1 Quantum memory and classical memory

Classical memory consists in storing zeros and ones sequence. Well known example is hard disc, where the single bit value is determined with magnetization direction. Another example is widely used ssd memory. In quantum memory instead of zeros and ones we store sequence of quantum states $|0\rangle$ and $|1\rangle$. What is the difference? The classical bit always has well defined value: 0 or 1. The quantum bit doesn't have this feature. It means that I can write the state in so called superposition, for example $1/\sqrt{2}(|0\rangle + |1\rangle)$. So our quantum bit can be at the same time a little in state $|0\rangle$ and a little in state $|1\rangle$. This unique feature of quantum memory can have very interesting application.

2 Why should we develop quantum memory?

Quantum memory is required to build equipment such as quantum computer or to quantum communication. The question is: Why it could be better than classical machines?

In comparison to the classical state, the quantum state is impossible to copy. It means that the information sent in quantum way is completely safe. The thief can't steal the information without being detected.

And what is an advantage of quantum computer? Quantum operations allow us for parallel computing of different variants. It is impossible for simple classical computer. It means that some calculations could be done many times faster.

3 How our quantum memory works?

Our quantum memory is based on non-elastic photons scattering on rubidium atoms group. Atomic ensemble remembers direction of scattered photon as a so called spinwave. When we want to read written information we use non-elastic scattering again. Then the direction of the readout photon is opposite to direction of the writing photon. For example if the writing photon scatters to the right, the reading photon will scatter to the left.

4 What is the aim of our researches?

Classical memory is useful only if we control what data we read at a moment. The situation is similar with quantum memory. In case of our quantum memory at this moment we don't have control what stored state is read in the readout process. This control could be possible if we modified stored states between readout operations. However, it will be possible only if we know how our states evolve. Therefore, we are going to create precise simulation. It will allow us to design future experiment, where the full controlled readout will be possible.