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Using Hyperpolarized Xenon-129 NMR to Detect Atherosclerosis

B. PATTON, N.N. KUZMA, Princeton University, N. LISITZA, Princeton University, Schlumberger-Doll Research, I.E. DIMITROV, University of Pennsylvania — Hyperpolarized noble gas MRI has recently emerged as a powerful diagnostic tool in medicine, as it allows researchers to obtain high-resolution lung images in real time. Yet perhaps more promising is the application of spin-polarized noble gas NMR to biological spectroscopy. Although both ^{129}Xe and ^{3}He benefit from the extremely high signal-to-noise ratios characteristic of polarized noble gas NMR, xenon is preferable for such studies because unlike helium it is highly lipophilic (thus readily absorbed by most tissues) and because its NMR chemical shift is much greater. Atherosclerosis is a good candidate for ^{129}Xe NMR study because xenon dissolved in blood will be absorbed by artery walls, exactly where the symptoms of the disease are most manifest. We have previously verified that ^{129}Xe spectroscopy can be used to detect the degree of atherosclerosis in human blood vessel samples by demonstrating that the dissolved xenon spectrum correlates with the apparent pathology and histology of the tissue. In this work we expand upon our earlier research by quantifying the features of the ^{129}Xe NMR spectrum in order to characterize the underlying physical effects of atherosclerosis. In addition to showing high-resolution NMR spectra of xenon dissolved in healthy and diseased artery tissue, we will also compare T_1 and T_2 data and diffusion measurements for the different samples.

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