Quantum technologies

British quantum computing experts leave for Silicon Valley

New start-up aims to create commercial quantum computer within 5 years

The move to Silicon Valley by scientists at PsiQ was driven partly by a need for capital © AFP

Madhumita Murgia in London JUNE 23, 2019

A group of Britain's best-known quantum computing scientists have quietly moved to Silicon Valley to found a start-up called PsiQ that believes it can produce a commercial quantum computer within five years.

The departure of some of the UK's leading experts in a potentially revolutionary new field of technology will raise fresh concerns over the country's ability to develop industrial champions in the sector.

The news comes just weeks after the successes of the British start-up scene were extolled at London Tech Week, where prime minister Theresa May pledged £150m specifically to help develop commercial applications for quantum computing.

The scientists' move to Silicon Valley was driven partly by a need to raise capital. "The story is that the best of Britain is going to the United States to scale up," said Hermann Hauser, co-founder of UK-based chip designer Arm, which is now owned by Japan's SoftBank, and an early investor in PsiQ.

"They rightly concluded that they couldn't access the capital in Europe so moved to the Valley," he added. So far PsiQ has received investment from Playground Global, a venture firm started by Android founder Andy Rubin.

PsiQ, which has 50 employees according to LinkedIn, was co-founded by Jeremy O'Brien, a physicist at the University of Bristol and Terry Rudolph, a professor at Imperial College London. Several PhD graduates of the two UK labs have followed the researchers to Palo Alto, where the start-up has set up shop close to Stanford University.

Chief operating officer Stu Aaron was previously a partner at premier Silicon Valley investment firm Khosla Ventures and has worked for at least five start-ups based in California.

The company is now bolstering its engineering expertise to start building a working machine, Mr O'Brien said.

"The majority of our staff come from the wider industry — systems engineering, the semiconductor industry, photonics and so on," he said. "It's called Silicon Valley for good reason. We are building a computer that will look similar to a regular computer so that's the place to be."

Quantum computers, if they can be built at scale, will harness properties that extend beyond the limits of classical physics to offer exponential gains in computing power.

A November 2018 report by the Boston Consulting Group said they could "change the game in such fields as cryptography and chemistry (and thus material science, agriculture and pharmaceuticals) not to mention artificial intelligence and machine learning . . . logistics, manufacturing, finance and energy".

Unlike the basic binary elements of classical computers, or bits, which represent either zeros or ones, quantum bits, or qubits, can be both at the same time. By stringing together qubits, the number of states they could represent rises exponentially, making it possible to compute millions of possibilities instantly.

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Jeremy O'Brien

PsiQ has taken a different scientific approach to every company that is working on quantum computing today. "When we founded the company we took a contrarian position on everything, based on the combined 60 years of experience of the founders, and a determination to make [quantum computing] practical in terms of a manufacturable, scalable product," Mr O'Brien said.

The PsiQ computer will encode information in photons instead of electrons. Although efforts by companies such as IBM and Google that use electron-based approaches have been successful in inventing small-scale working computers, the technology is highly error-prone because of the nature of electrons, making it hard to build a device at a large scale.

One venture capitalist familiar with PsiQ said the company still had a series of hurdles to overcome. There are “six or seven hard science problems to solve,” said the VC, and as a result “they’re six or seven years behind everyone else. It’s promising research, but very, very early.”

Scientists such as Mr Rudolph and Mr O’Brien have been working on a photon-based approach for decades but had struggled to create the smallest unit of a quantum computer, known as a two-qubit gate.

But Mr O’Brien said they had now passed that hurdle, and “everything else is that much easier”.

“PsiQ [has] an ambition to develop a large-scale . . . quantum computer . . . based on photons as qubits, with 1 million qubits as its first go-to-market product within about five years,” writes Philipp Gerbert, senior partner at BCG and a former physicist. “This would be a major breakthrough if and when it becomes available.”

“Having had zero ambition to be entrepreneurs, start a company or move to Silicon Valley, we did all of those things because we felt a moral responsibility to bring this technology to bear,” Mr O’Brien said. “This is nothing short of a necessary tool for humans to invent our future.”