

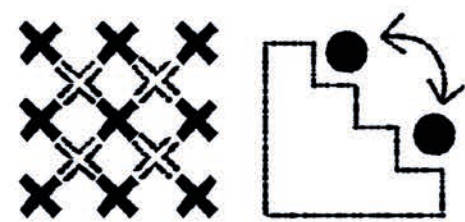
In the 1980s, one understood that small electrical circuits based on superconductors...

...can behave like artificial atoms!

Superconductors conduct current perfectly in a sort of quantum electron wave.



Some electrical circuits using these superconductors present energy levels as an atom.



They can be excited from one level to another or even placed in two levels at once.

This electrical circuit is quantum!

It is composed of superconductors, and behaves like a kind of giant atom, with quantum energy levels.

It only works at very low temperatures.

Our goal is also the famous **QUANTUM COMPUTER!**

THE SUPERCONDUCTING QUBIT LIVE FROM QUANTUM LABS

We can use these super circuits to encode quantum information and manipulate it.

And that's the "cryostat" the device that allows to cool them to 0,01 degrees from absolute zero.

THE "QUBIT" OF THE QUANTUM COMPUTER
It can be 0, 1 or both at the same time!



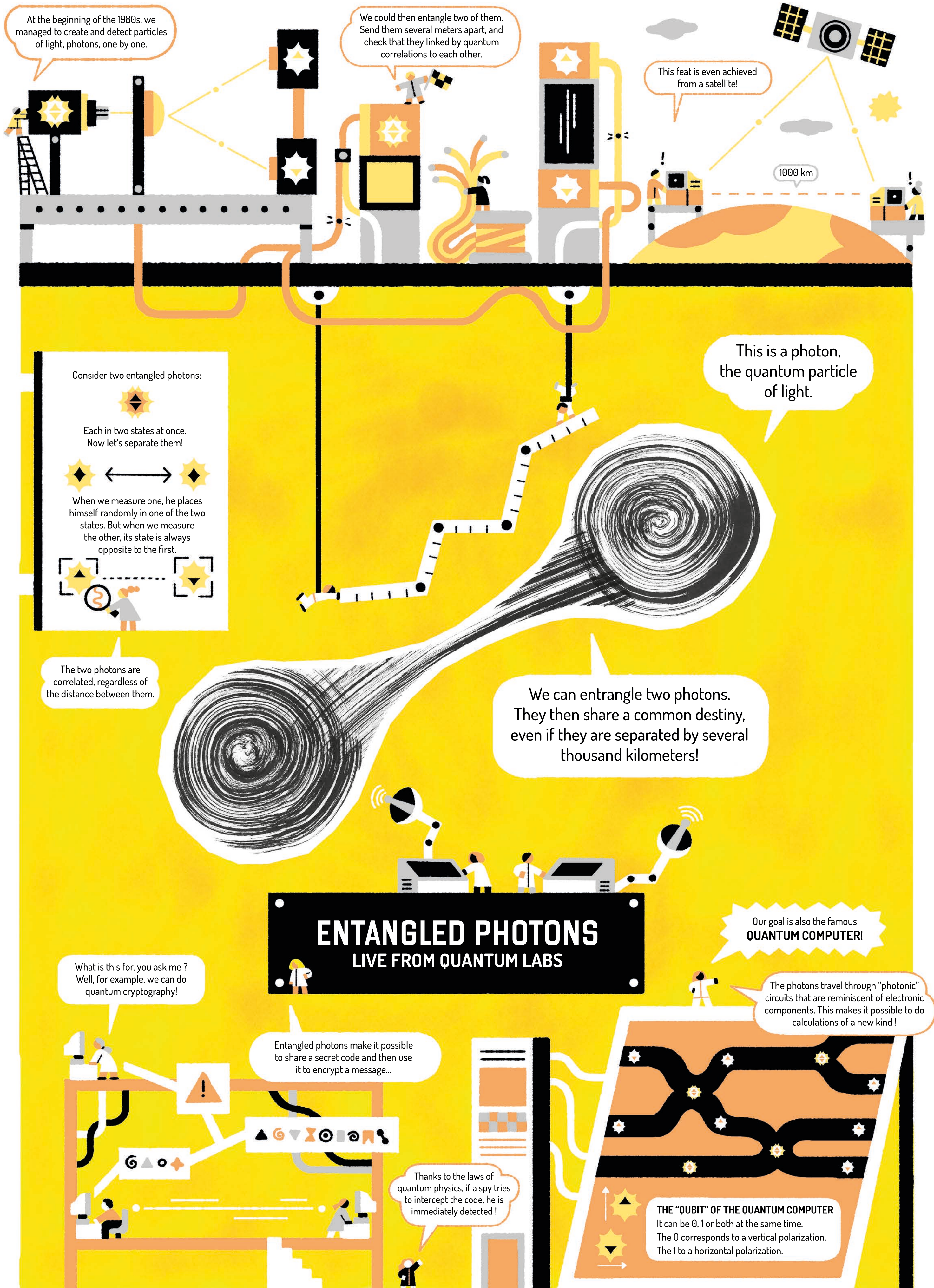
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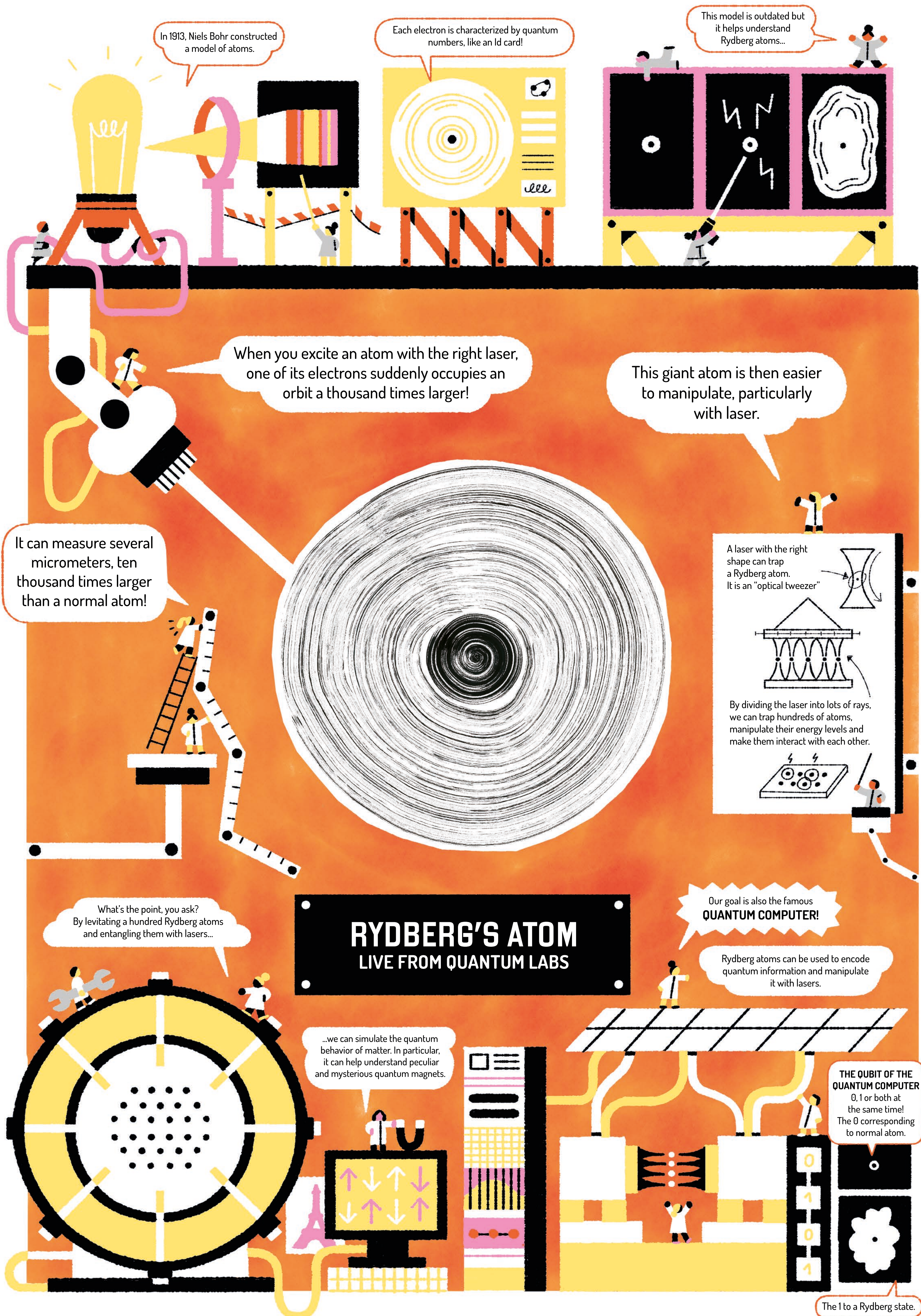
1st electrical state



1

2nd electrical state





In 1913, Niels Bohr constructed a model of atoms.

Each electron is characterized by quantum numbers, like an Id card!


This model is outdated but it helps understand Rydberg atoms...

When you excite an atom with the right laser, one of its electrons suddenly occupies an orbit a thousand times larger!

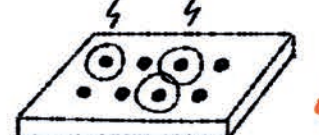
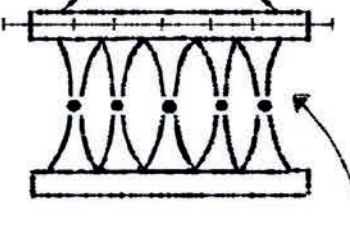
This giant atom is then easier to manipulate, particularly with laser.

It can measure several micrometers, ten thousand times larger than a normal atom!

A laser with the right shape can trap a Rydberg atom. It is an "optical tweezer"



By dividing the laser into lots of rays, we can trap hundreds of atoms, manipulate their energy levels and make them interact with each other.



RYDBERG'S ATOM LIVE FROM QUANTUM LABS

Our goal is also the famous **QUANTUM COMPUTER!**

Rydberg atoms can be used to encode quantum information and manipulate it with lasers.

THE QUBIT OF THE QUANTUM COMPUTER
0, 1 or both at the same time!
The 0 corresponding to normal atom.

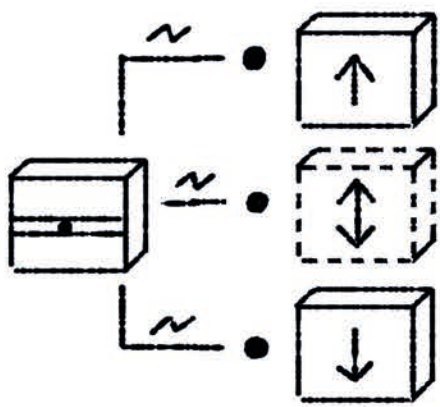
The 1 to a Rydberg state.

In the 1980's, researchers managed to create the first quantum dots by manufacturing nanoparticles in glass or in colloidal solutions.

On a small scale, quantum physics governs the properties of these quantum dots. For example when their size changes, they have different colors.

We can also make a quantum box with a sandwich of semiconductors!

In a quantum dot, one can trap a single electron. This electron carries a small quantum magnet, the spin.



With electromagnetics fields, one can then manipulate this small magnet and align it upwards, downwards or both directions at the same time!

Certain stacks of semiconductors allow electrons to be trapped.

We can choose the number of electrons that we trap with electric voltages.

This "quantum box" measures around a hundred nanometers.



Our goal is also the famous **QUANTUM COMPUTER!**

What's the point you ask ? Well the color of these boxes makes it possible to make very high resolution GLED screens.

THE QUANTUM DOT LIVE FROM QUANTUM LABS

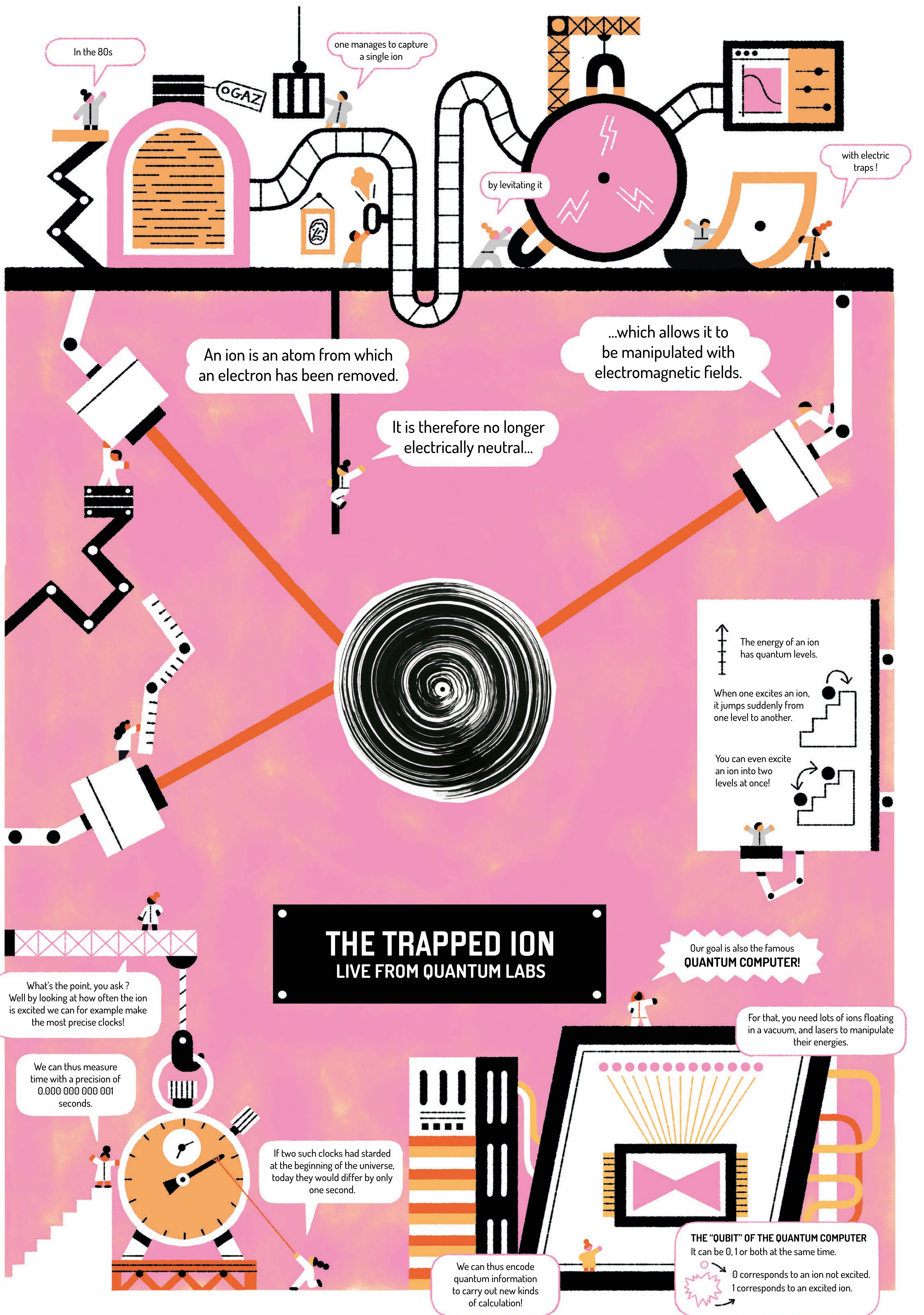
To properly stabilize these spins, the setup must be cooled to within a few degrees of absolute zero.

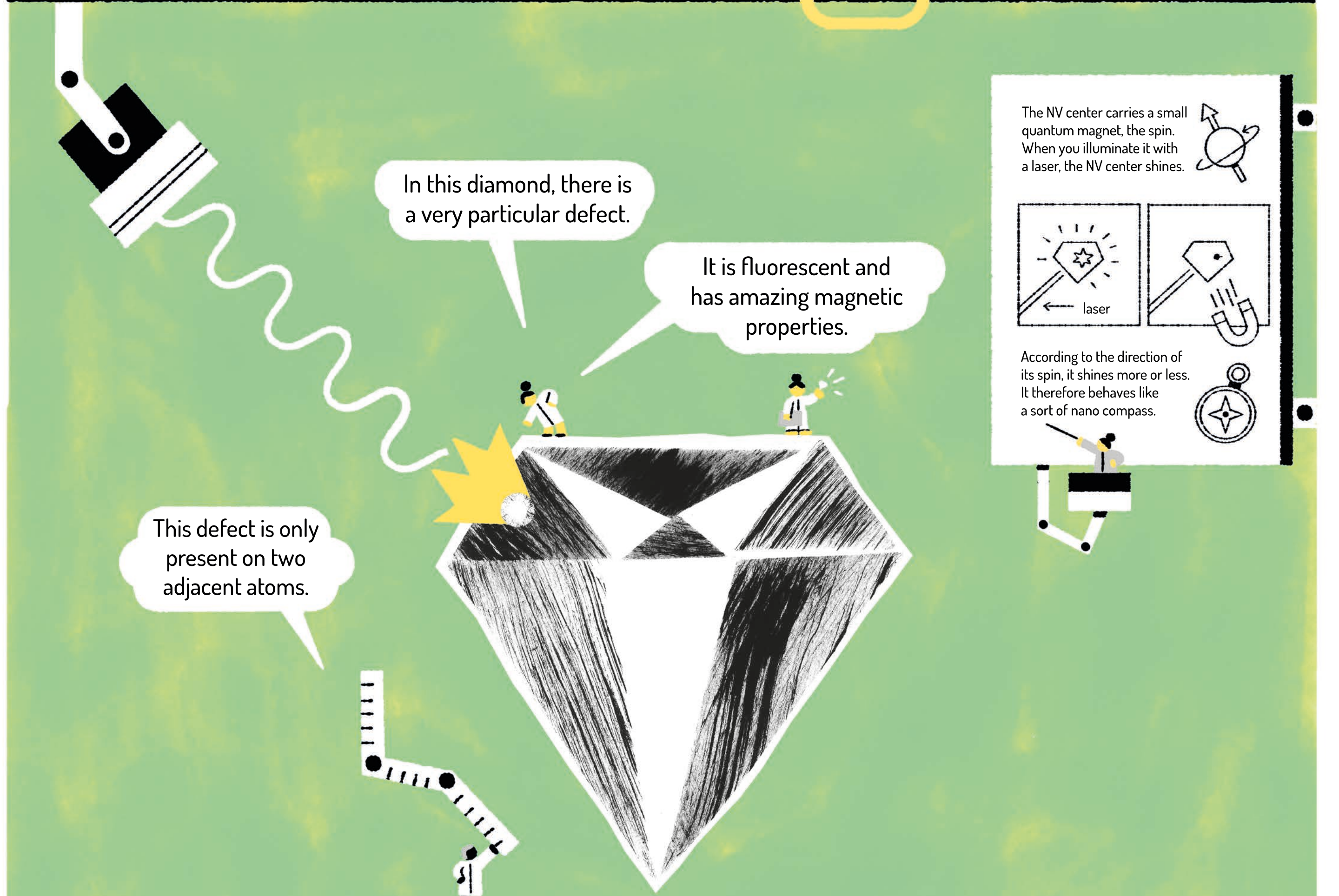
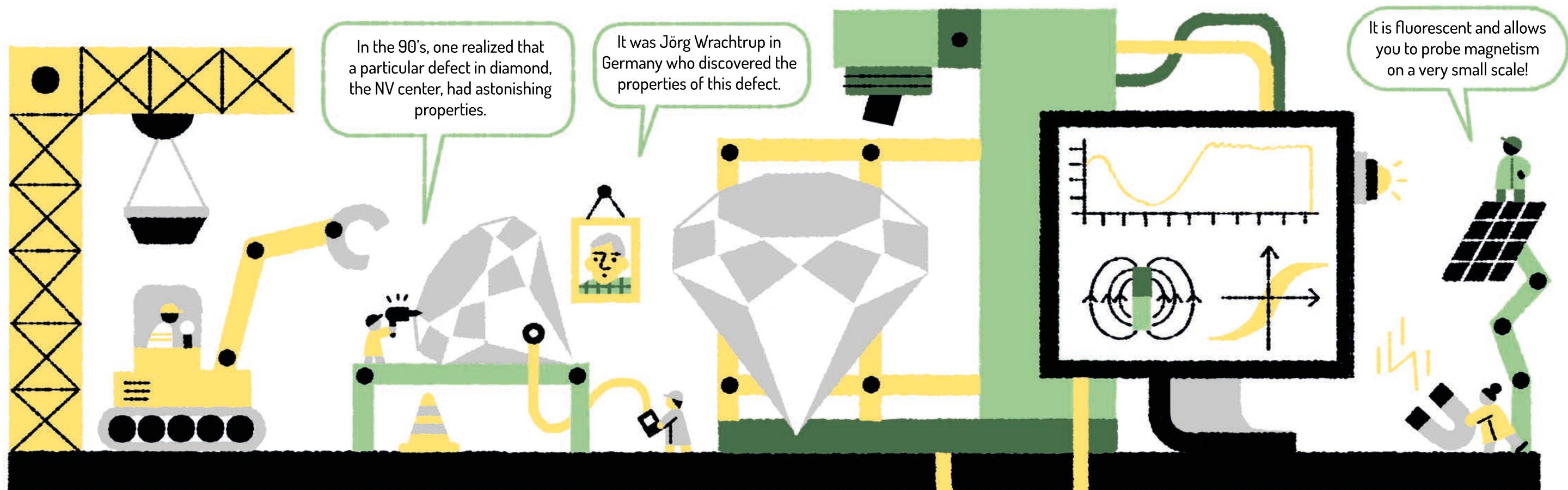
By manipulating the spins of several boxes, we hope to perform calculations of a new kind!

Spin can be used in quantum dots to encode and manipulate quantum information.

THE "QUBIT" OF THE QUANTUM COMPUTER
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THE NV CENTER IN DIAMOND LIVE FROM QUANTUM LABS

