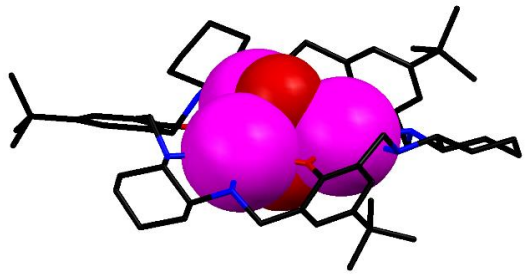
DESCRIPTION FOR THE GENERAL PUBLIC

Lanthanides are rather exotic elements not very familiar to the general public. Yet these elements play an increasing role in everyday life. Material based on the these elements are of widespread use as magnets and screen display components. In addition, molecular complexes of lanthanide ions, that is the combination of these metals with organic molecules also find important applications. Thus macrocyclic complexes of one of the elements of the lanthanide series that is gadolinium (in its tripositive cationic form Gd(III)) are widely used as contrast enhancing agents in the very important tool of medical diagnostics – magnetic resonance imaging (MRI). Complexes of some other tripositive cations of lanthanides (denoted here as Ln(III) ions) are used in medical and biological test as so called luminescent probes. Some of the applications of lanthanide compounds are related to polynuclear complexes. Polynuclear, for instance dinuclear or trinuclear, complexes constitute a class of inorganic compounds, where two, three or more metal ions are linked by fragments called bridges. These bridges can be simple anions such as an oxo anion, hydroxide, chloride and so on; the bridging fragments may also be based on bigger organic ligands. The lanthanide(III) ions are very capricious (more precisely – they are labile and do not possess well defined coordination preferences), for this reason it is very difficult to obtain designed polynuclear complexes of lanthanides in a controlled manner. This project is aimed at developing the chemistry of polynuclear lanthanide(III) complexes with hydroxide bridges. The idea is to tame the capricious lanthanide(III) ions and "tidy up" the formation of dinuclear or trinuclear lanthanide(III) hydroxo-clusters by embracing them by large organic ring – so called macrocyclic ligand:



Left: an example of a complex proposed in this project. The magenta balls indicate three lanthanide(III) ions linked by oxygane atoms (red balls) of hydroxide anions; this fragment is bound in the center of large ring made of carbon, nitrogen, oxygen and hydrogen atoms (black lines)

The complexes that we are going to study are chiral. Chirality is a special feature of some molecules which is of paramount importance for mutual recognition of molecules in chemistry and in biology.

Another emerging field of potential applications are single-molecule magnets (SMMs) based on lanthanides. In a single-molecule magnet, the magnetic properties are associated with single molecules of metal complex, in contrast to conventional magnetic materials, where magnetism is associated with cooperative interactions of very many ions or molecules forming crystal structure. Single-molecule magnets are candidates for new kind of magnetic memory – memory based on magnetization of single molecules. Such an approach enables enormous density of stored information – one bit of information per one molecule. In this project the issue of structural modifications influencing the SMM properties of lanthanide(III) polynuclear complexes will be addressed.