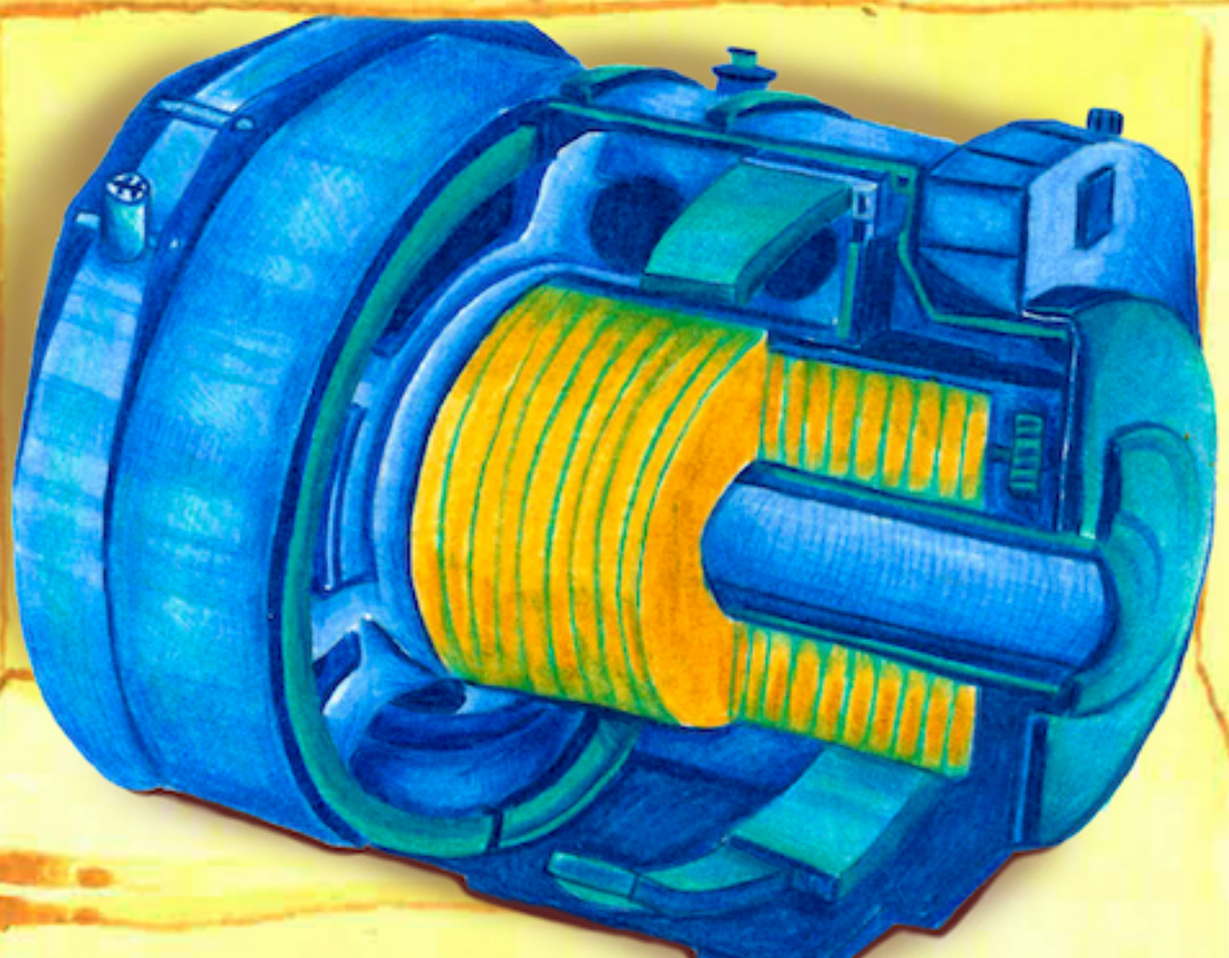
This electron microscope makes it possible to observe the infinitely small, down to the atoms!
For this, it uses electrons.
Indeed, quantum physics shows that the electron behaves like a wave. The microscope exploits this property to obtain images in three dimensions at the nanometer scale.

This electronic circuit is a "quantum box". It is so small that we can slip electrons into it one by one, which makes it look like an atom.
It is used as a pixel for screens and researchers are also using it to build the quantum computer of the future.

Transistors are a kind of switch, which let pass or block the current. They are the basic building blocks of all our our computers.
Currently, a microprocessor can contain up to one hundred billion of them!

$1,602\ 10^{-19}$



MRI allows us to visualize the inside of the body. To do this, we enter a huge electrical coil that creates a magnetic field.
This coil must first be be cooled to -269°C, to become superconducting and make the current flow without any resistance!

illustré par Margaux Pailha

LA PHYSIQUE AUTREMENT

This is the electrical charge of an electron, in Coulomb.

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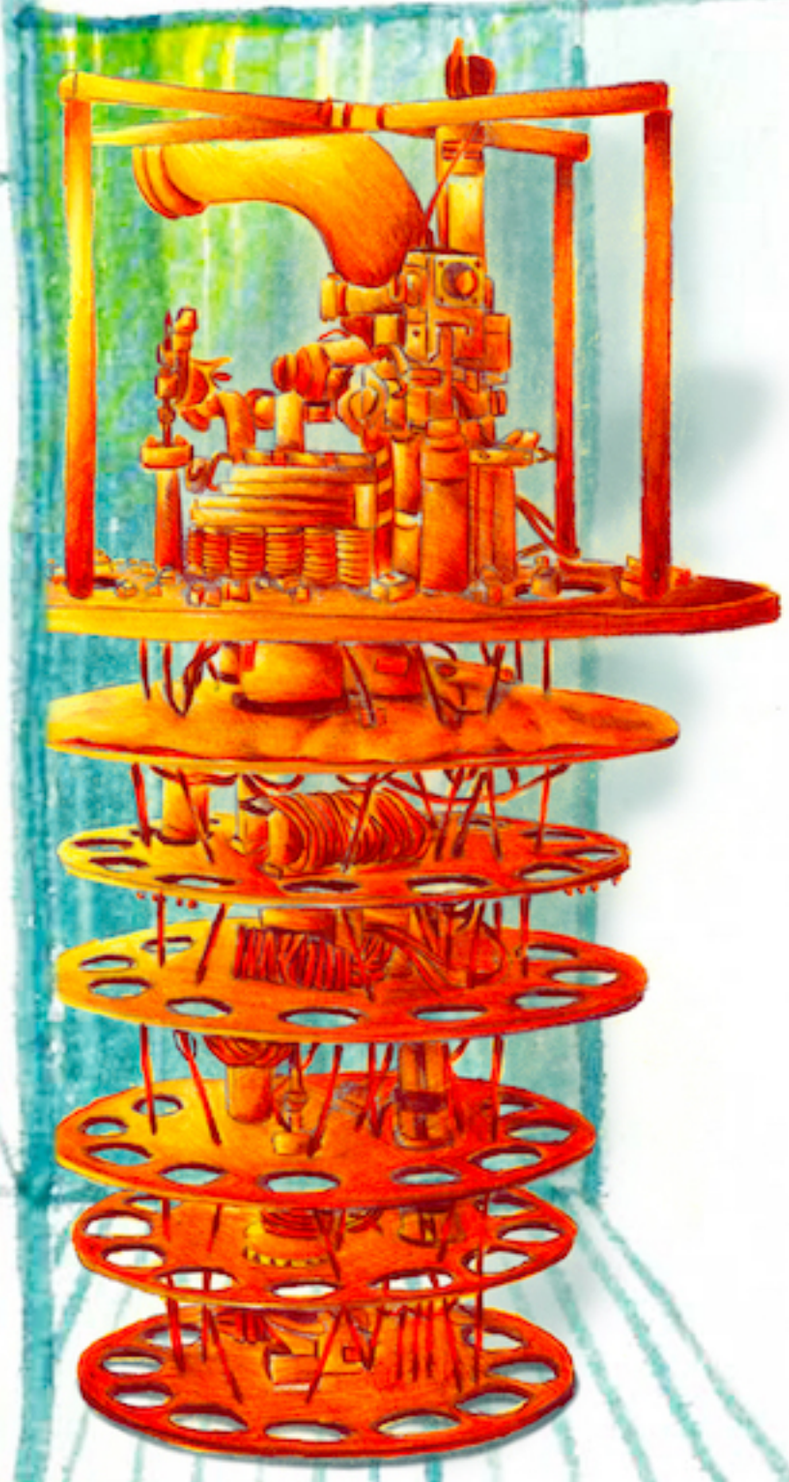
The thermometers we all have at home take the temperature by measuring the expansion of a liquid or the electrical resistance of a solid.

This super thermos is filled with liquid helium. At -269°C, it is the coldest liquid in the world! In the open air, it would evaporate instantly.

This strange machine is a dilution cryostat. Powered by liquid helium, it can cool any material to only a few thousandths of a degree from absolute zero. This is what is used to make quantum computers.

-273,15



In 2021, physicists reached 0,000 000 000 038 K, the record for the lowest temperature, by using lasers to slow the atoms down as much as possible. In order not to be hindered by gravity, they made the measurement by dropping their experiment from a 120 meter high tower!

LA PHYSIQUE AUTREMENT

This is the temperature of absolute zero, in Celsius.

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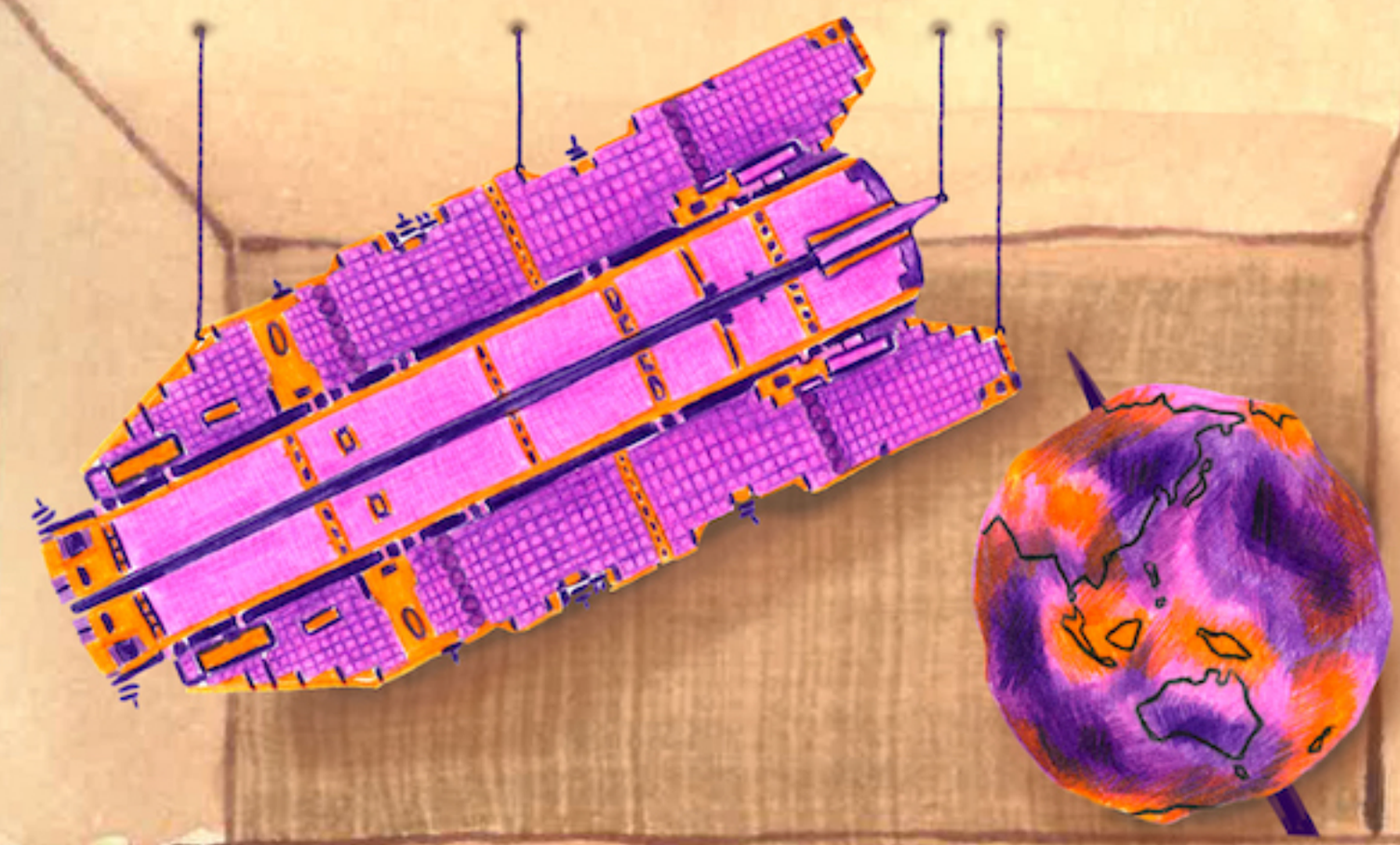
Illustré par Margaux Paillat

The GOCE satellite has measured the variations of gravity on the surface of the Earth with unprecedented accuracy. Gravity varies because the Earth is not spherical, and also because of mountains, oceans, basements, and even large buildings.

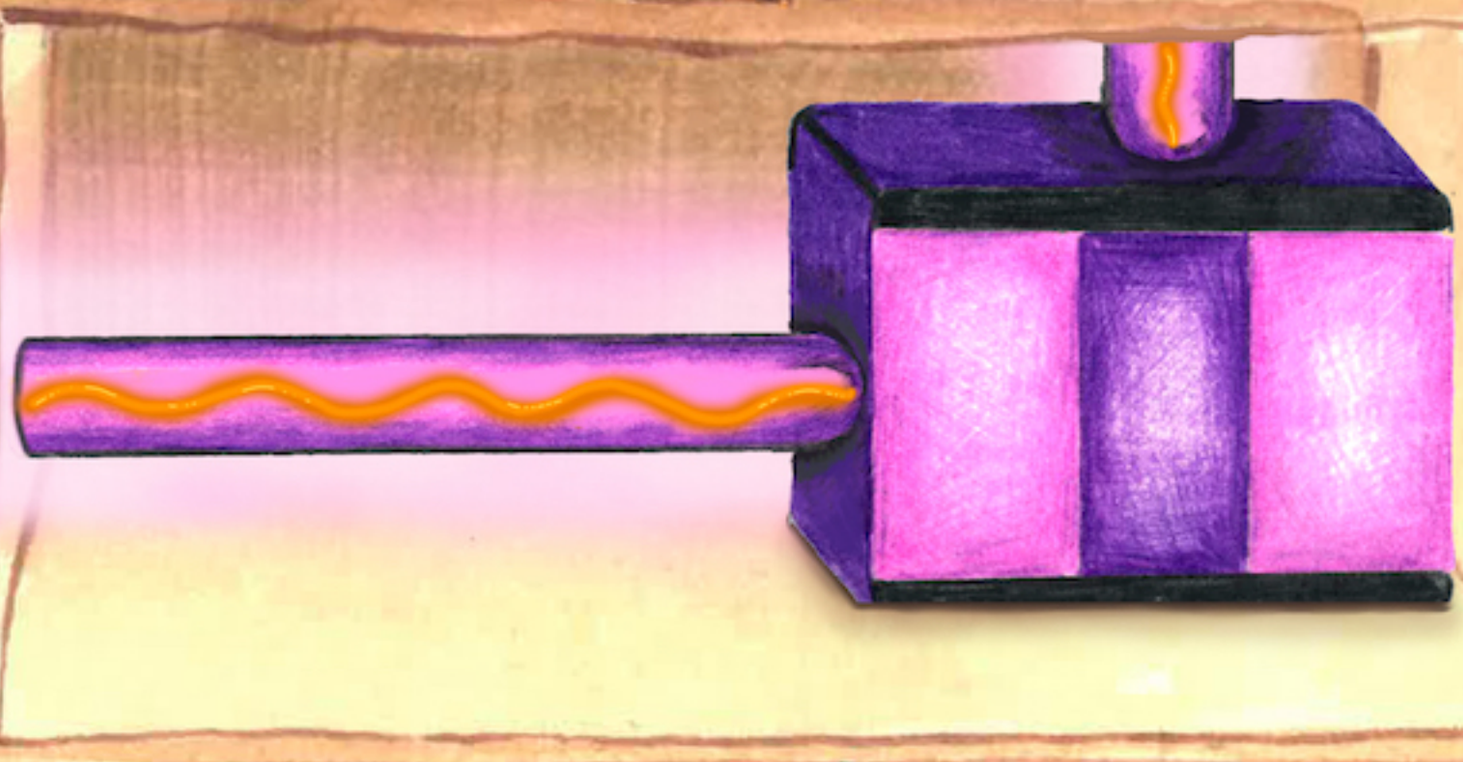


In this atomic fountain, atoms are used to measure gravity with an incredible precision. To do this, they are excited and the effect of gravity on their fall is measured.

9,81

Every smartphone has an accelerometer that measures acceleration and and gravity. The smartphone then knows if it is vertical or horizontal.

This detector is the most accurate instrument in the world. A laser travels along two arms 4 km long before interfering. In 2015, it detected the passage of a gravitational wave, a tiny wave of gravity coming from the depths of space!



LA PHYSIQUE AUTREMENT

This is the acceleration due to the Earth's gravity measured in Paris, in m/s^2.

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In this experiment, laser beams are used to trap the atoms. This allows researchers to manipulate them and make them float where they want. This technique is used to build quantum computers, computers of a new kind.

Light is composed of particles, the photons. This Chinese satellite has succeeded in sending two entangled photons to two different points on Earth. This means that when one of the two photons was measured, its properties instantly influenced those of the other photon, 1000 km away!

299 792 458

The cameras in our smartphones use CCD or CMOS sensors, which contain tens of millions of pixels. Each pixel transforms the photons of light into electrons.
To reconstitute the colors, it is covered with filters that select only the green, blue or red.

At 100 billion frames per second, this camera is the fastest in the world.
For the first time, it has made it possible to film light moving forward!

This is the speed of light in vacuum, in m/s.

LA PHYSIQUE AUTREMENT

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Illustré par Margaux Pailha

This big column is an atomic clock. Time is measured by dropping atoms, which are excited with a specific frequency setting. A dozen of these clocks are permanently used to calculate universal time, and to synchronize our watches and smartphones.

The GPS in our smartphones picks up a signal sent by satellites. By precisely measuring the time it takes for this signal to reach us, it deduces our position. To do this, each satellite carries an ultra-compact atomic clock, which shifts by less than one billionth of a second per hour!

In electronic watches, time is given with precision thanks to a small piece of quartz. When the battery sends electric current into this material, it starts to vibrate precisely 32,768 times per second! On the basis of this periodicity, the watch is calibrated. The first quartz watch was the the "Astron" by Seiko, designed in 1969.

9 192 631 770

Here is the most accurate clock in the world. It measures time with 20 digits after the decimal point! Strontium atoms are probed with ultra-perfected lasers. Such a precision makes it possible to detect that the time passes more slowly when one approaches of the Earth. An astonishing consequence of the theory of general relativity.

LA PHYSIQUE AUTREMENT

It is the frequency at which the Cesium atoms are excited, in Hertz.

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