# Schrödinger's cat

To help us having a better understanding of the way quantum particles behaves, Erwin Schrödinger suggested the following thought-experiment. Don't try this home with your own cat 😃
In a box is installed a system that has fifty-fifty chance of spreading a mortal gas.

Get a cat, put it in the box, close the box and wait a minute…when you open the box you have fifty chance to see the cat dead; fifty chance to see the cat alive.
But while the box is closed you don't know. You only know if the cat is dead or alive when you open the box and notice the cat.



This is exactly the behavior or particles and this is why Schrödinger invented this experiment. While you don't *read* the state of the particle, its state is undetermined, like if it was in all possible states **at the same time**.

Let's consider the experiment a bit differently: while the box is closed the cat is both dead **and** alive. And it is the opening of the box that *fixes* the cat into one of the two possible states.

You see this particular state of the cat being dead **and** alive while the box is closed? This is called **superposition**. And this is where Schrödinger wanted to bring us with this experiment. Because this is exactly what happens with quantum particles: while you don't *sensor* it, the particle is a superposition of all possible states. And when you observe it you *fix* it into a final state, forcing it to a determined value.

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Remember the electron? This little thing *orbiting* around an atom nucleus? Well the equivalent of the cat being *dead* or *alive* is the electron having its state called *spin up* or *spin down*.
I won't explain here what a spin is, so let's simplify as follow: spin up is a logical **1** and spin down is a logical **0**.

Look at the following experiment:
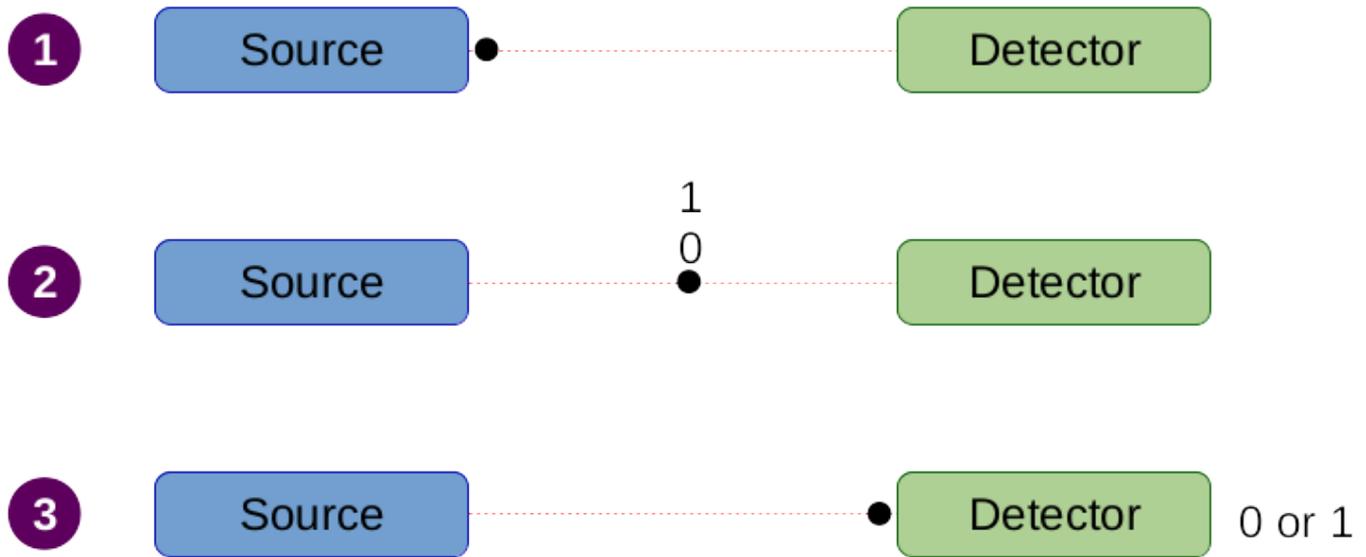
At the left we have a source of particles that produces electrons one by one.
At the right we have a detector that *reads* the spin of the electron and indicates 0 when spin is down or 1 when the spin is up.

When the electron leaves the source (step 1 & 2), it is in the superposition of all possible states. Meaning that it is at the same time 0, 1, and **all states between 0 and 1**. Unbelievable but true! Once the detector is reached (step 3), the electron value is read and then we got the basic result: 0 or 1.

During the travel of the electron from the source to the detector, the electron is in superposed state and when he reaches the detector it *collapses* to a stable state that we can read. Transition from superposed state to stable state is called **quantum decoherence**.

This is what Schrödinger wanted to explain with his though-experiment: while the box is closed the cat is both dead an alive. Like the electron that is both 1 **and** 0.
When you open the box (or read the electron state), you fix the reality to a stable state: dead or alive for the cat; 0 or 1 for the electron.

As stated above, the cat is in a box with a system that has 50% chances to release the gas. This is another thing Schrödinger wants to point out: the fact that quantum behaviors are ruled by **probabilities**.
For instance in the experiment above, we can tune the source to release electrons in a superposed state 50/50 (50% chance to be measured 1, 50% chance to be measured 0).
The same way we can tune the source to 20/80 and we will have 20% chance to measure a 1, 80% chance to measure a 0.

This is another mystery of quantum mechanics: we can tune the probability of the result, but not the result itself. That is to say: I can tune my source to 99/1 to have 99 chances to have a 1, but still it is impossible to predict the result. We only have the possibility to *influence* the probability on one side or another, that's all.

In the next chapter we'll meet what is in the heart of quantum computing: the qubit.

Previous: Nobody really understands quantum mechanics      Next: This little thing called qubit

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