Haiqu and HSBC Demonstrate Scalable Quantum Encoding for Financial Models

Peer-reviewed Physical Review Research paper shows efficient preparation of financial distributions on quantum hardware

NEW YORK CITY, NY, UNITED STATES, April 28, 2026 /EINPresswire.com/ -- Haiqu, a leading developer of quantum middleware, today announced the publication of joint research with HSBC in Physical Review Research demonstrating an efficient approach to encoding real-world probability distributions into quantum circuits.

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> *Philip Intallura, Group Head of Quantum Technologies, HSBC*

Quantum state preparation, the process of encoding classical data into quantum states, is widely recognized as a major bottleneck when implementing many quantum algorithms on hardware. This challenge is particularly relevant for applications such as financial risk modelling and simulation, where complex probability distributions must be loaded onto quantum devices.

The research uses matrix product state (MPS) methods to construct shallow quantum circuits that encode smooth functions, including probability distributions, directly into quantum states. It also introduces a sampling-based workflow that avoids storing the full discretized dataset in classical memory, enabling larger encoding circuits to be generated.

The approach was validated on finance-relevant models including heavy-tailed Lévy distributions, commonly used to capture extreme market events.

On IBM quantum hardware, circuits up to 25 qubits produced samples that passed standard statistical tests, showing the method can accurately reproduce the probability distributions these models rely on in practice.

Using the sampling-based workflow, the researchers also executed circuits up to 64 qubits, reproducing qualitative features of the target distributions under realistic device noise and demonstrating feasibility at larger scales. Similar behavior was observed in simulations up to 156 qubits, indicating the approach can extend to substantially larger problem sizes.

“Preparing complex probability distributions efficiently is a key step in many quantum algorithms,” said Dr. Philip Intallura, Group Head of Quantum Technologies at HSBC. “This work shows how they can be implemented with much shallower quantum circuits, bringing practical applications such as financial risk modelling closer."

“One of the biggest practical barriers is getting realistic financial data onto today’s quantum hardware,” said Mykola Maksymenko, Co-founder and CTO of Haiqu. “This work shows a scalable path around that barrier and helps move quantum finance workflows from theory toward execution.”

Read the paper in Physical Review Research.

About Haiqu
Haiqu is an emerging leader in quantum software that supports the notion that near-term, commercially viable quantum applications are achievable with the right software, even on current hardware. Haiqu’s hardware-agnostic software can run applications with up to 100x more operations on current devices compared to competitors. Headquartered in New York City in the United States, Haiqu’s expert team operates from US, Canada, Ukraine, UK, EU, and Singapore, contributing to the company’s mission to make quantum computing practical as soon as possible.

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