



SUZH1

**Solution to Quantum Computing
Education in Colleges and Universities**



本源量子计算科技(合肥)股份有限公司
Origin Quantum Computing Technology (Hefei) Co., Ltd.

01

**The Next
Technological
Revolution**

量子计算：下一个技术
革命的风口

02

**Education
Solution**

本源溯知教育解决方案

目录

CONTENTS

03 Full-stack Solution

本源溯知全栈式综合
解决方案

04 Education Product

本源溯知系列教育产品

05 About Origin Quantum

关于本源量子

ITS

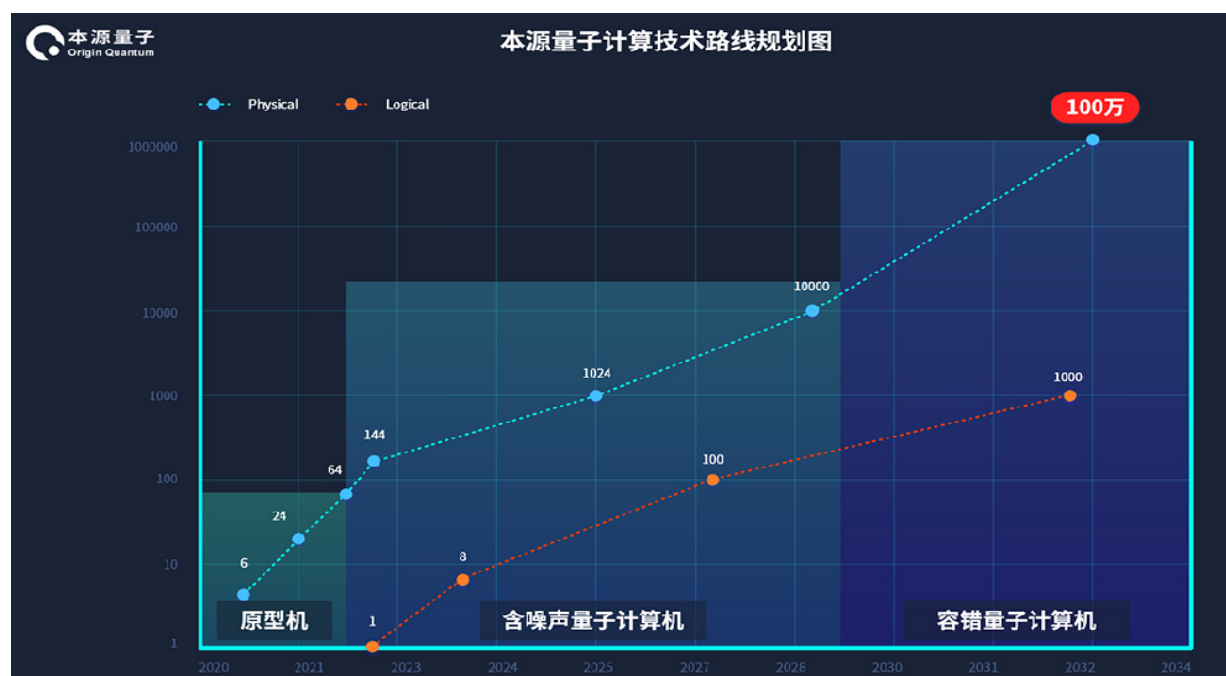
By focusing on speciality construction and collaborative research of quantum computing, Origin Quantum provides universities with comprehensive full-stack quantum computing solutions, assisting them in rapidly building quantum education frameworks.

Quantum Computing: The Next Technological Revolution



Quantum computing is a new kind of computing which follows the laws of quantum mechanics and performs high-speed operation, storage and processing of information. Compared with traditional computers, quantum computers have natural quantum parallel computing capabilities, strong storage capacity and fast computing speed, which will bring a qualitative leap to the existing computing capabilities. With the advancement of the new round of information technology revolution and industrial revolution, the amount of data information in various industries is increasing. Improving computing power and reducing energy consumption at the same time is a key problem to be solved urgently.

The superconducting technology route will surpass 100 qubits by 2022-2023, 1,000 qubits within three years, and 1 million qubits by the end of the decade (2030). International competition is a very tricky situation in quantum computing because, conceptually, only one such machine would be needed to break the encryption used by governments and companies around the world to protect sensitive internal information, and "once universal quantum computers are built, they will be much more efficient than today's supercomputers".



The skill needs of quantum Information Technology talents

Due to the high complexity and frontier of the discipline, quantum information technology talents are scarce resources in the world. Quantum computers are fundamentally different from the classical computers we use every day. Instead of relying on classical bits, quantum systems use the complex laws of quantum physics to create qubits that can be computed at an exponential rate. So building, programming, and maintaining a quantum computer is a completely different way. Practitioners need to understand quantum physics and how to map problems to quantum space, as well as mastering the programming languages, architectures, workflows, and software unique to quantum computing. It is becoming increasingly difficult for the industry to find people who can master theoretical quantum computing and also be competent in software development, and teams in the industry need to prepare for interdisciplinary training.

Lack of large-scale talent

For research and development companies in the quantum computing industry, whether in the software or hardware field, a background in quantum physics is required, along with some kind of experience in data analysis, engineering, modeling, or programming. The number of candidates with this level of expertise is very limited, and currently mainly exists at the PhD level.

With the expansion of the global quantum computer market, the training speed of PhD is far lower than the development demand of the industry, and there is a large-scale talent gap in quantum computing. According to P&S Intelligence, the market size of quantum computing industry will reach 65 billion US dollars by 2030 ; According to Gartner, as many as 20% of organizations may budget for quantum computing in 2023, up from 1% in 2018.

Global development of quantum information education

In response to the new quantum technology revolution, major powers around the world are actively carrying out industrial layout, and many policy bills have been promulgated at home and abroad to support quantum computing education and the research and development of quantum computing equipment.

Taking the United States as an example, in 2018, the United States released a 10-year strategic goal, the National Strategic Overview of Quantum Information Science, and allocated 1.3 billion US dollars in the first three years, accounting for 50% of its total scientific research investment, with the purpose of training quantum scientists and engineers in large numbers. In the United States, quantum computing education has been written into the national K12 education Act. It is because of the development and popularization of quantum technology that human society will eventually be brought into the quantum age in the future. The EU issued the Quantum Declaration in 2016, which called on European countries and the European Commission to launch multi-billion euro flagship quantum technology initiatives aimed at keeping Europe at the forefront of the second quantum revolution.

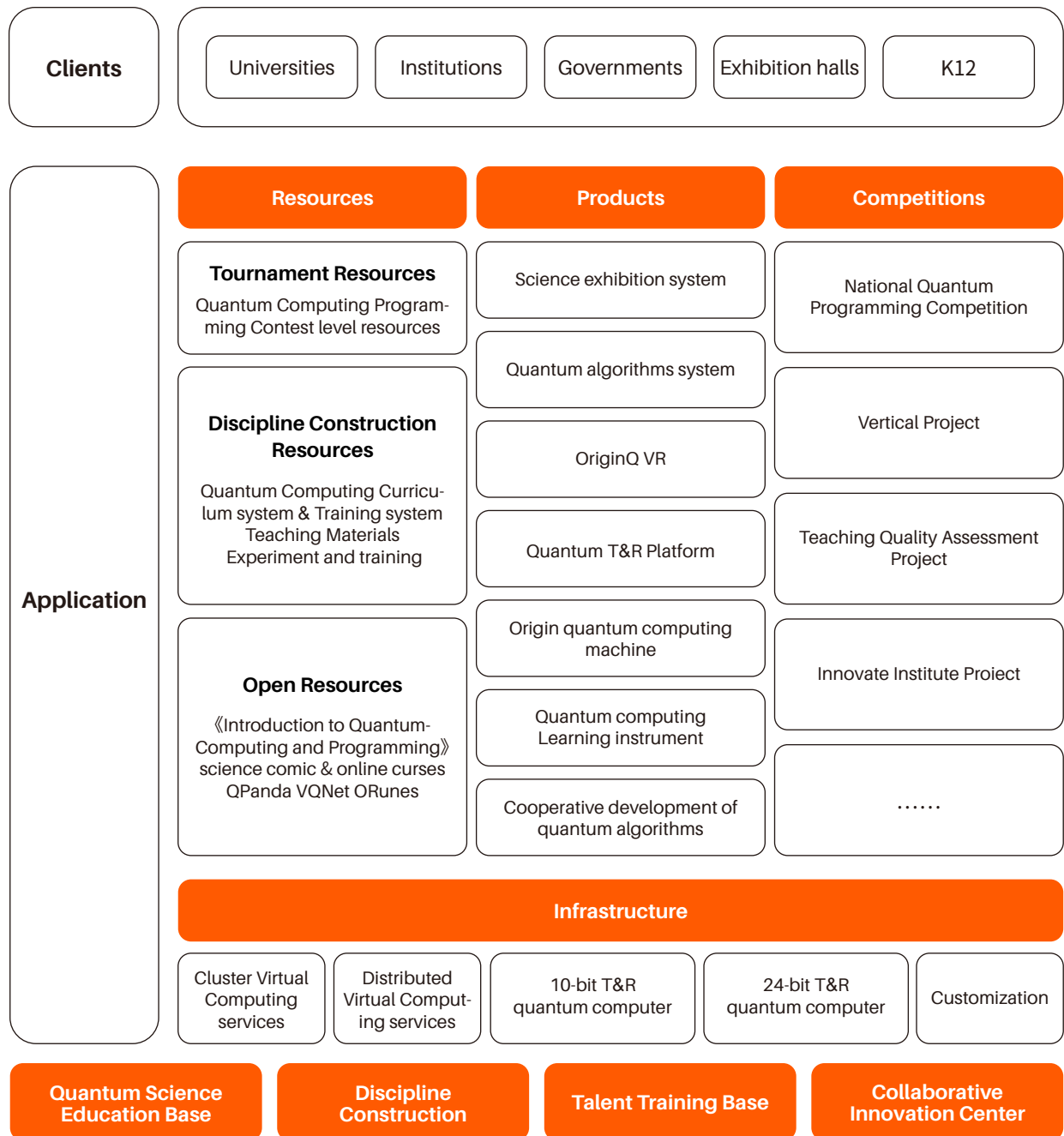
Education solution

Origin Suzhi is a brand of Origin Quantum focusing on quantum computing education. Relying on the powerful performance of quantum computers and computing services of Benyuan Quantum, Benyuan provides whole-chain solutions for quantum computing education for universities, scientific research institutions, government agencies, popular science exhibition halls and K-12 schools, aiming to meet the needs of interdisciplinary talent training and scientific research, and create a complete quantum computing ecosystem.

02



Education



Solution

The full-stack integrated solutions of Origin Suzhi

Discipline construction of quantum information science

Based on the successful construction experience of quantum information science in University of Science and Technology of China, and relying on the talents and technologies of the Key Laboratory of Quantum Information of the Chinese Academy of Sciences, it provides one-stop curriculum setting, teaching guidance and other support for partner universities, and collaborates with schools to complete the construction of quantum computing science. Jointly cultivate quantum computing talents.

Support the development of faculty teams for quantum computing in universities

The construction of quantum computing teaching staff plays a vital role in the school-enterprise cooperation, collaborative education, industry-research integration and discipline construction of quantum computing in colleges and universities. Led by Professor Guo Guangcan, academician of the Chinese Academy of Sciences, and Professor Guo Guoping, chief scientist of the Super 973 project of the Ministry of Science and Technology, the core teacher training team of Biyuan quantum computing regularly conducts offline training workshops, Sharon meetings and other activities, and trains a group of excellent lecturers with professional quantum computing knowledge and operational ability.

○ Training Mode



▽
online learning



▽
training camp



▽
Innovation Salon

.03

○ Core Teacher Training Team



Guo Guangcan

Pathfinder and founder of quantum optics and quantum information in China, academician of the Chinese Academy of Sciences



Guo Guoping

Deputy Director of the CAS Key Laboratory of Quantum Information. Associate Dean of the School of Microelectronics and the Institute of Advanced Technology of USTC



Wu Yuchun

Associate Professor of USTC Research interests: Fundamental Theory of Quantum Information



Luo Gang

Associate Researcher of USTC Research interests: Silicon Quantum Devices Graphene NEMS

Support universities in creating a curriculum system for quantum computing

Combined with the current teaching situation of the school, relying on the Key Laboratory of Quantum Information of the Chinese Academy of Sciences, the University of Science and Technology of China, and Origin Quantum talents and technologies, the systematic teaching resources in line with the needs of school curriculum construction are co-created to help colleges and universities strengthen the cross integration of emerging technologies and traditional disciplines, and take the lead in building a systematic quantum computing curriculum system.

Chapter	Name	Teaching Session	
		Theoretical Teaching Hours	Experimental Teaching Hours
1	Basic concepts of quantum mechanics	6	
2	Foundations of quantum mechanics	6	
3	Principles of quantum Computation	8	
4	Quantum algorithm	6	10
5	Quantum programming	8	10
6	Quantum computing physical systems	6	6
Total		66	

University
quantum computing
curriculum system

Compilation: Prof. Guo Guoping's team from the Key Laboratory of Quantum Information of the CAS, and Origin Quantum's research team

Introduction to Quantum Computing and Programming, QPanda Quantum Computing Programming, Quantum Finance Theory and Practice, Quantum Machine Learning Theory and Practice



Help the construction of training conditions for quantum computing teaching needs in colleges and universities

Quantum computing training classroom is the main position of quantum computing teaching, learning and practice, and a good teaching environment is helpful to improve the teaching effect. Following the pace of educational informationization 2.0, the original quantum enforces the traditional computer room of the school, relies on the original hardware, avoids secondary procurement, combines the immersive space layout, supplements the quantum computing teaching resources and equipment, and adds bricks and tiles to the construction of quantum computing training conditions.



One room with multiple uses

It can be used for quantum computing theory teaching, quantum computing programming practice, quantum computing PBL learning, quantum computing research competition

Cost savings

Relying on the original equipment of the traditional computer room to upgrade and transform, avoid secondary investment

Set up "quantum information science" specialty

The university and enterprise jointly build a quantum computing talent training base

Anhui Quantum Computing Engineering Research Center, jointly established by Origin Quantum and the Key Laboratory of Quantum Information of the Chinese Academy of Sciences, takes quantum computing as the research direction, provides internship practice and employment and entrepreneurship platform for related majors, and jointly promotes the professional level certification of quantum computing, and provides outstanding talents to quantum computing application industry chain enterprises. For outstanding graduates who meet the original requirements of quantum technology, priority will be given to admission, and more than 40% of the quantum talents of the enterprise will compete on the stage.

○ School-enterprise cooperation case



01

School of Physics, Xi'an Jiaotong University

University-Enterprise Cooperation to Build "Quantum Computing Teaching, Experiment and Research Center"



02

Central South University

School-Enterprise Co-construction of "Central South University-Origin Quantum Computing Talent Training Base"



03

Anhui University

School and enterprise to build internship and employment base



04

Chongqing University of Posts and Telecommunications

University-Enterprise Cooperation to Build "Quantum Computing Teaching, Experiment and Research Center"



05

Guilin University of Electronic Science and Technology

University-enterprise cooperation to build quantum computing science popularization training base

University-enterprise collaborative innovation Center for Quantum Computing

Quantum Computing Collaborative Innovation Center takes universities as the construction center, strongly supports discipline construction and talent cultivation with innovation quality and service contribution, actively collaborates with all parties to undertake major national, regional and industrial tasks, and solves practical application problems of quantum computing. Relying on the talents and technology of the Key Laboratory of Quantum Information, Benyuan Quantum works with the intention of colleges and universities to gradually improve the construction of quantum computing industrial application research laboratories, and jointly develops application software for industrial needs to promote industrial development.



Origin Suzhi Series of Educational Products

Quantum science exhibition system

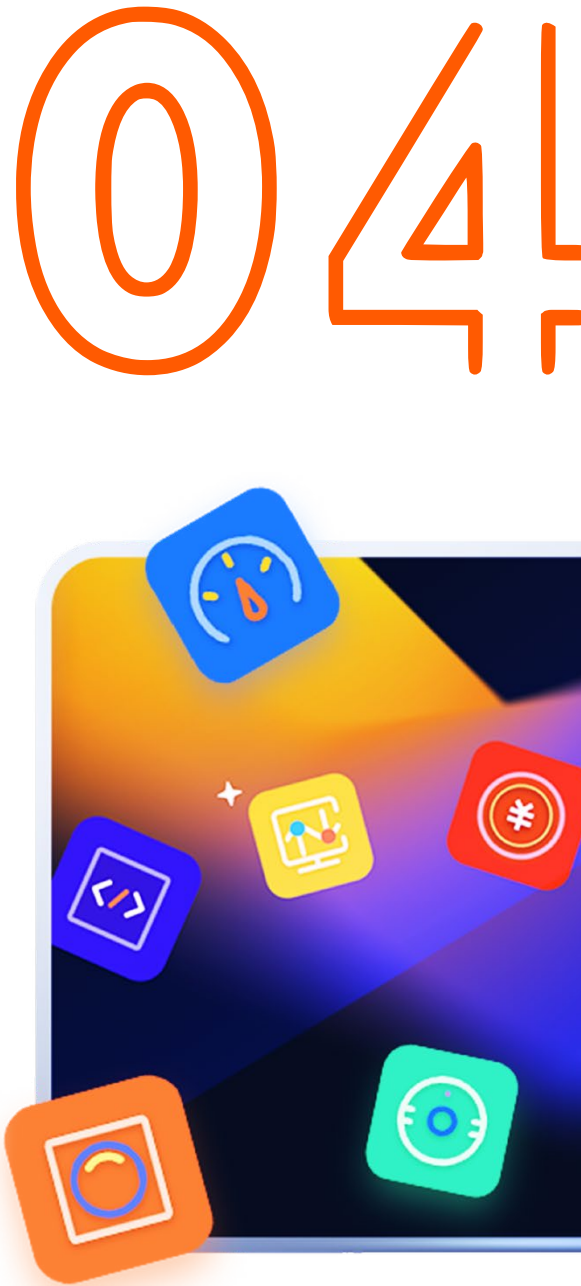
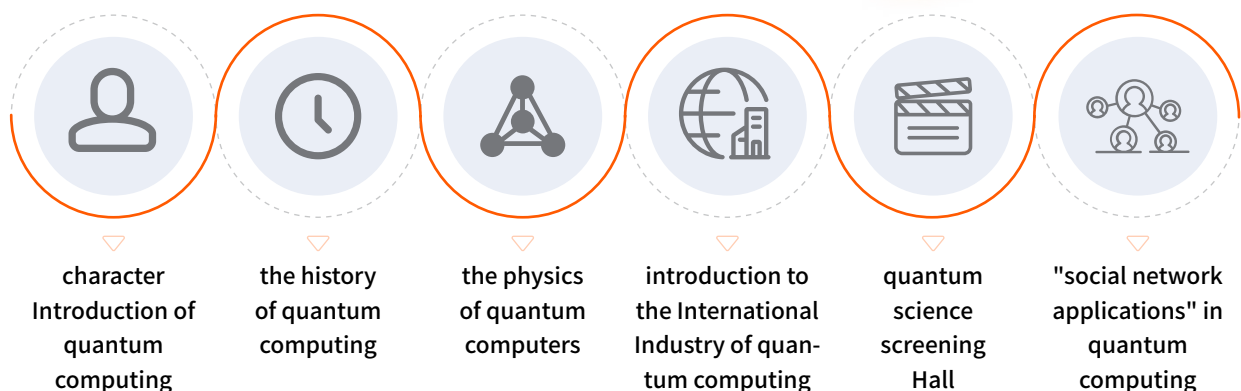
In the form of pictures, videos and interactive animations, supplemented by interactive exhibition items, the quantum science exhibition system vividly displays the development history of quantum computing, related figures, research status and international industrial layout, popularizes the basic knowledge of quantum computing, and brings users a journey of quantum computing beyond classical and space-time.



○ Application Scenarios

Science exhibition hall : Around the quantum science popularization system, with a reservation mini program, a quantum information science popularization exhibition hall is built to provide users with exhibition hall reservation and quantum science popularization services

○ Functions



Experiential system for quantum algorithms

The quantum algorithm experience system takes the advantages of quantum computing experience application, quantum computing algorithm application, and quantum computing industry application as cases to vividly present the frontier exploration of quantum computing in many fields.



Application Scenarios

Exhibition hall construction: With the quantum science popularization exhibition system, the quantum computing science popularization exhibition hall is built around the quantum algorithm experience system, and the exhibition hall reservation and science popularization services are provided

○ Functions



Superconducting quantum computer disassembled

By equal-proportion reduction superconducting quantum computer and parts, you can observe superconducting quantum computer closely in virtual space, familiarize yourself with the basic structure of superconducting quantum computer, and experience the construction process of superconducting quantum computer.



Quantum circuit construction

Different from the construction of traditional quantum computing circuit, quantum circuit can be built in virtual space. By closely observing the state evolution of quantum qubit when quantum circuit is running, the effect of each logic gate can be intuitively understood.



Quantum state evolution

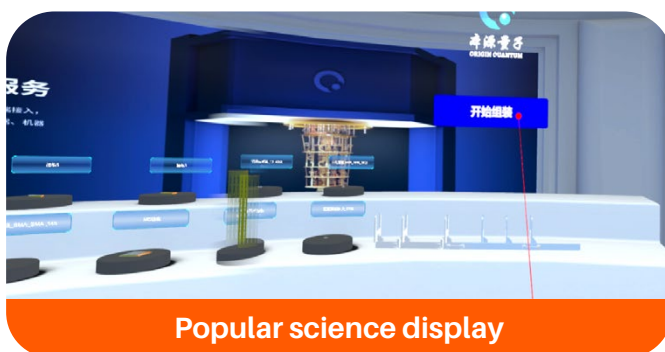
By constructing the quantum qubit model in the virtual space, the evolution of the quantum qubit state can be observed and the change of the state equation of the Bloch sphere can be observed.

Orig
VR

OriginQ VR

The OriginQ VR combines virtual reality technology (VR) with quantum computing, builds a "realistic" quantum computing training teaching environment in the virtual reality space, and provides users with a new kind of immersive quantum computing teaching experience.

○ Application Scenarios



Popular science display

To meet the needs of popular science exhibition in popular science exhibition halls/schools and other places, visitors can quickly experience the composition of superconducting quantum computers and understand the relevant principles of quantum computing



Professional teaching

To create virtual simulation teaching in line with the training of professional talents, meet the needs of teaching training, and provide low-cost, safe and reliable teaching means and teaching methods for college teaching.

Quantum T&R platform

Quantum T&R Platform is a quantum computing education teaching and research platform for universities to use, aiming to help universities to establish their own quantum computing teaching system, providing the whole process of teaching solutions from lesson plan projects, quantum graphical programming and code programming, lesson plan project examples, quantum computing learning center and teaching management.

The screenshot displays the Quantum T&R platform interface. At the top, there is a navigation bar with the title '本源量子教研一体化平台' and a user profile 'admin'. The main content area is divided into several sections:

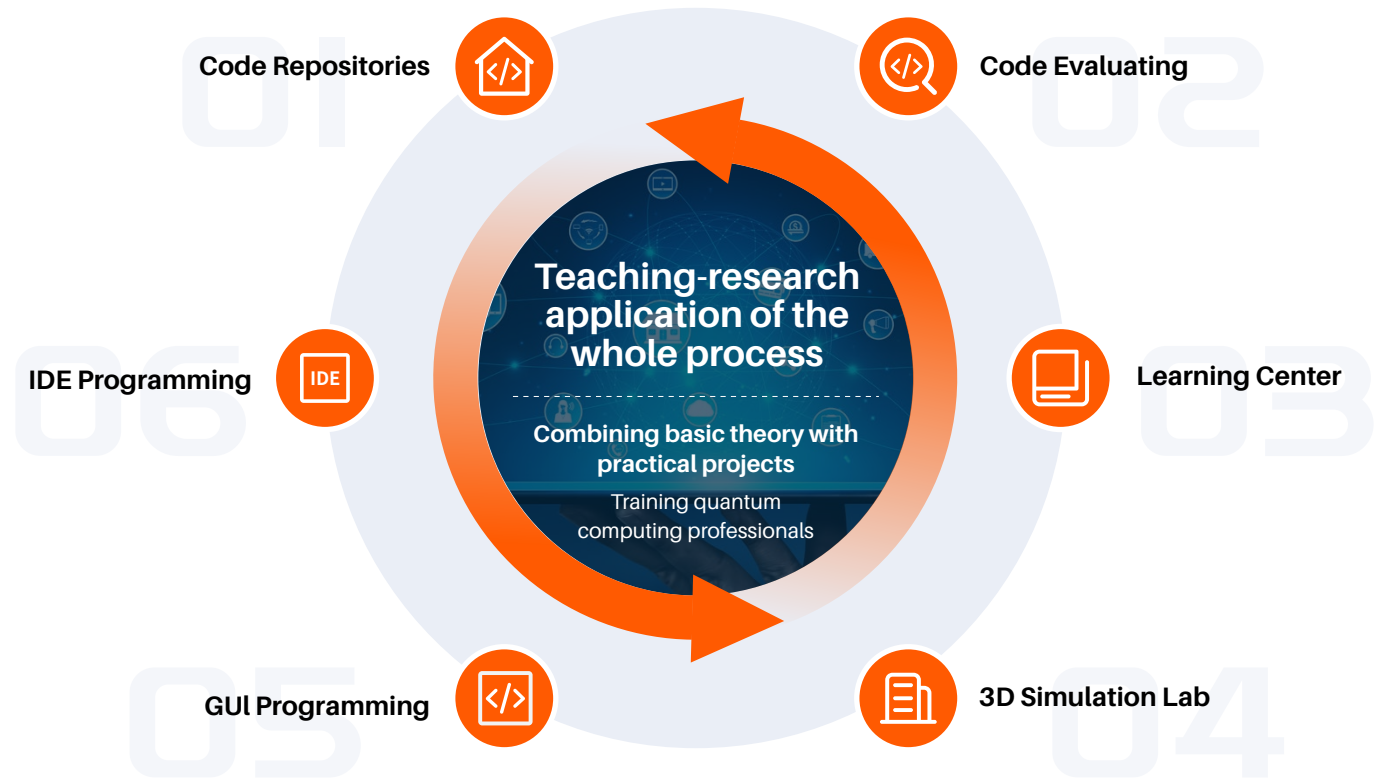
- 图形化编程** (Graphical Programming): A section titled '图形化编程 图形拖拽，快速完成线路创建' (Graphical Programming: Drag and drop, quickly complete circuit creation). It contains eight cards for different quantum computing resources:
 - 本源悟源1号: 6 bits, 支持量子比特 (Supports qubits), 创建线路 >>
 - 本源悟源2号: 6 bits, 支持量子比特 (Supports qubits), 创建线路 >>
 - 本源悟空: 12 bits, 支持量子比特 (Supports qubits), 创建线路 >>
 - 全振幅量子虚拟机: 33 bits, 支持量子比特 (Supports qubits), 创建线路 >>
 - 含噪声量子虚拟机: 32 bits, 支持量子比特 (Supports qubits), 创建线路 >>
 - 部分振幅量子虚拟机: 68 bits, 支持量子比特 (Supports qubits), 创建线路 >>
 - 单振幅量子虚拟机: 200 bits, 支持量子比特 (Supports qubits), 创建线路 >>
- 常用入口** (Common Entry): A section with six cards for quick access to various features:
 - 添加成员 (Add member)
 - 排行榜 (Ranking)
 - 成员使用数据 (Member usage data)
 - 成员与部门 (Member and department)
 - 用户操作日志 (User operation log)
 - 用户登录日志 (User login log)
- 算法示例** (Algorithm Examples): A section with three cards for algorithm examples:
 - HHL Algorithm
 - Deutsch-Jozsa Algorithm
 - Shor Algorithm
- 学习中心** (Learning Center): A section with two cards for learning resources:
 - 量子世界 (Quantum World)
 - 量子力学 (Quantum Mechanics)

Quantum T&R Platform

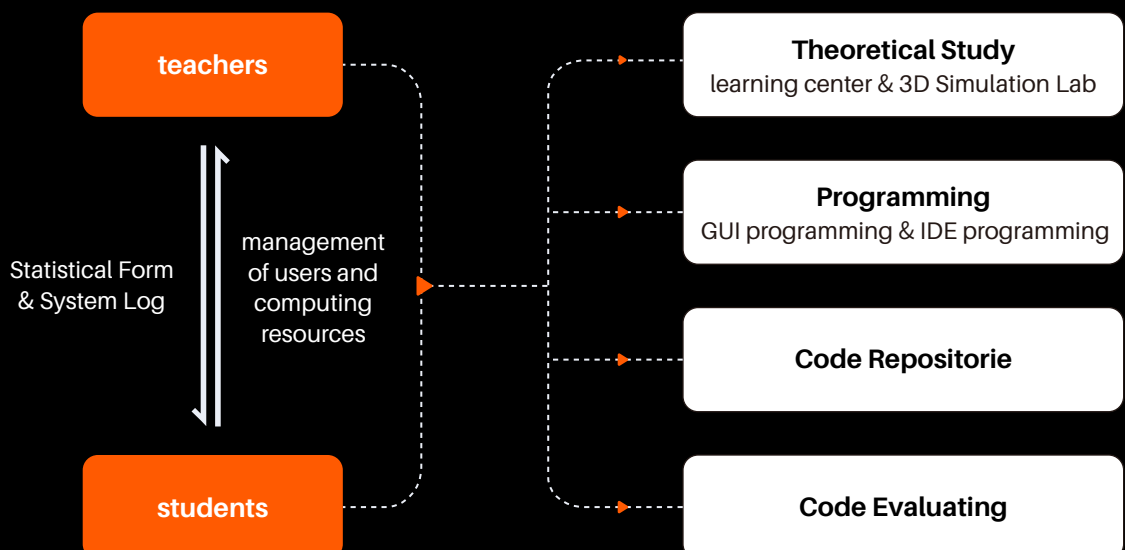
Features

- ▶ Support user local private deployment
- ▶ The backend accesses the virtual machine system to support access to the real machine service
- ▶ Modular customization
- ▶ Building a virtual simulation laboratory with 3D simulation technology

○ Functions



○ Application Scenarios

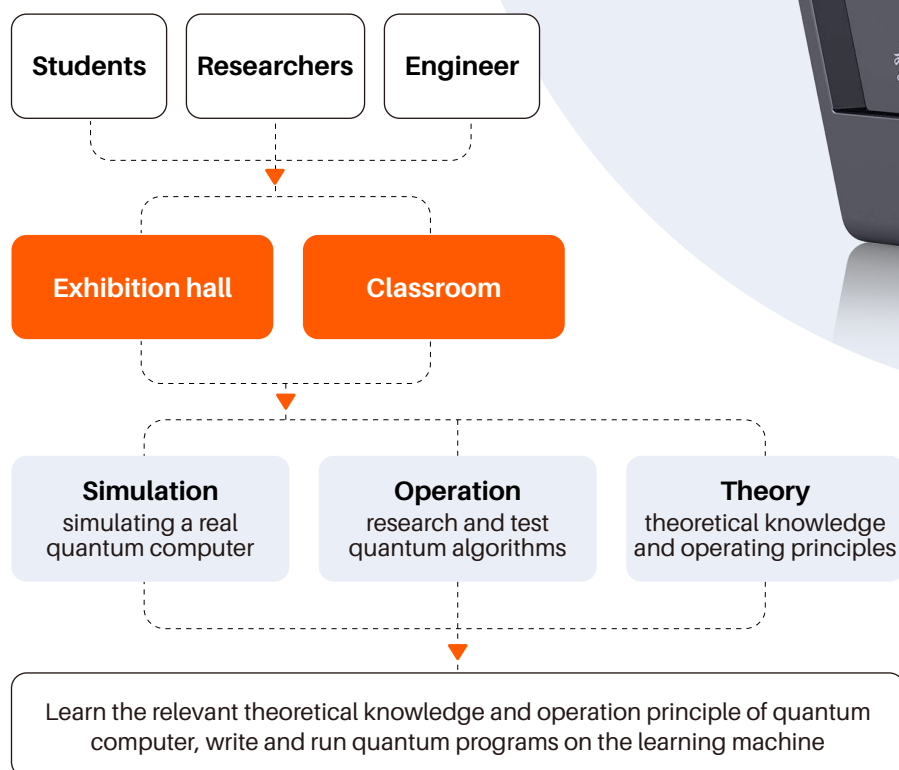


All-physics system quantum learning machine

The all-physics system quantum learning machine is a one-stop quantum computing learning system built by the original quantum. It focuses on providing a quantum computing learning environment. With its powerful dedicated quantum computing simulation environment, it can meet the needs of students, researchers and engineers to learn the relevant theoretical knowledge and operation principle of quantum computers, and write and run quantum programs on the learning machine. At present, many colleges and large institutions have used the whole physical system quantum computing learning machine as the main equipment of quantum computing learning.



○ Application Scenarios



○ Functions

The learning machine is equipped with multiple functional modules, including 3D simulation virtual laboratory, quantum computing micro classroom, quantum computing graphical programming module and so on. The close cooperation between the multiple modules helps the users of the learning machine to understand the structure of the quantum computer, gain insight into the algorithm of quantum computing and write quantum programs.

01

3D Simulation Lab

- Superconducting Quantum Computer
- Semiconducting Quantum Computer
- Trapped Ion Quantum Computer

02

Quantum computing micro classroom

- Video teaching
- Dialogue teaching

03

GUI programming

- Virtual quantum computing
- Complete quantum programming capabilities

○ Features

- ▷ Different customized versions are provided for different users
- ▷ Powerful dedicated quantum computing simulation environment
- ▷ Multi-scene adaptation with hardware carrier

Quantum computing learning instrument

By constructing systematic learning resources and carrying visual and dynamic human-computer interaction models, this product provides users with an efficient and interesting quantum computing teaching product. The product will solve the problems faced by quantum computation-related majors in the process of traditional teaching or self-study, such as boring classes, obscure knowledge, and no ideas for learning.



instrument

○ Features

○ Application Scenarios



TEACH

- ▷ Five major teaching resource systems
- ▷ Dynamic presentation of knowledge points



LEARN

- ▷ Real-time statistics on learning progress
- ▷ Problem, highlight



PRACTICE

- ▷ Hundreds of knowledge points
- ▷ Errors collected, strengthen and consolidate



ASSESSMENT

- ▷ Knowledge nanoscale separation
- ▷ Comprehensive assessment of learning

01
STEP



21.5-inch
4K display

10-point
touch
technology



02
STEP

03
STEP



Z-bracket
flexible
adjustment

Five major
teaching
resource
systems



04
STEP

05
STEP



More than
100 intelligent
interaction
models

Teaching
and testing
closed loop
business
services



06
STEP

T&R Quantum Computer

The T&R quantum computer is a real quantum computer for quantum computing research, which is developed based on the first engineering quantum computer in China -- the "Origin Wuyuan" series superconducting quantum computer.

The superconducting quantum chip system based on Kuafu seires superconducting quantum processor is tthe core of quantum computer, which can realize the execution of quantum programs, support 10 qubits and 24 qubits, including superconducting quantum chip, control system, operating system, environmental support system, etc.

○ Functions

- ▷ Kuafu seires superconducting quantum processor
- ▷ Carrying the first quantum computing operating system in China can greatly improve the efficiency of quantum computers
- ▷ Reliable on-site installation, commissioning and maintenance support

○ Complete machine services

Origin Quantum focuses on the ecological construction of quantum computing industry to build autonomous and engineering products. We have delivered 24-qubit superconducting quantum computers equipped with a 24-qubit superconducting quantum chip, which ensures international advanced technologies like fidelity and coherence time.



Supply



Equipment
Installation



Commissioning
Support



Trial Operation
Support



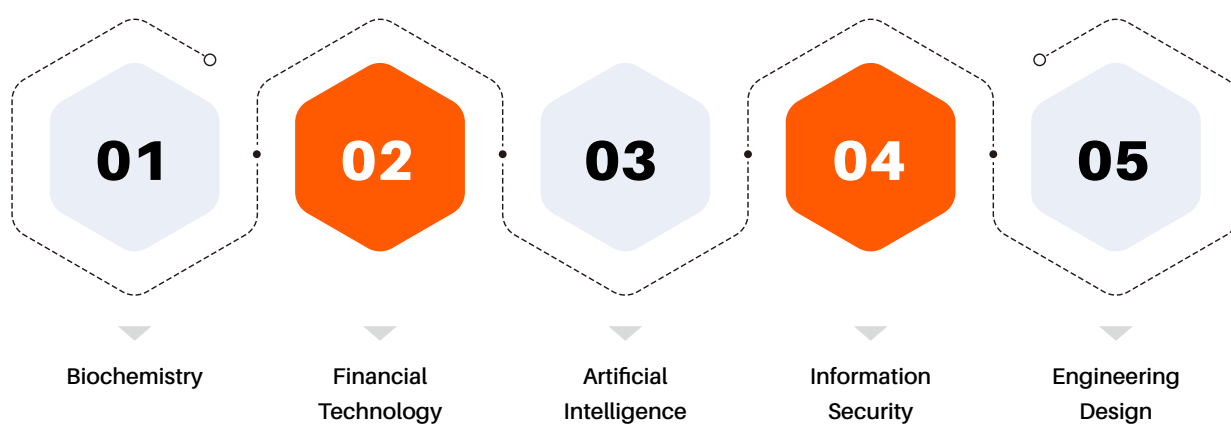
Operational
Maintenance

quantum cor

Collaborative Development of Quantum Algorithms

Origin Quantum actively follows up the algorithm research of various research directions in the field of quantum computing, and has a strong ability to develop quantum algorithms. For universities and institutions, the original quantum provides quantum algorithm cooperative development services.

○ Research direction



○ Development form



Joint development



Outsourced development

○ Result release

- ▷ Common ownership of intellectual property
- ▷ Exclusive intellectual property
- ▷ The right to use knowledge achievements

○ Collaboration method

Support the combination of various forms, including various awards, projects, courses and other cooperation.

computer



About Origin Quantum

05

Composition of industry alliance

Upstream and Downstream Manufacturing Alliance of Quantum Computing



中船重工709所



航空工业西安航空计算技术研究所



中国电科



中微达信



晶合科技



中船鹏力

Application Ecology Alliance for Quantum Computing

Finance



Biochemistry



AI big data



Education Alliance for Quantum Computing



Universities



中国海洋大学



北京航空航天大学



中南大学



南京航空航天大学



上海大学



宁波大学



浙江大学城市学院



中国矿业大学



上海海事大学



南京师范大学



重庆邮电大学



合肥工业大学



南京邮电大学



天津工业大学



安徽大学



桂林电子科技大学



长江大学



湖北师范大学



合肥师范学院



蚌埠医学院



浙江金融职业学院



CCF量子计算专业组

Authority team

FOUNDER

Academician Guo Guangcan

Chief advisor and co-founder

- Pioneer and Founder of Chinese Quantum Optics and Quantum Information, Academician of Chinese Academy of Sciences;
- The Chief Scientist of the 973 Program on Quantum Communication and Quantum Information Technology at the Ministry of Science and Technology.



Professor Guo Guoping

Chief scientist and founder

- Deputy of the 14th National People's Congress (NPC);
- One of the first batch of scholars who started the research of quantum computing in China;
- Deputy Director of Key Laboratory of Quantum Information of Chinese Academy of Sciences.



○ CORE TEAM



ORIGINQ

Company profile

Incorporated in High-Tech Development Zone, Hefei in 2017, Hefei Origin Quantum Computing Technology Co., Ltd. (shortly referred to as "Origin Quantum") is a leading enterprise in domestic quantum computing with branches in Beijing, Chengdu, Shenzhen and Zhengzhou.

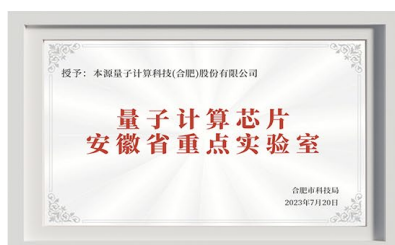
Goal

Bring quantum computing out of the laboratory to truly serve humanity

Vision

Produce China's autonomous controllable quantum computer

Company honor



intellectual property

Sort	Enterprise abbreviation	Country/region	As of October 18, 2022, the number of invention patent applications for quantum computing technology published in the world
1	IBM	United States	1323
2	Google	United States	762
3	D-Wave	Canada	501
4	Microsoft	United States	496
5	Northrop Grumman	United States	262
6	Origin quantum	China	234
7	Intel	United States	221

Source: IPRdaily Chinese Website and incoPat Innovation Index Research Center

Sixth in the world and first in China

270 authorizations, including 52 invention authorizations



learn.originqc.com.cn

 Tel: 0551-6383 6038

 Web: www.originqc.com.cn

 No. 900 Wangjiang West Road, Shushan District, Hefei, Anhui;
Floor 6, Building E2, Innovation Industrial Park Phase II, No. 2800, Innovation Avenue, High-tech District, Hefei, Anhui (Headquarter)