Recent contributions for Zero-, Low-, and High-field NMR

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Recently our group decided moving to some specific applications of zero-, low-, and high-field NMR, not only because they could drive us to rich physical problems, but also because we could transfer to them methods applied for high-resolution NMR.

In the case of zero-field NMR, employed to study magnetic materials, using only two arbitrary rf pulses, we obtained multiple-quantum (MQ) echoes, which were used to construct the spectra. To understand the data observed, we proposed a method for selecting each MQ echo based on phase-cycling and time-averaging, and a model in which there are two regions along the sample with different inhomogeneous spectral line broadenings. These methods offered complementary physical information about the nuclear spin interactions and the properties of the magnetic materials.

In the case of low-field NMR, used to study porous media, we are going to discuss new procedures to perform 1D and 2D T_2xT_2 exchange experiments, which allow observing only the migrating fluid molecules. *In the 2D method*, which employs two CPMG T_2 encoding stages separated by a z-store mixing time, the signals from the molecules that do not migrate are subtracted from the raw NMR data, after processing the 2D Inverse Laplace Transform. This procedure eliminates the intense diagonal ridge, providing an accurate study of the migrating molecules. *In the 1D method*, instead of varying the number of π pulses at the first CPMG stage, it is kept fixed and small enough to act as a short T_2-filter. Thus, varying the mixing time in a wide range provides a set of 1D T_2 distributions, which shows simultaneously the effects of both exchange and full T_1 relaxation.

Finally, in the case high-field NMR, we are going to present some NMR tools developed for quantum information studies.

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