

Le Monde Idées

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« Quantum Technologies are about to create a revolution in many economic sectors »

Quantonation founders Charles Beigbeder and Christophe Jurczak share their vision of Quantum Technologies in a manifesto published by “Le Monde”. They wish that public policy should support the “disruptive technologies” offered by engineering based on quantum physics.

Manifesto. The United States and China are engaged in several battles, including one that goes unnoticed by the general public which will have considerable consequences for France and Europe: the leadership for quantum technologies. Indeed, the engineering of profoundly non-intuitive phenomena is beginning to be mastered after decades of work in public research laboratories.

France and Europe have tremendous assets to share in order not to remain passive spectators: quantum can be the winning vector to get us back in the information technology race. In order to fully understand this battle stakes, we must go back to the beginning of the 20th century with Einstein, Bohr, Heisenberg, De Broglie...

These immense scientists established quantum theory to explain phenomena that their physics - called “classical”, that of Newton and Maxwell - could not explain. The wave and particle characteristics of light is one of them. Also, much more subtle effects resulting from the manipulation of individual objects such as atoms, photons or electrons can be explained by using concepts such as entanglement and superposition of states.

“Quantum Advantage”

Concepts so counter-intuitive that even Einstein had expressed doubts, contradicted by the French physicist Alain Aspect in the 80s. And, this new physics - which has already given us the transistor and the laser - is revolutionizing entire sectors of the economy.

For computation, the theory promises a “quantum advantage”, i.e. remarkable time savings compared to the most powerful conventional computers. With a computer

integrating these new processors, it is possible to considerably accelerate the discovery of materials and molecules by simulating chemical reactions in hours instead of years, even with the best supercomputers available today. The same applies to finance, aeronautics, mobility and defence.

In telecommunications, the so-called “non-cloning” theorem prevents the duplication of information encoded in quantum form. It has been used by China to build ultra-secure data communication channels between a network of ground stations and a satellite. Researchers have invented “blind computing”, which would allow calculations to be performed on the cloud without disclosing the algorithms and data used. These are the technological building blocks of the future of the Internet.

Mature technologies

Admittedly, for large-scale implementation, progresses must be made in the manipulation of individual quantum objects to limit the loss of purely quantum qualities at the heart of the expected performance gains. But the great novelty is that we have now passed the stage of scientific validation and time has come for the engineering and industrialization of products, creation of start-ups, patents, search for customers, and recruitment of talent that is rare and therefore valuable.

Some of these technologies are mature, such as the gravimeters marketed by the French start-up Muquans, which could revolutionize early detection of volcanic eruptions, or the electronic cards of the British start-up Kets Quantum Security, generating “real” random numbers for cryptography. For quantum computation and

communications application, we forecast about five to ten years period of time.

An industry is emerging. Silicon Valley is investing in disruption. An incubator such as the Creative Destruction Lab in Toronto brings several dozen start-ups to the forefront of quantum software. IBM, Google and Microsoft in the United States, as well as Huawei and Alibaba in China, have set up teams dedicated to quantum physics. The Chinese and American governments have ambitious plans to support their laboratories and industries, amounting to billions of dollars in funding.

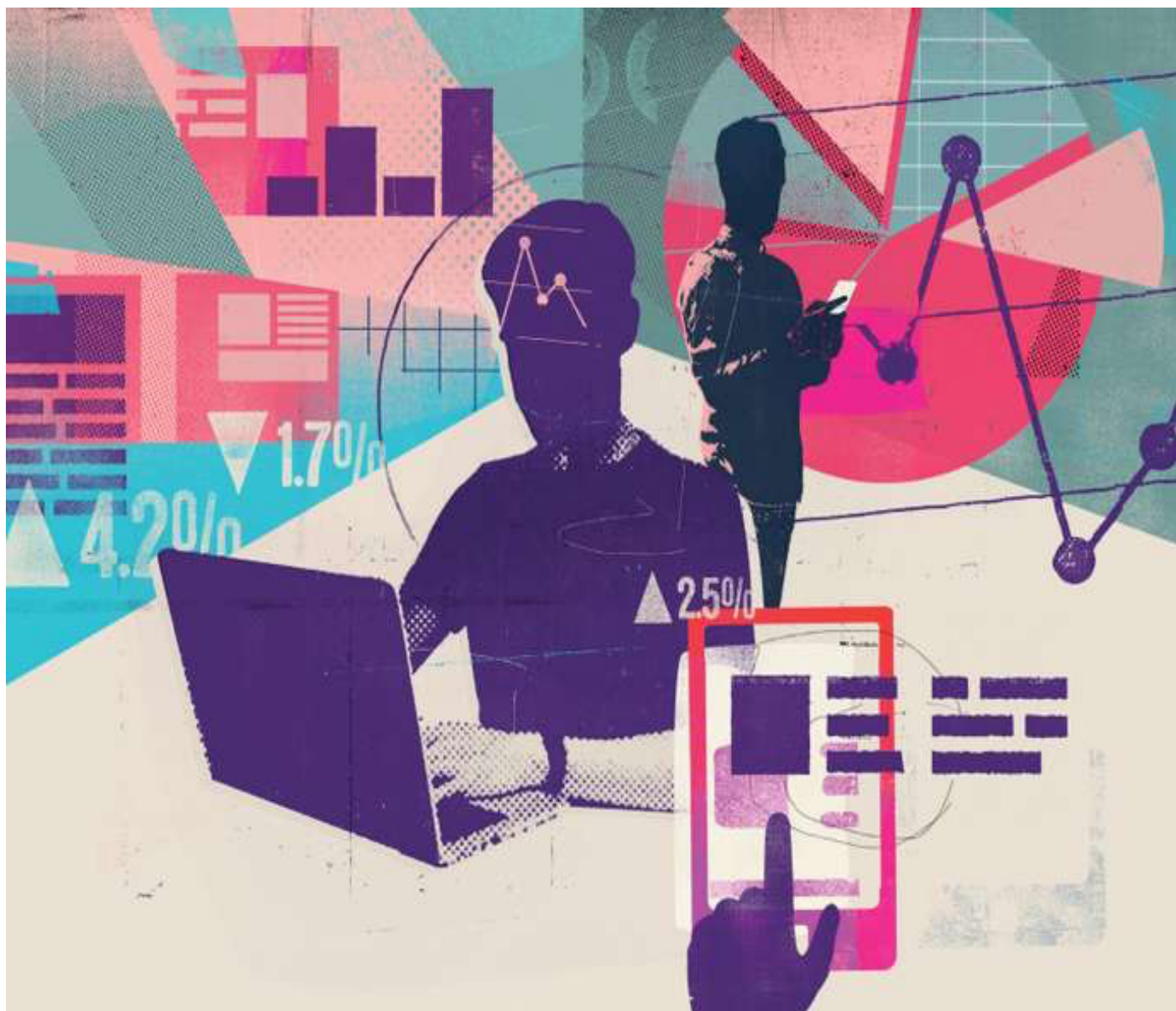
A strong initiative on quantum physics

The European Union is not outdated and will devote more than €1 billion to research on quantum technologies over the next ten years. The timing is therefore excellent for France to assert itself in this sector and benefit from decades of academic excellence, embodied by Nobel Prize winners in physics Claude-

Cohen Tannoudji, Serge Haroche and Gérard Mourou. French industry also has strong assets. Indeed, Atos, the global super computer giant, has understood the revolution by creating a dedicated team and marketing quantum emulators to prepare for the transition to this new model. With quantum, war is not lost, since it has not yet fully begun.

In terms of calculation, the lead taken by the first movers is only of two to three years, which is relatively limited considering a complete overhaul of IT, from hardware to compilers, from programming languages to application software. In this value chain, there is room for both our large industrial groups and our SMEs.

We also call for a strong national initiative on quantum physics. We're not starting from scratch. The "deep tech" plan launched by the government is intended to be its natural support. Nicolas Dufourcq, Director of the French Public Investment Bank (BPI), announced a target more than 1,500 start-ups to be supported by



« La France devrait aussi être le moteur de dispositifs de soutien dédiés aux PME du quantique au niveau européen. » Stuart Kinlough/Ikon Images / Photonstop

2023. Let's give ourselves a goal for quantum start-ups! An ambitious French quantum plan is all the more necessary as these technologies are very often called "sovereignty" technologies.

Investments have already been made in France in LightOn, which produces optical processors to accelerate artificial intelligence, and Pasqal, the first French quantum computer start-up. A hackathon for quantum coders was held at School 42, a round table at Station F and several events constituting a French ecosystem were organized, with hundreds of participants. France should also be the driving force behind support schemes dedicated to quantum SMEs at European level.

Neither too early, nor too late: it is just the right time for France to build the leaders of a breakthrough technology, quantum.

Charles Beigbeder and Christophe Jurczak have founded Quantonation, an investment fund dedicated to breakthrough technologies in physics and in the quantum space.