From our daily life we know that (*i*) the left hand is a mirror image of the right hand and (*ii*) a left glove does not fit the right hand. Thus, although hands are closely related with each other they are not the same. This fascinating property, called chirality, also has some molecules. Not all molecules are different from their mirror images, but the ones which are different are very frequently biologically active.

In order to understand how crucial chirality is let us consider two examples. The first one refers to a drug, thalidomide. One enantiomer of thalidomide is a teratogen (causes malformation of fetus' limbs) while the other enantiomer has therapeutic effect (first used against morning sickness in pregnant women, currently as an immunomodulatory drug). The second example is connected with a human nose which has the phenomenal ability to discriminate between some chiral molecules. For instance, (*S*)-carvon is primarily responsible for caraway's distinct odor and (*R*)-carvone is mainly responsible for smell of spearmint. Therefore, efficient methods of chiral discrimination can have some long term impact on control of industrial process, like food processing. Moreover, it is now a requirement of the FDA to monitor the handedness of a chiral drug molecule throughout the entire production process. Therefore, chirality is a very intensively studied field of science, especially in biological and pharmaceutical researches.

The methods routinely used in chemistry for studies of chiral molecules have a common feature. They require the second chiral substance in order to discriminate between enantiomers (*i.e.*, mirror images) of a given molecule. But, if for some reasons we cannot use these standard techniques (*e.g.* we do not want to perturb a biological system) then other methods are necessary.

The goal of the project is to provide a new method which could be used for this purpose. Our idea is to modify a widely used method for determination of the structure of molecules: nuclear magnetic resonance (NMR). Thus, in the proposed experiments an additional strong electric field will be applied. One can expect that the electric field will induce the nuclear magnetization which will have opposite orientation for two enantiomers of a given molecule. This phenomenon has not been observed experimentally yet, therefore, one of the goals of this proposal is to detect for the first time chirality-sensitive NMR signals.

In order to build the dedicated NMR probe for this experiment computer-aided engineering programs will be extensively used. The properties of the optimal sample for the experiment will be determined from advanced quantum chemical computations. The project will be conducted in international collaboration with partners in Germany and France.