State the objective of the project, description of the research to be carried out, and present reasons for choosing the research topic.

One of key markers of our civilization is that it uses more and more energy (note the steady worldwide 3% growth *per annum*) and it produces more and more information. With this comes an exponentially increasing need for large data storage capacity. Most modern data storage devices utilize magnetic memory, which is easy to construct and fast to access. Albeit the data storage density of these devices undergoes constant development, it is still relatively low. One particularly promising field of research focuses on molecular magnetic memory, with its potentially unprecedented high information density. Here, one molecule may store one or even more bits of information, depending on how many spin states it may have (spin is a special feature of elementary particles, here: of electrons). Molecules containing chemical elements called lanthanides are intensely explored, since they offer many spin states (bits). The usable memory is even larger if a tiny molecule contains several atoms of lanthanides simultaneously. However, currently such storage devices may operate only at unpractically low temperatures not exceeding –250 ^{o}C. The reason for that is that lanthanide centers easily "forget" information when subjected to higher temperatures, since the magnetic interactions in such systems are inherently weak and prone to be affected by external stimuli.

In the current project we aim to increase mutual magnetic interactions in lanthanide systems by using another metal cation, Ag^{2+}, *i.e.* so called divalent silver. This is quite a rare form of silver, as it is found only in less than 200 chemical compounds. It also has many unusual properties. The one which is of particular value for this project is that Ag^{2+} cations have their own spin and they easly transmit a share of their spin to all neighbouring elements, even such, which normally do not prefer to carry any spin. This effect of Ag^{2+} cations may extend over several neighbouring atoms further away from the silver center. Here we are planning to prepare and thoroughly investigate the first chemical compounds which simultaneously contain lanthanides, Ag^{2+}, and other elements. In order to learn what useful or maybe exotic features may be achieved due to the combined presence of lanthanides and Ag^{2+}, we are planning to explore both the extended ("polymeric") solids as well as molecular ("monomeric") systems. Based on preliminary results and numerical evaluations, we expect that the powerful influence of Ag^{2+} will affect lanthanide centers and will facilitate the appearance of strong magnetic interactions (both between Ag^{2+} and lanthanide centers, as well as between different lanthanide centers). This will ultimately lead to magnetic memory which does not "forget easily" i.e. which may store information at ambient temperature, and not just when frozen to –250 ^{o}C.

The project utilizes the expertise of the German partner (prof. Paul Kögerler from the RWTH University in Aachen) who is a recognized authority in manufacturing and investigations of magnetic properties of lanthanide compounds. Simultaneously, the project beneficiates from the long-time experience of the Polish partner (prof. Wojciech Grochala from the Center of New Technologies at the University of Warsaw) in the chemistry and physics of the compounds of Ag^{2+}, which require special synthetic approaches. We expect that complementarity of the two groups will be highly rewarding and will contribute to the success of the project.