SPINQ

Bring Quantum Computing To Life

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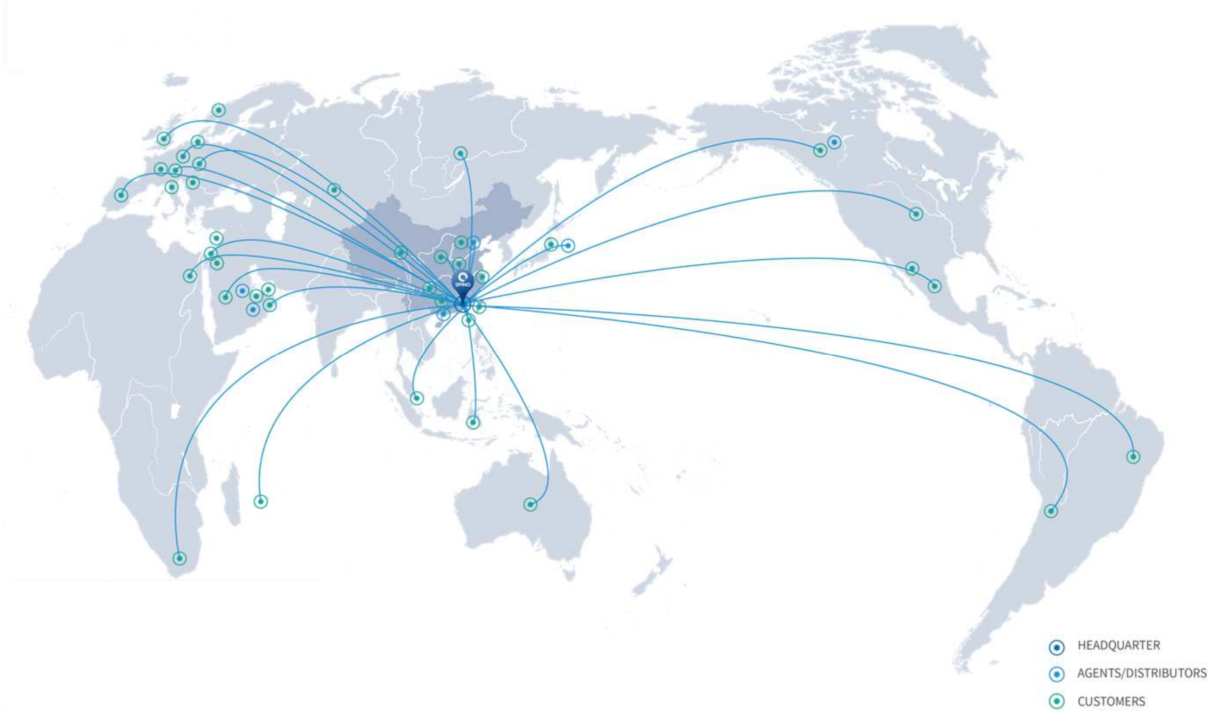
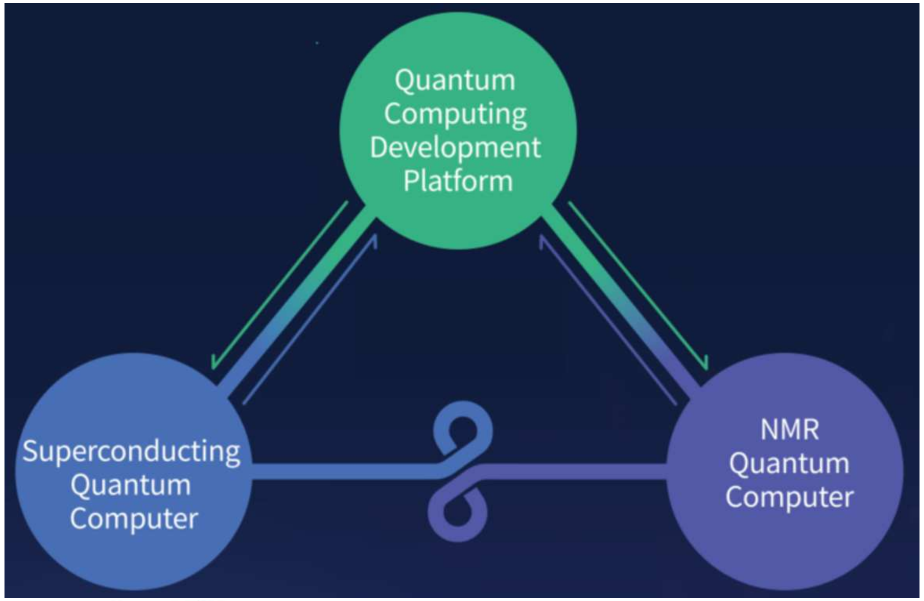
Global Solutions Engineer

Trusted by universities in 40 countries





SPINQ 量旋科技

Bringing Quantum Computing To Life

R&D team with strong backgrounds in quantum computing

Dr. Jingen Xiang

Founder
CEO

HARVARD UNIVERSITY · University of Waterloo · SAP

Dr. Yike Guo

Chief Consultant

Imperial College London · Royal Academy of Engineering · ACADEMIA EUROPAEA

Dr. Guanru Feng

Cofounder &
Senior Scientist

University of Waterloo · 清華大學

Dr. Shiyao Hou

Scientist
Consultant

清華大學 · University of Waterloo

Dr. Tiejun Meng

CTO

UNIVERSITY OF CAMBRIDGE · visionICs

Dr. Hongyang Zou

Superconducting
Director

Washington University in St.Louis · 中国科学技术大学 University of Science and Technology of China

Dr. Cong Guo

Algorithm
Director

University of Waterloo

Wei Shi

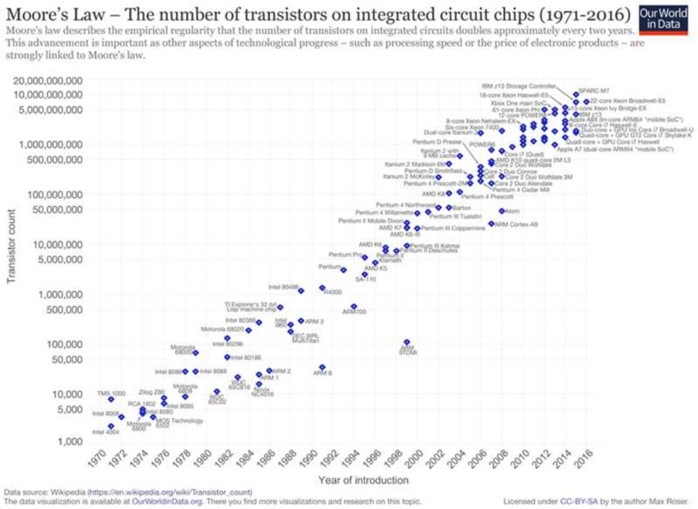
NMR
Director

南開大學 Nankai University · SAP

Bringing Quantum Computer to

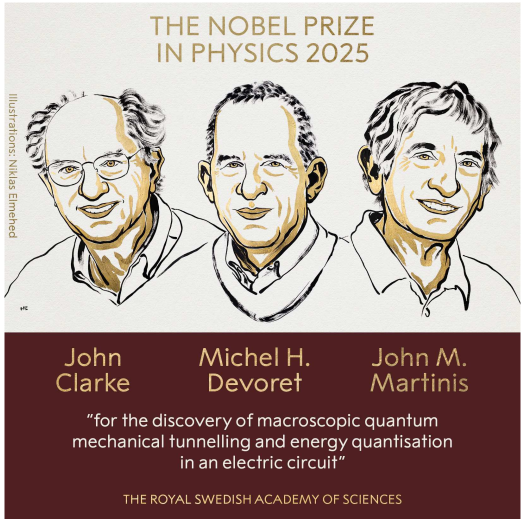
Why talking so much about quantum

Quantum computing uses quantum superposition and entanglement to process information, with great **potential in enhancing computing power** in drug discovery, finance, AI, and more.



Moore's Law is on the verge of its limit

Source: https://en.wikipedia.org/wiki/Moore%27s_law

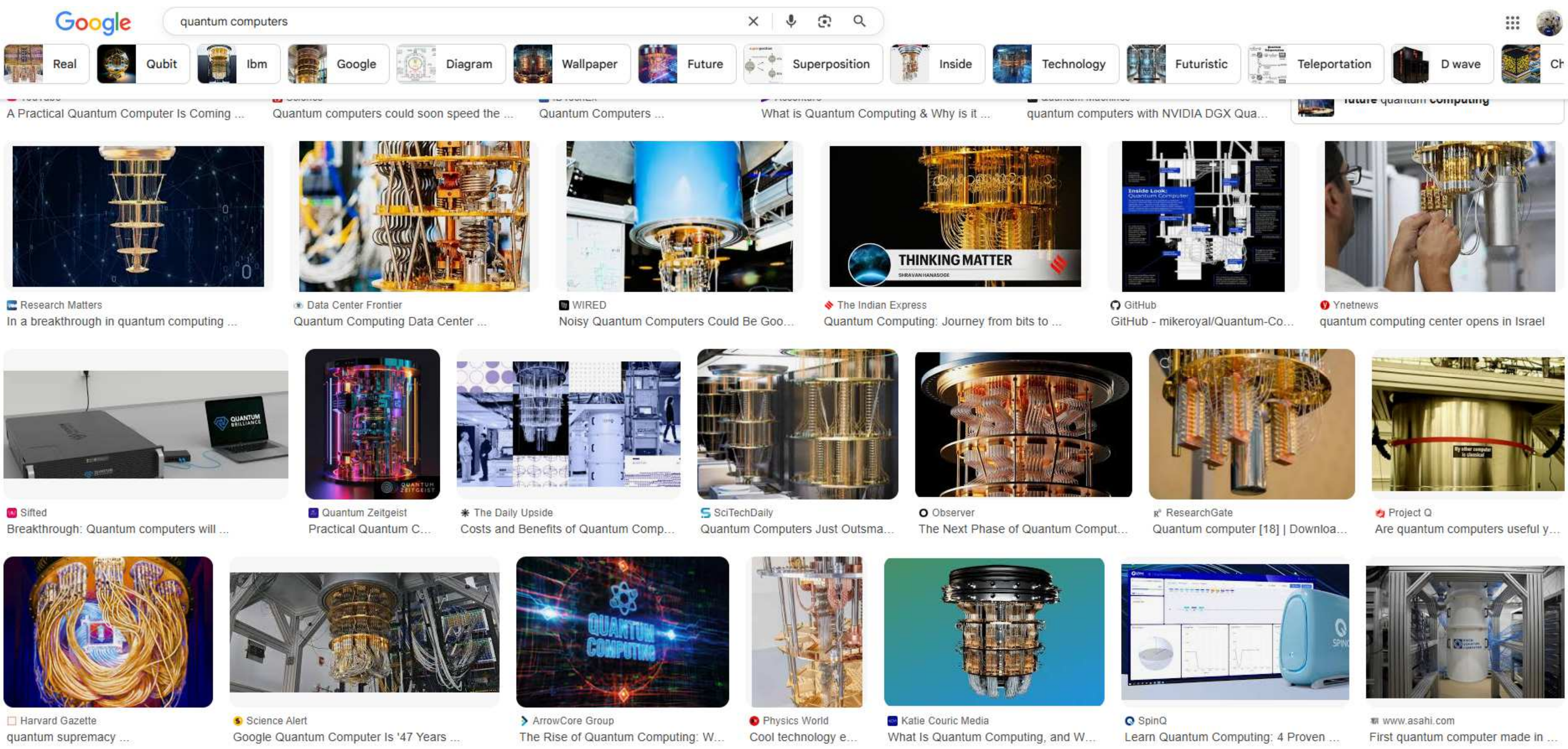


A foundation for superconducting qubits

Source: Nobel prize, https://x.com/NobelPrize/status/1975498493218394168

Superconducting Quantum Computer

When you Google "quantum computers"



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Diffirent Quantum Computing Hardware

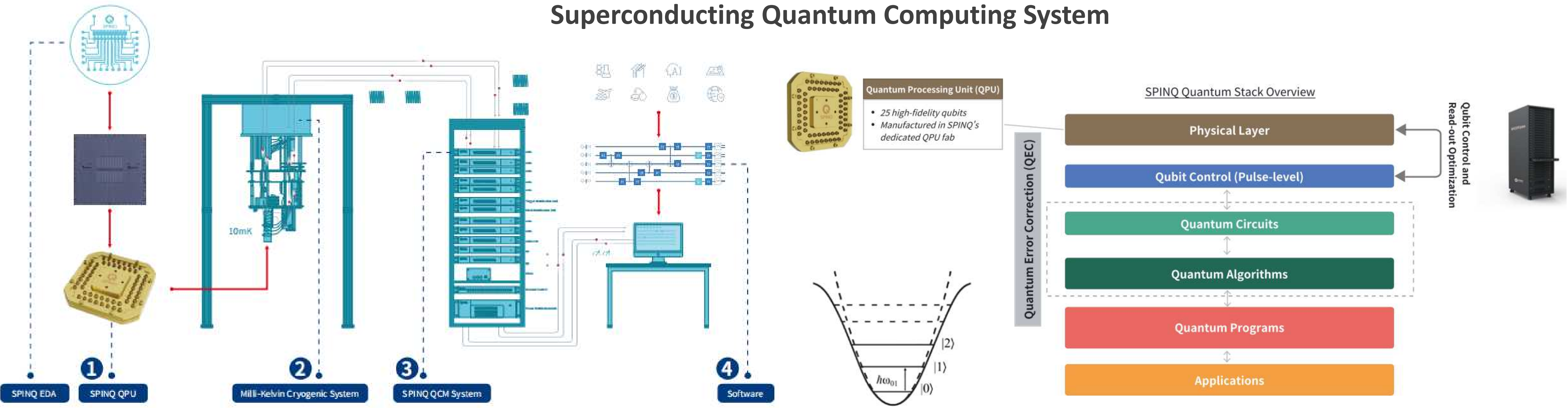
Tech	Solid-state based			Atom-based			Photon-based
	Superconducting	Semiconductor quantum dots	Topological	Neutral atoms	Ion traps	NMR	Photonic
Principle	superconducting Josephson junctions	Quantum dot electron confinement	Anyon/ Topological states	Neutral atoms trapped by optical tweezers	Ions in electromagnetic traps	Nuclear spin states in molecules or solids	Photonic interference and entanglement
Current Progress	1000+ qubits, error correction	About 10 qubits	Fundamental research stage	Hundreds of qubits	Around 50 qubits	Within 13 qubits	-
Strength	Mature, reliable, strong engineering	Combines with semiconductor industry	Theoretical fault tolerance	Scalable, reconfigurable	Stable, high-fidelity	Stable, long coherence time, Mature Tech	Room temperature, long-distance friendly
Weakness	High cost	Difficult qubit uniformity, challenging fabrication	Still theoretical, no scalable system yet	Complex laser control, error correction immature	Slow gate speed, large hardware footprint	Limited scalability	Only for specific quantum tasks

Comparison Table: SPINQ Quantum Computers

Image		
Technology	**Superconducting**	**Nuclear Magnetic Resonance (NMR)**
Qubit Type	Artificial qubits based on superconducting circuits	Nuclear spins
Qubit Number	2–25 qubits	2–3 qubits
Scalability	Scalable	Not scalable
Architecture	Quantum chip, Dillution Refrigerator, QCM system, etc	All-in-one desktop device, plug and play
Operating Temperature	-273.14 °C to -273.13°C	0 to 40°C
Size	An entire room	Desktop size
Ease of Use	A professional team with physics, computer engineering, quantum information science background	Beginner-friendly
Typical Applications	**Advanced research, industrial exploration**	**Education, entry-level research, public outreach**

Why SpinQ focuses on Superconducting?

Superconducting Quantum Computing System



One of the most **promising** quantum computing tech, paving the way toward **universal quantum computing**

- Fully solid-state
- Strong scalability
- High-performance
- Compatible with semiconductor processes
- More

Projects Supported by SpinQ Superconducting QC

· 01 Flexible QPU Access for Quantum Hardware Research

The Technology Innovation Institute (TII) is a leading research center in the United Arab Emirates focused on advancing quantum computing and related technologies. As part of the UAE's broader innovation strategy, TII is actively developing superconducting quantum computing systems and requires access to calibrated QPUs for short-term experimentation and systems integration.

With the SPINQ QPU C10, TII is able to carry out focused quantum hardware development, including:

Receive characterized and tested quantum hardware.

Unlike many commercial QPU offerings, the SPINQ QPU C10 includes factory test reports detailing gate fidelity, coherence times, and other key metrics for a workable QPU. This enables early-stage validation of system performance before integration or deployment.

Conduct integration and control development.

With the SPINQ QPU C10, TII is able to advance its efforts in developing superconducting quantum control stacks, including low-level pulse sequencing and calibration routines. Access to a pre-characterized, stable QPU enabled repeatable experimentation and rapid development cycles.

Utilize dedicated technical support.

Post-deployment engineering support facilitated the QPU's integration with TII's existing infrastructure, allowing the research team to resolve system-level challenges efficiently and maintain experimental uptime.

· 03 Experimental Quantum Dynamics and Hamiltonian Inference

The SPINQ QPU C20 was used as part of an experimental framework for investigating quantum many-body dynamics and system characterization. Researchers integrated machine learning methods with real-time quantum data collected from a 20-qubit superconducting chip, enabling bidirectional analysis of observable evolution and Hamiltonian structure.

This application demonstrates the SPINQ QPU C20's role in:

Predictive modeling of quantum system dynamics.

A recurrent neural network (RNN) model, based on Long Short-Term Memory (LSTM) architecture, was trained to forecast the evolution of local observables in driven quantum systems. Experiments were performed using the SPINQ QPU C20 configured in a 2D ladder architecture with 20 transmon qubits.

Hamiltonian parameter inference.

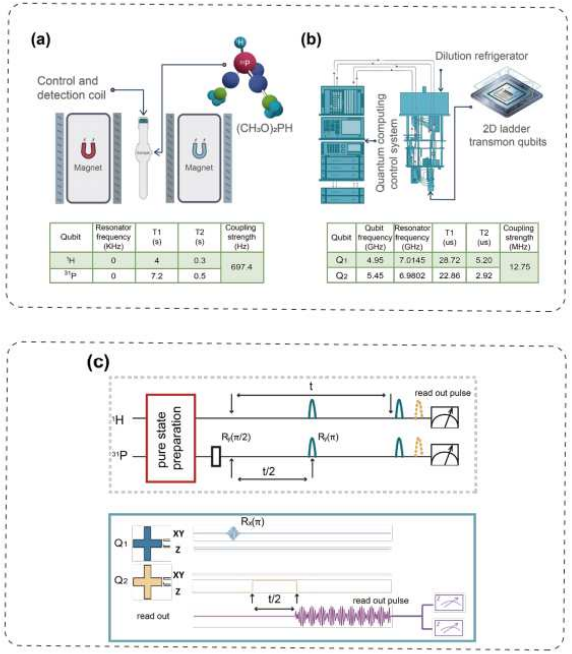
The same model was applied in reverse to infer time-dependent Hamiltonian parameters from observed system behavior. This dual capability enabled researchers to extract underlying field strengths and coupling parameters from experimental data, supporting tasks in quantum control and feedback optimization.

Validation across distinct driving regimes.

Experiments included quench dynamics and periodic driving, with system evolution predicted beyond training intervals (e.g., 20–50 ms), and validated through local measurements (e.g., < σx0 >). The model demonstrated high fidelity in reproducing observed results.

Application to quantum error mitigation and control.

characterization of system behavior and inference of Hamiltonian structure support broader objectives in noise modeling, system calibration, and feedback-based control — critical components of scalable quantum computing.



Qubit	Resonator frequency (KHz)	T1 (s)	T2 (s)	Coupling strength (Hz)
¹H	0	4	0.3	697.4
³¹P	0	7.2	0.5	

Qubit	Qubit frequency (GHz)	Resonator frequency (GHz)	T1 (us)	T2 (us)	Coupling strength (MHz)
Q1	4.95	7.0145	28.72	5.20	12.75
Q2	5.45	6.9802	22.86	2.92	

Experimental platforms and control protocols used for quantum dynamics prediction and Hamiltonian inference on NMR and superconducting qubit system

Why Quantum Education Matters?

Quantum computing won’t become practical without more professionals in the field.

University of Aveiro

https://www.ua.pt/en/curso/459

University of Coimbra

https://www.uc.pt/en/cncg/dig.intel-_reforco-das-competencias-digitais/specialised-training-course-in-quantum-computing-and-technologies-2/

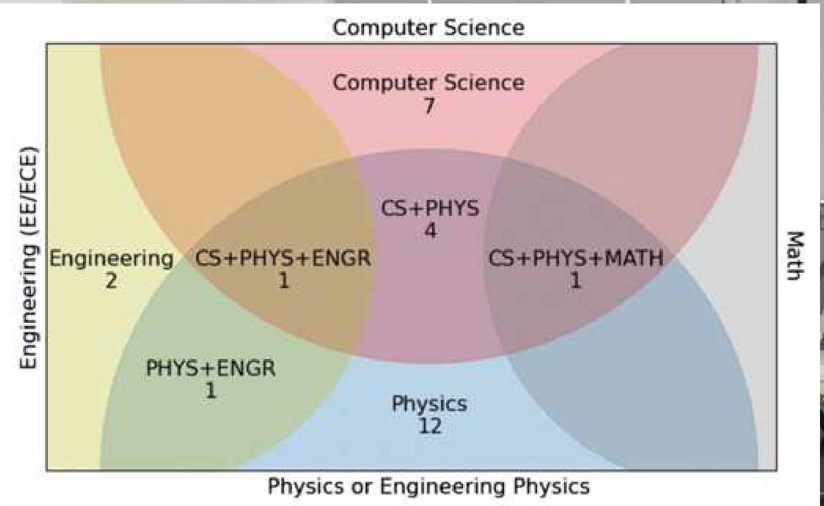
However, quantum education is not easy.

Quantum Education Challenges

1. Interdisciplinary Barriers

Quantum computing courses bring together **physics, computer science, mathematics, engineering**, making it challenging for students to fully grasp the subject.

Proven curricula by our experienced instructors



2. Lack of Structure and Instructors

Quantum computing is still in its **early stage** as an academic field. Structured programs and qualified instructors are still lacking, even in the US, Europe, or China.

Instructor training, course design, project assistance services

3. I

A g ... tical

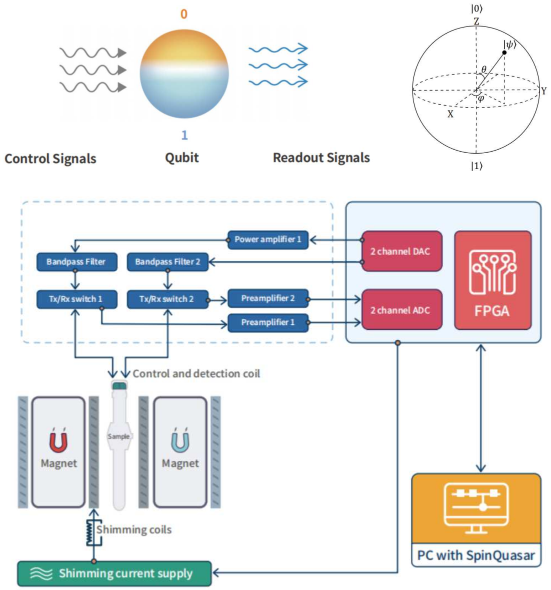
skill

4. Limited Teaching Resource

- **Real quantum computers** are often expensive, too large for teaching.
- **Quantum Cloud** come with long queues and limited access.
- **Simulators** lack physical reality, limiting student experience.

with supporting software for hands-on learning

Why NMR Quantum Computer For Education?



SPINQ Gemini Lab

A real quantum computer?

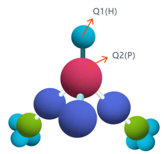
Or

Just a toy?

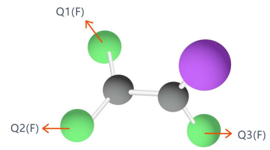
An NMR quantum computer with 2-3 qubits!

How NMR Quantum Computing Works:

- Uses **the nuclear spins of atoms** as qubits
- **Radio-frequency pulses** are applied to control spin states and perform quantum logic gates
- **The NMR signal** is measured to read out the result of the computation



2-Qubit Sample: $(CH_3O)_2POH$



3-Qubit Sample: C_2F_3I

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Why NMR Quantum Computer For Education?

1. An ideal experimental platform

- NMR was **one of the earliest systems** to realize quantum computing
- It is highly precise, very stable, and supported by **decades of mature research**

2. Universality

- Supports **a full set of universal quantum gates**
- **Compatible** with other mainstream quantum technologies, including superconducting qubits

3. Classroom-ready design

- **Easy to operate, affordability, and small-size**

4. Comprehensive teaching materials

- From quantum computing principles, well-known algorithms, to even quantum information science

Lab Course - Principles & Algorithms & Technologies - Gemini Lab

Quantum Computing Experiments	**The Principles of Quantum Computing**				**Objectives**
	NMR Phenomena & Signals	Rabi Oscillation	Qubit	Quantum Decoherence	Explore the quantum properties of nuclei, qubits, and understand their role in quantum computing experiments
	Quantum Control		Quantum System Initialization		learn quantum system control methods
	......				......
	Quantum Algorithms				**Objectives**
	Deutsch Algorithm	Grover Algorithm	HHL Algorithm	Quantum Fourier Transform (QFT)	Understand quantum algorithms' principles and practical efficiencies
	......				......
Quantum Information Technology	**Quantum Control Techniques**				**Objectives**
	Spin Echo	Dynamical Decoupling	Pulse Shaping	Numerical Pulse Optimization	Master essential control techniques for research purposes
	Quantum Simulation				**Objectives**
	Analog Quantum Simulation		Digital Quantum Simulation		Study quantum systems using simulation techniques to understand their behavior and applicatio
	......				......

Trusted by universities in 40 countries

Quantum Computing Education

Dual-Capability Machine Learning Models for Quantum Hamiltonian Parameter Estimation and Dynamics Prediction

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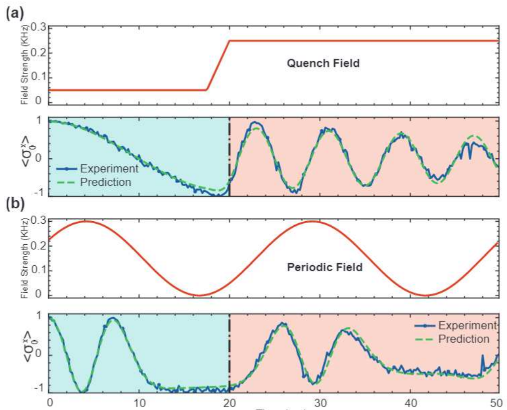
Recent advancements in quantum hardware and classical computing simulations have significantly enhanced the accessibility of quantum system data, leading to an increased demand for precise descriptions and predictions of these systems. Accurate prediction of quantum Hamiltonian dynamics and identification of Hamiltonian parameters are crucial for advancements in quantum simulations, error correction, and control protocols. This study introduces a machine learning model with dual capabilities: it can deduce time-dependent Hamiltonian parameters from observed changes in local observables within quantum many-body systems, and it can predict the evolution of these observables based on Hamiltonian parameters. Our models validity was confirmed through theoretical simulations across various scenarios and further validated by two experiments. Initially, the model was applied to a Nuclear Magnetic Resonance quantum computer, where it accurately predicted the dynamics of local observables. The model was then tested on a superconducting quantum computer with initially unknown Hamiltonian parameters, successfully inferring them. Our approach aims to enhance various quantum computing tasks, including parameter estimation, noise characterization, feedback processes, and quantum control optimization.



Research Papers Using SpinQ Quantum Computers

UNIVERSIDADE D COIMBRA

U.PORTO

NYU ABU DHABI

جامعة نيويورك أبوظبي

Thanks!

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Global Solutions Engineer

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