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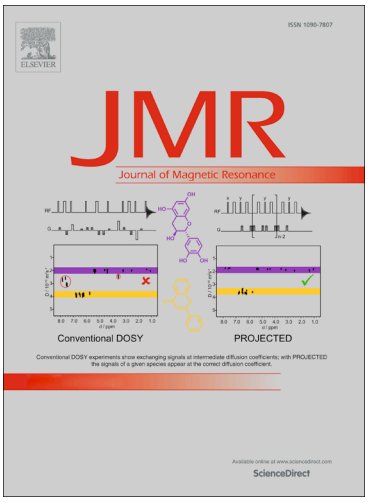

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Re-polarization of nuclear spins using selective SABRE-INEPT

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Abstract

A method is proposed for significant improvement of NMR pulse sequences used in high-field SABRE (Signal Amplification By Reversible Exchange) experiments. SABRE makes use of spin order transfer from parahydrogen (pH$_2$, the H$_2$ molecule in its singlet spin state) to a substrate in a transient organometallic Ir-based complex. The technique proposed here utilizes "re-polarization", i.e., multiple application of an NMR pulse sequence used for spin order transfer. During re-polarization only the form of the substrate, which is bound to the complex, is excited by selective NMR pulses and the resulting polarization is transferred to the free substrate via chemical exchange. Owing to the fact that (i) only a small fraction of the substrate molecules is in the bound form and (ii) spin relaxation of the free substrate is slow, the re-polarization scheme provides greatly improved NMR signal enhancement, ε. For instance, when pyridine is used as a substrate, single use of the SABRE-INEPT sequence provides $\varepsilon \approx 260$ for ^{15}N nuclei, whereas SABRE-INEPT with re-polarization yields $\varepsilon > 2000$. We anticipate that the proposed method is useful for achieving maximal NMR enhancement with spin hyperpolarization techniques.

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