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Beta-NMR as a novel technique using radioactive beams for biophysical studies

Beta-NMR spectroscopy

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Summary

Beta-NMR is a technique where NMR resonances are observed as changes in beta-decay anisotropy. It has already been successfully applied in solid state physics and the technique holds great potential for successful applications in biology as well, although, it has never been applied to that field before.

Currently we are focused on setting up a new instrument at the ISOLDE/CERN which will allow to carry out the first measurements ever performed on biological samples. The combination of the ISOLDE facility and both optical pumping and tilted-foils opens up a wide spectrum of isotopes which are interesting from the biological point of view. With the use of beta-NMR one will gain the access to these properties of metalloproteins which are silent in most other spectroscopies.

The underlying physics of beta-NMR is basically the same as for classical NMR using stable isotopes what is a considerable advantage since the large expertise gained within the last decades of using this method in the field of biophysics and chemistry can be easily projected to future beta-NMR experiments. Moreover, this technique offers many advantages over NMR spectroscopy. Most notably, it is extremely sensitive, several orders of magnitude in comparison with standard NMR, and it may be applied for elements which are otherwise difficult to explore spectroscopically for certain biologically highly important oxidation states, such as Zn(II) or Cu(I). We strongly believe that beta-NMR will contribute to studies of many important biological problems, such as structure and dynamics of molecules in solution, and therefore it would have a considerable impact in biological chemistry.

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