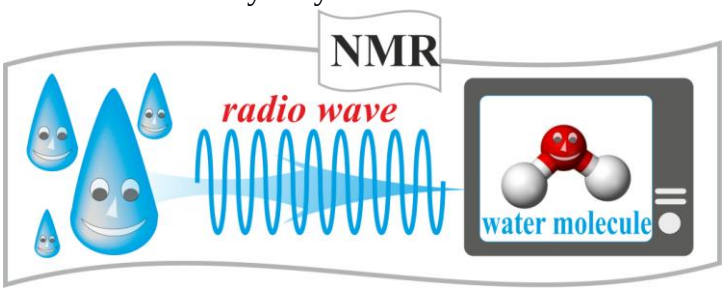
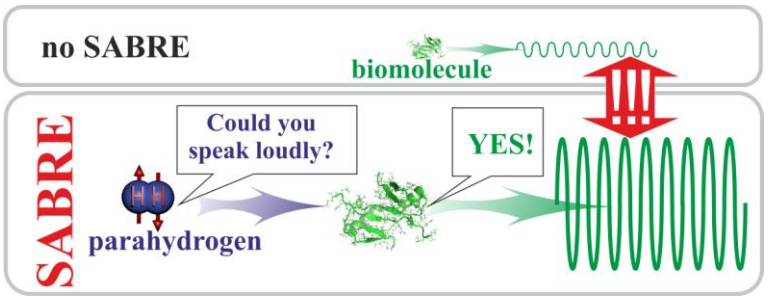
Living and non living matter consists of very small building blocks called molecules, which are so small that we cannot observe what they look like and how they move. However, this can be done with Magnetic Resonance – MR. This works in a similar way as your radio or television. Under special conditions, molecules placed in a very high external magnetic field emit radio waves. These radio waves contain a lot of information about what molecules look like, how they move and what the environment is like where they are located.



This is very important for our every-day life. For example, we may obtain detailed information of the composition of medications that we have bought in the pharmacy. We may detect any toxic substances in this liquid or solid medicine which may be potentially dangerous for our health. We may also do the same with food products. We may check the food quality of, for example, chocolate candy that is bought in the store.

Another extremely important application is the visualization of our bodies. By using a special scanner, doctors may visualize the molecules in our bodies without any invasive procedure. The doctor may see our internal organs using this technology in great detail. However, in order to receive and translate all this valuable information into something that is understandable, we need a special radio which is called a spectrometer or scanner. Because the radio waves of molecules are extremely weak. This very strongly limits the applications of MR in science, industry and biomedical research. Therefore, a lot of effort has been put into overcoming the limitations of MR signal weakness. One of the most promising approaches is hyperpolarization, which forces the molecules to emit stronger radio waves. Herein, we wish to develop one of the most promising hyperpolarization techniques, which is called SABRE. SABRE employs the unique properties of special molecules which are called parahydrogen. Under special conditions, parahydrogen molecules may interact with other molecules and force them to emit very strong radio waves.

However, there is a large class of important molecules that do not want to interact with parahydrogen. The most important are peptides - the main building block of living matter. That is why here, we will develop a method which will encourage these very important molecules to have interplay with parahydrogen. Thus, these important biomolecules will also be easily audible by the “radio”.



The results of our project may essentially facilitate the applicability of SABRE for mass-scale production of various bio-relevant hyperpolarized substances. These hyperpolarized systems may find numerous applications. The most important of all are their applications for biomedical and clinical use in the diagnosis of serious illnesses, as well as their detection and prevention. Hyperpolarized systems may also find applications as fully functional MRI contrast agents.