NUSTAR Special Seminar

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Seminar Room KP1/KP3, SB3 4.161

GSI, Planckstraße 1, 64291 Darmstadt

"β-NMR Spectroscopy: From Nuclear Physics To Medicine"

β-radiation detected nuclear magnetic resonance (β-NMR) spectroscopy is an ultrasensitive NMR technique which is based on the detection of β-particles emitted anisotropically by spin polarized nuclei. The combination of nuclear spin polarization and high detection efficiency of β-particles gives rise to a billion fold (10^9) or higher increase in sensitivity as compared to conventional NMR, and allows for interrogation of elements which are otherwise difficult to access. β-NMR has been applied in nuclear and solid state physics for over six decades, and here we present recent advances of the technique for chemistry and medicine.

β-NMR has already been applied multiple times in measurements on Mg^{2+} and Li^{+} in ionic liquid solutions at TRIUMF, Canada's particle accelerator centre. In contrast to any previously reported measurements for Mg^{2+} ions, 25 mM $MgCl_2$ in EMIM-Ac and in EMIM-DCA compare favourably with conventional ^{25}Mg NMR, but do not suffer from line broadening due to quadrupole interactions (I=1/2 for ^{31}Mg while I=5/2 for ^{25}Mg). All spectra exhibit very high resolution, with line widths of about 3 ppm, allowing for discrimination of species with oxygen and nitrogen coordination. Furthermore, just recently β-NMR has also been applied to study of Mg^{2+} binding to ATP – the energy currency of life.

In this talk I will demonstrate the potential of the β-NMR technique and recent advances of β-NMR measurements in liquids, including experiments with ultra-trace amounts of ^{31}Mg. Furthermore, I will also highlight the advances made towards β-NMR measurements on Cu and Ac isotopes, and hint at how β-NMR and star dust could help us understand why we get sick.

Coordinator: Timo Dickel/Michael Block
Secretary: Luise Dörsching-Steitz
https://indico.gsi.de/event/10098/