Nitrogen-proton cross-relaxation in Fast Field-cycling MRI

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Cross-relaxation phenomena can occur between spins of various origins, such as in the case of electron-proton coupling, proton-proton coupling and many others.

Our research focuses on the cross-relaxation of ^{14}N and ^{1}H in proteins, which can be visualised by Fast Field-Cycling (FFC) NMR or MRI. This coupling depends mainly on the quadrupolar moment of ^{14}N, which relaxes to the lattice via the local gradient of electric field. This mechanism contributes to the relaxation process and increases the relaxation rate at certain frequencies.

This effect was studied by NMR on biological samples in the 1980's [1, 2] and showed unusual and interesting properties that can be exploited to measure the content of certain proteins in a sample, using FFC NMR.

Our FFC MRI facility allowed us to experiment on quadrupolar cross-relaxation in order to image the protein content of different samples by NMR and MRI [3, 4]. This presentation will focus on the results obtained so far with this technique by our research group and will present some of the potential applications for FFC MRI.

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