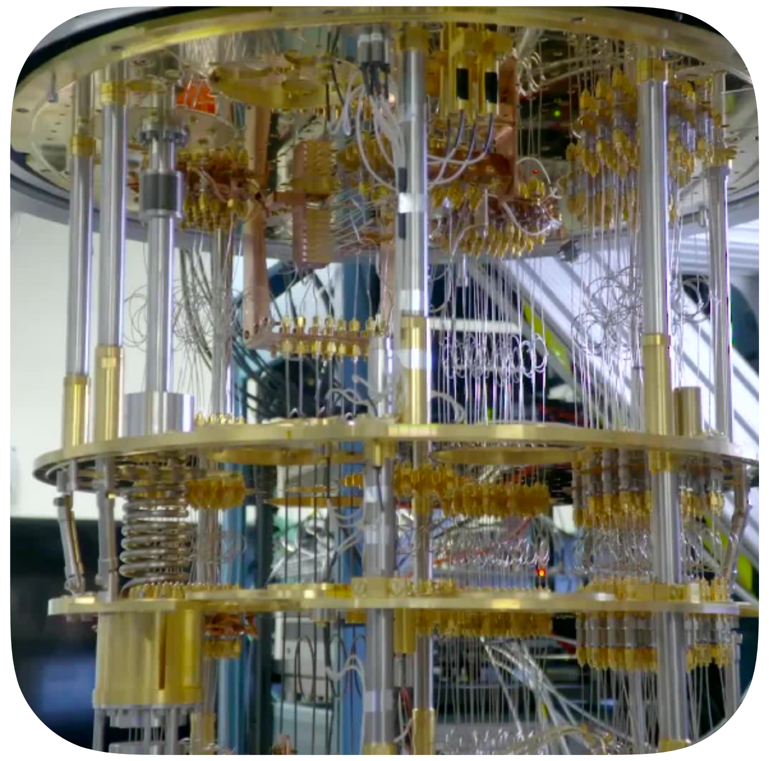
Google



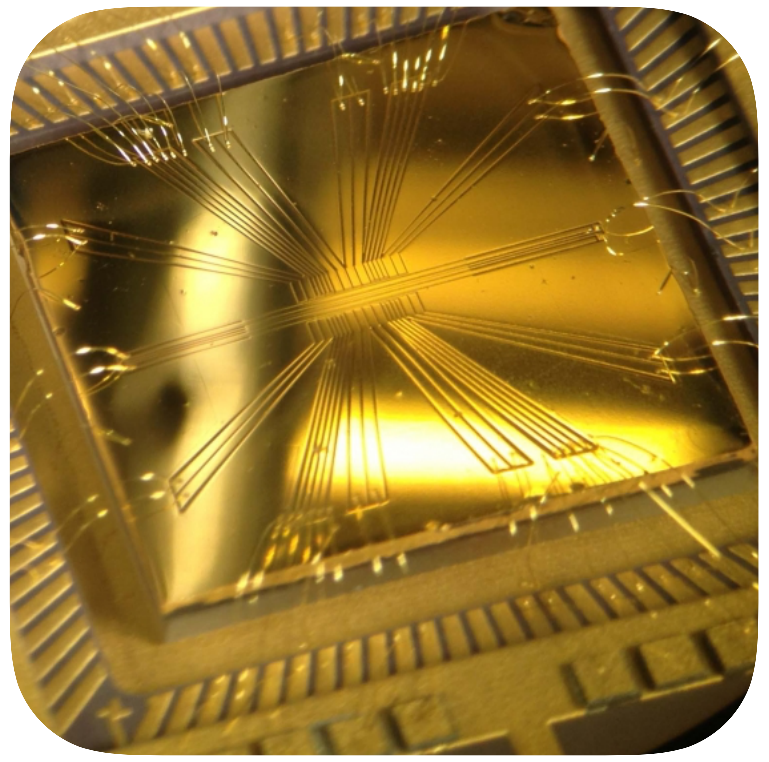
IBM

intel

Microsoft

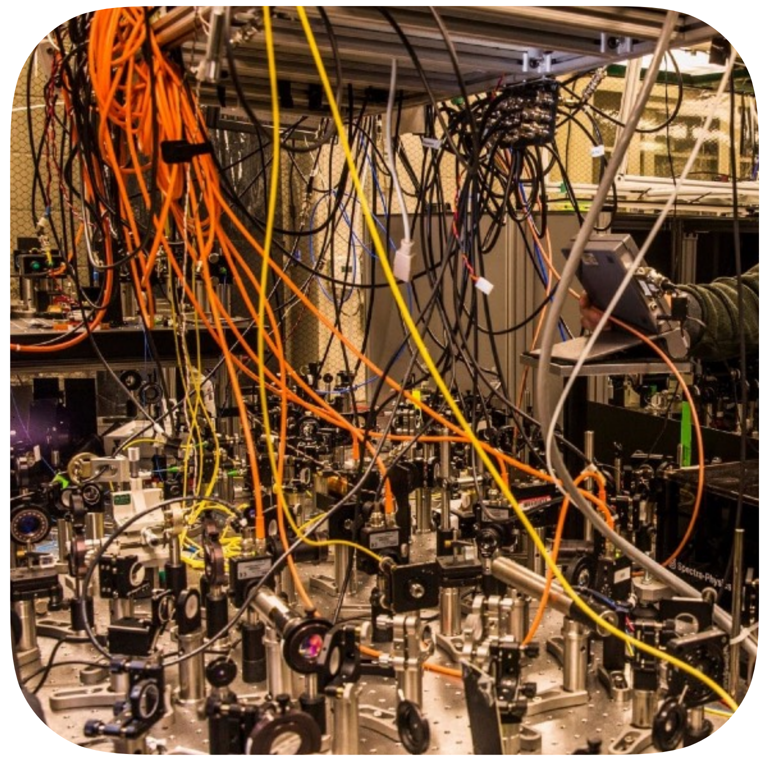


rigetti

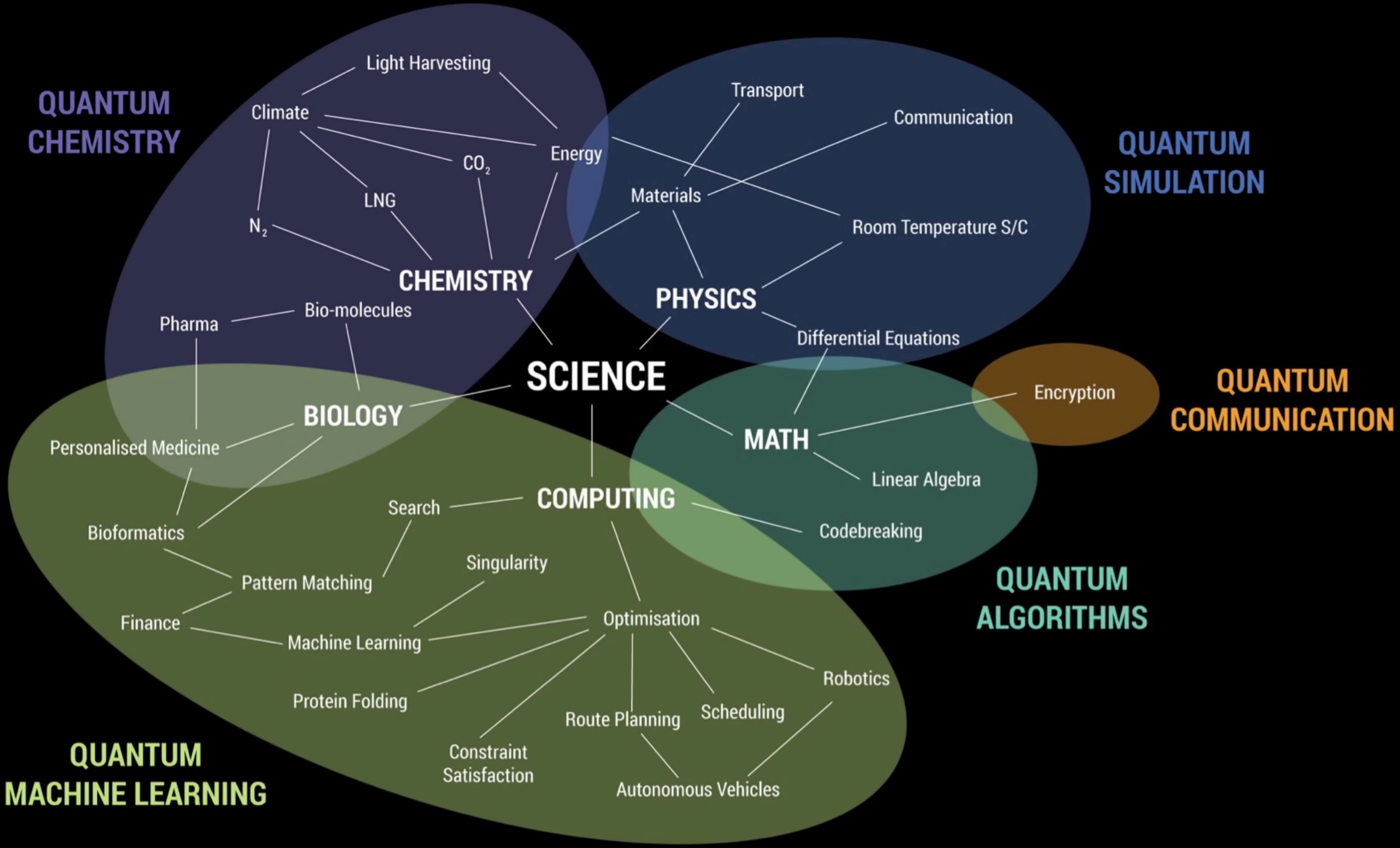


NQIT

Honeywell



IONQ



QUANTUM CHEMISTRY

Light Harvesting

Climate

Energy

CO_2

LNG

N_2

CHEMISTRY

Pharma

Bio-molecules

QUANTUM SIMULATION

Transport

Communication

Materials

Room Temperature S/C

PHYSICS

Differential Equations

SCIENCE

QUANTUM COMMUNICATION

Encryption

MATH

Linear Algebra

Codebreaking

QUANTUM ALGORITHMS

BIOLOGY

Personalised Medicine

COMPUTING

Search

Bioformatics

Pattern Matching

Singularity

Finance

Optimisation

Machine Learning

Robotics

Protein Folding

Route Planning

Scheduling

Constraint Satisfaction

Autonomous Vehicles

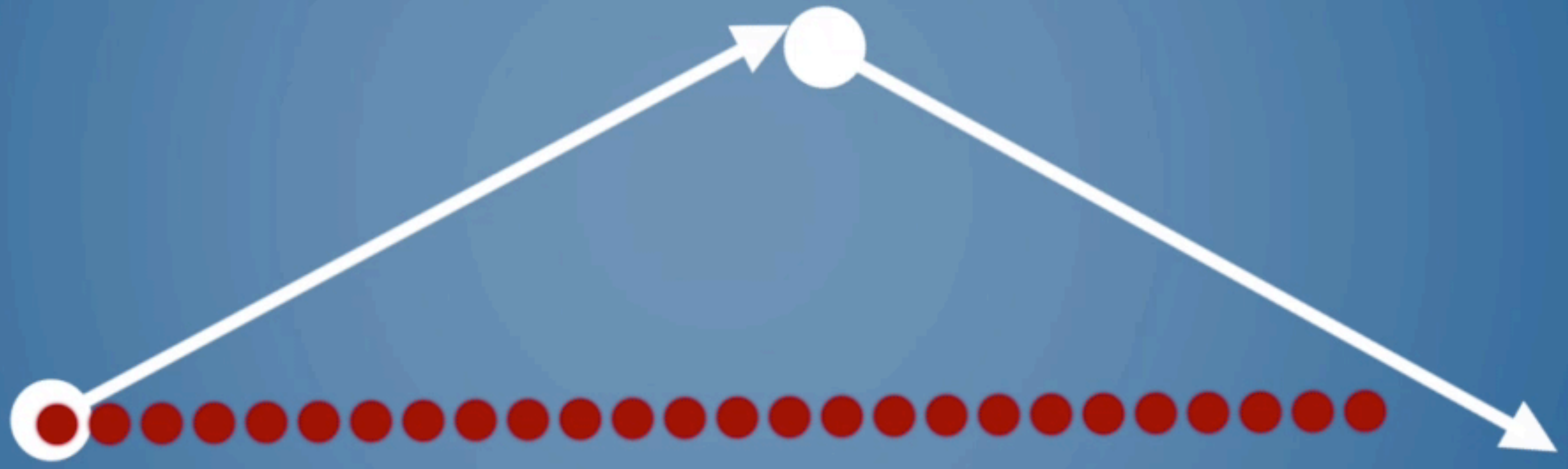
QUANTUM MACHINE LEARNING

Industries Transformed

Machine
Learning

Encryption
& Communication

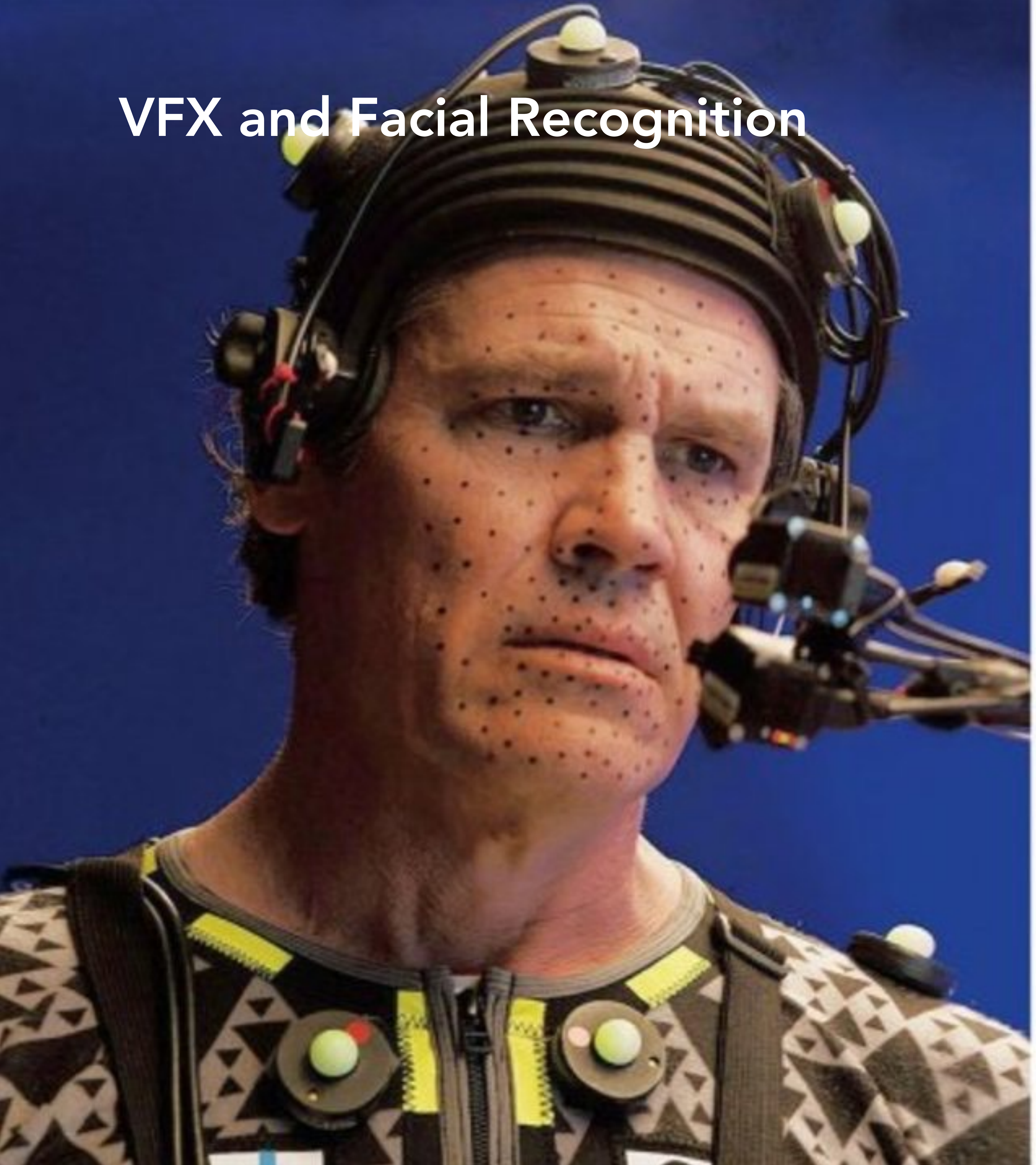
QUANTUM MACHINE LEARNING

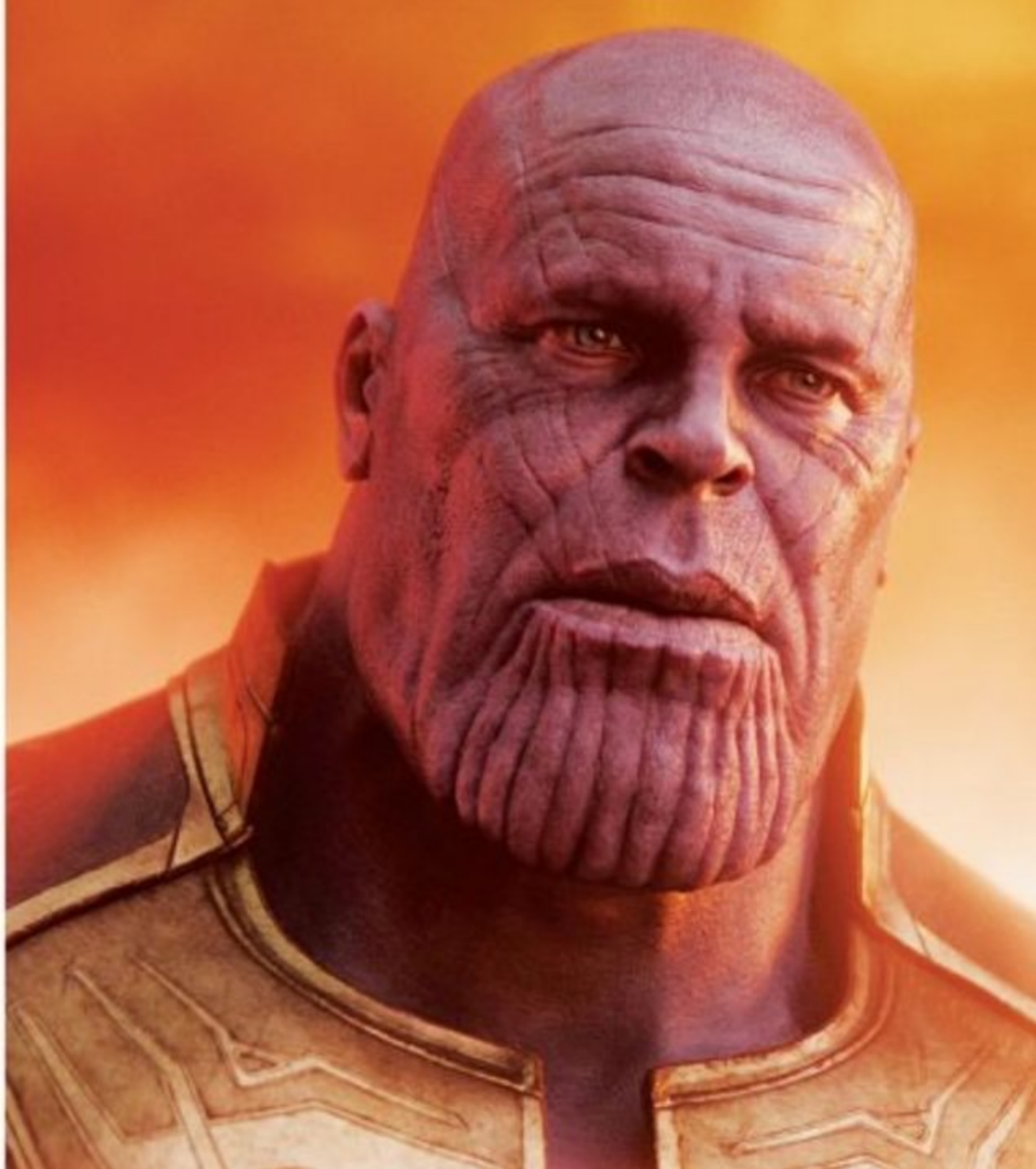


SOPHISTICATED DECISION-MAKING

Image Classification and Manipulation

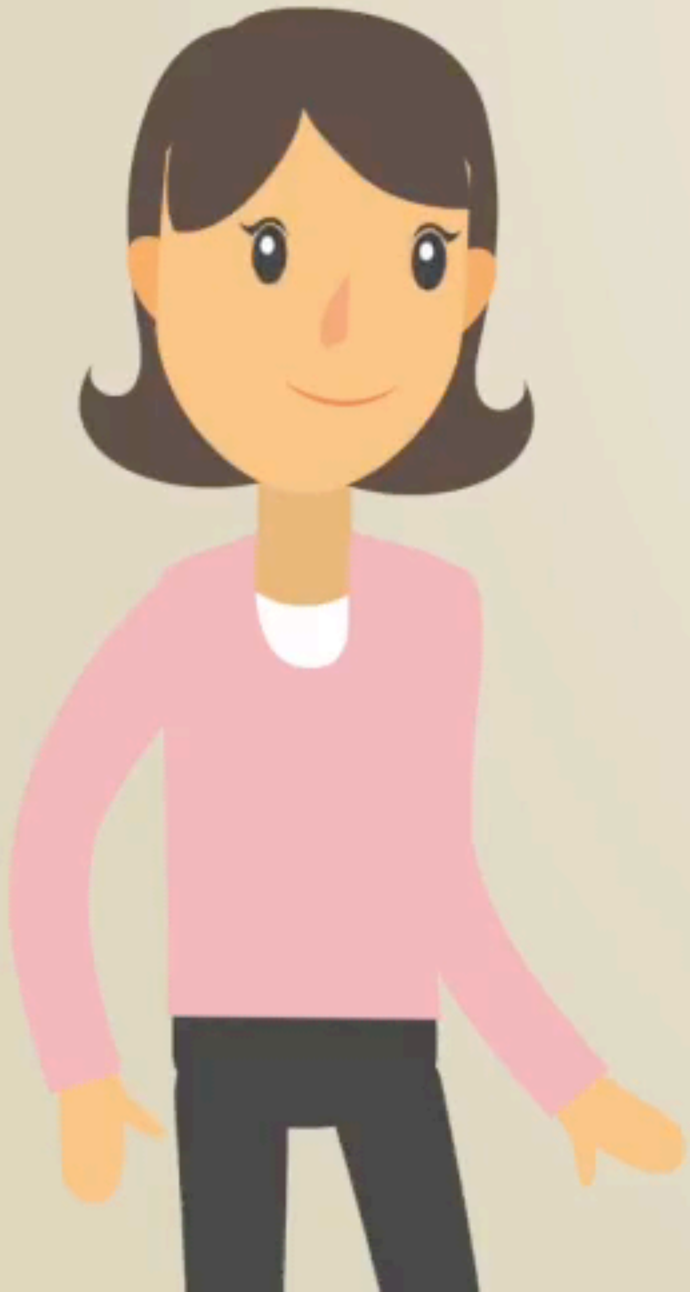
VFX and Facial Recognition





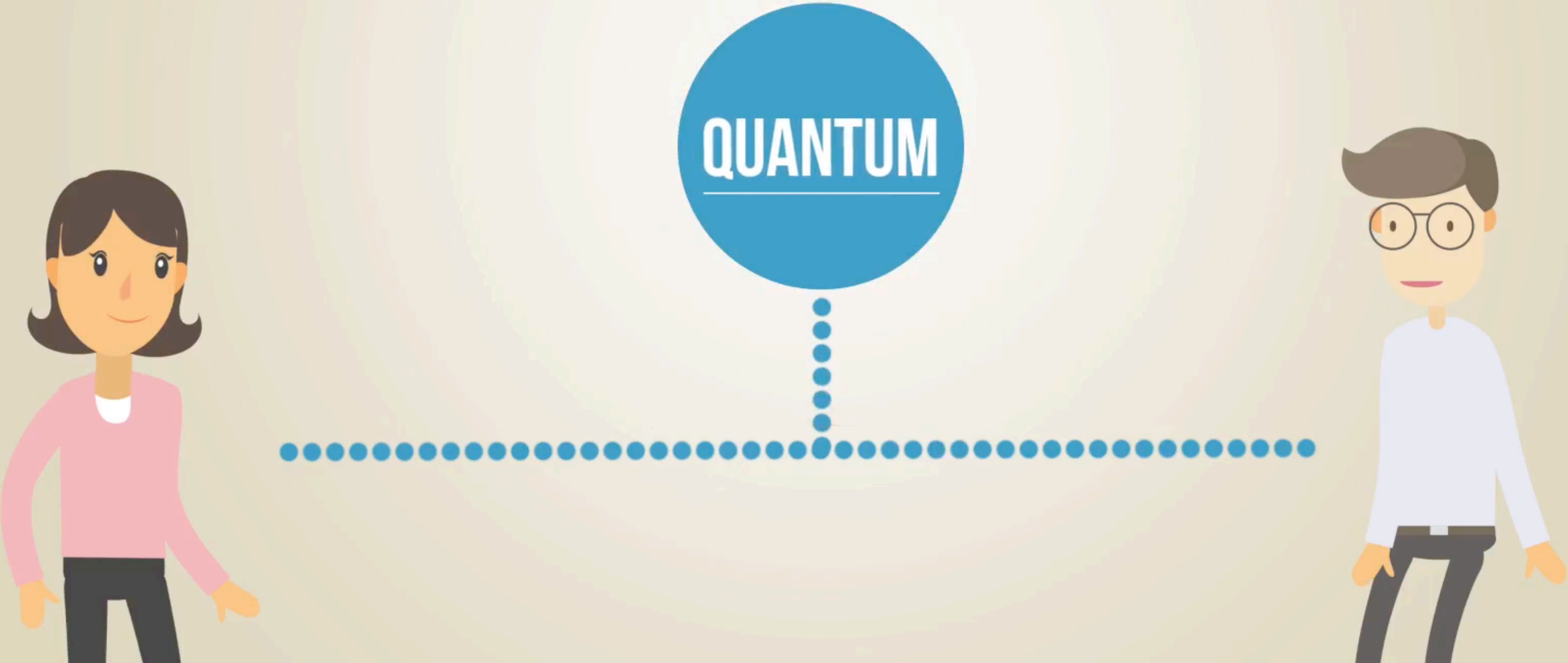
ENCRYPTION

KEY

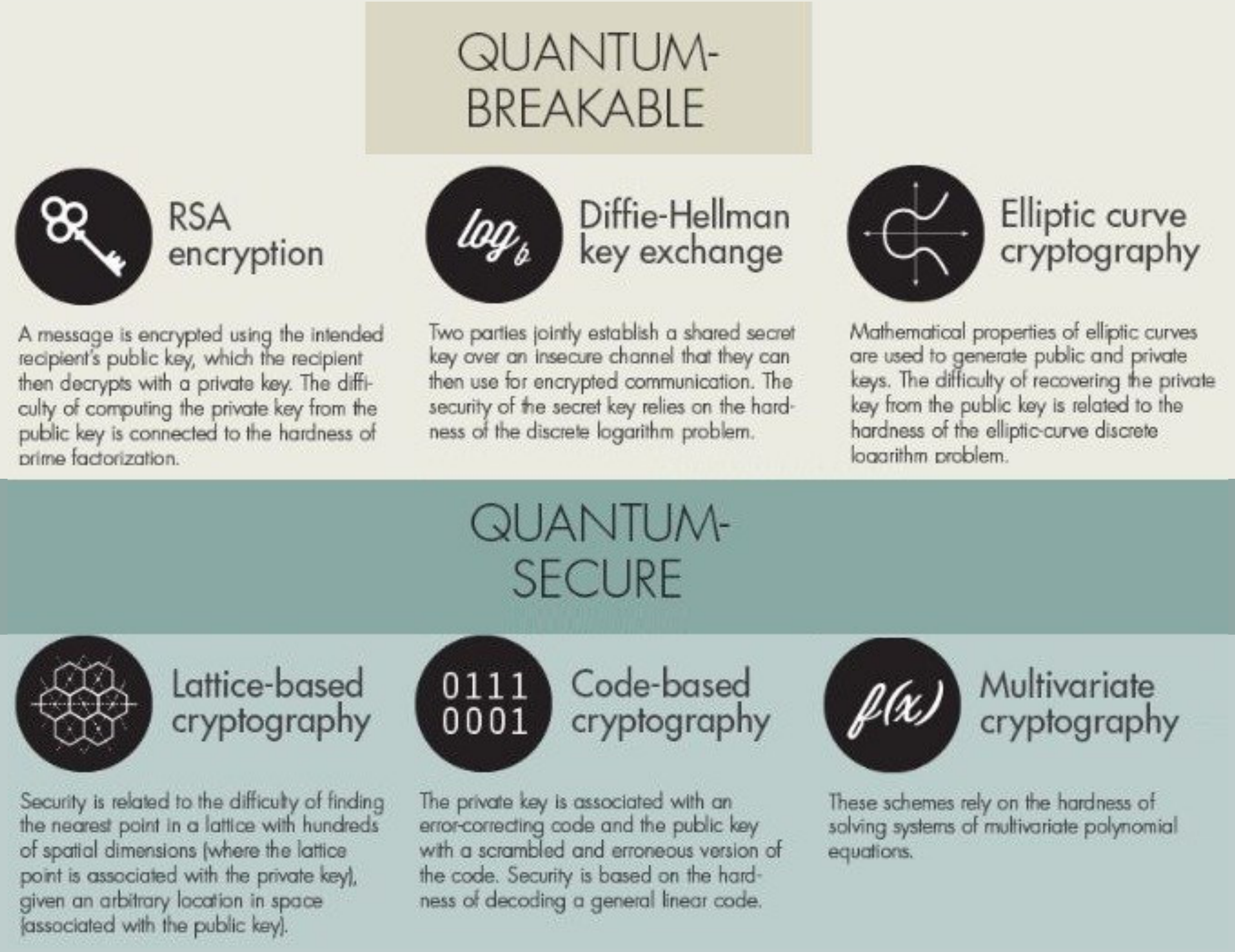


PROTOCOL

CURRENT ENCRYPTION IS AT RISK



Post-Quantum Encryption



QUANTUM-BREAKABLE

RSA encryption

A message is encrypted using the intended recipient's public key, which the recipient then decrypts with a private key. The difficulty of computing the private key from the public key is connected to the hardness of prime factorization.

Diffie-Hellman key exchange

Two parties jointly establish a shared secret key over an insecure channel that they can then use for encrypted communication. The security of the secret key relies on the hardness of the discrete logarithm problem.

Elliptic curve cryptography

Mathematical properties of elliptic curves are used to generate public and private keys. The difficulty of recovering the private key from the public key is related to the hardness of the elliptic-curve discrete logarithm problem.

} 99% of online encryption

QUANTUM-SECURE

Lattice-based cryptography

Security is related to the difficulty of finding the nearest point in a lattice with hundreds of spatial dimensions (where the lattice point is associated with the private key), given an arbitrary location in space (associated with the public key).

Code-based cryptography

The private key is associated with an error-correcting code and the public key with a scrambled and erroneous version of the code. Security is based on the hardness of decoding a general linear code.

Multivariate cryptography

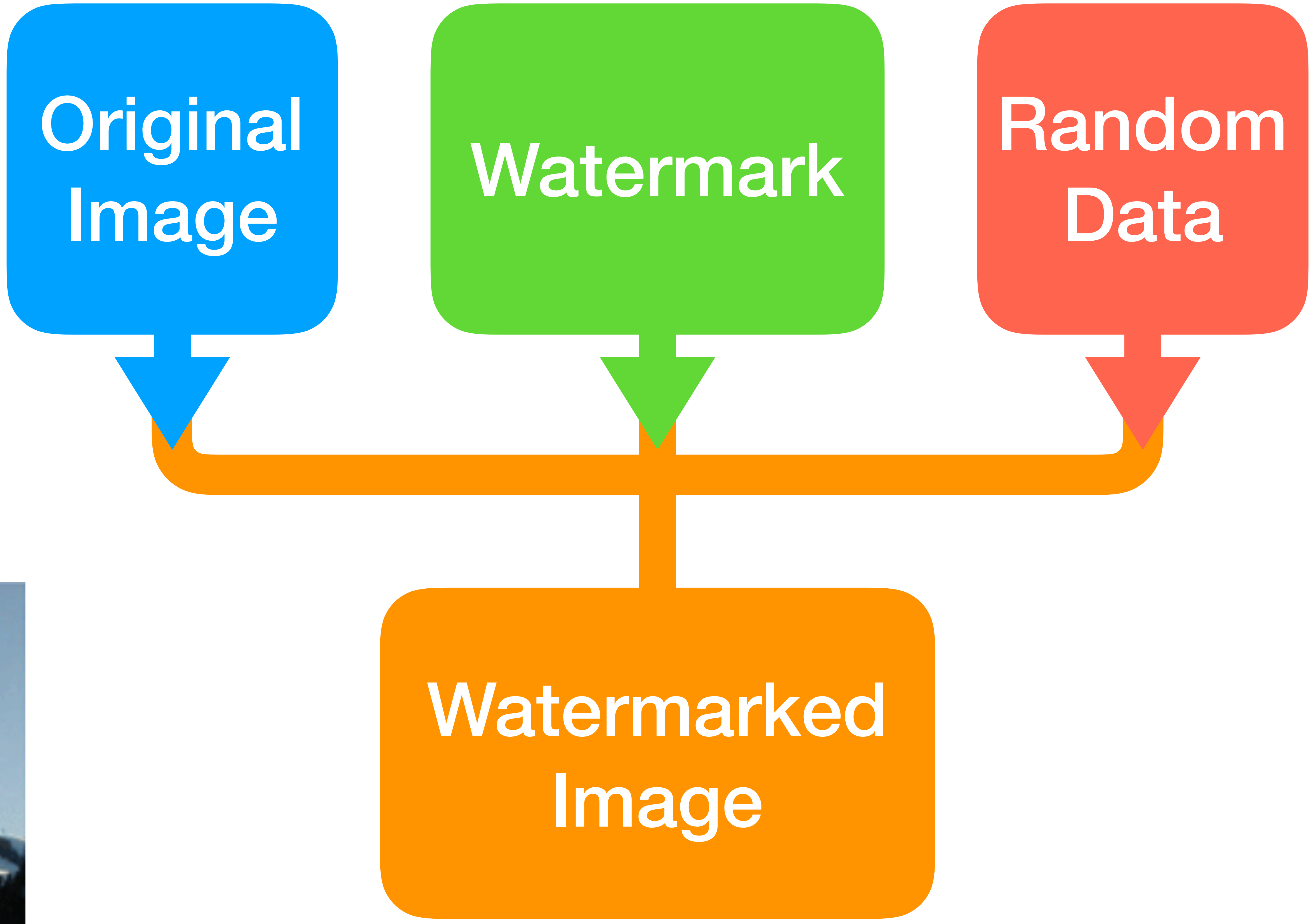
These schemes rely on the hardness of solving systems of multivariate polynomial equations.

Hackproof Communication through Quantum Entanglement

Watermarking

Original

Watermarked


Original Image

Watermark

Random Data

Watermarked Image