

Abstract Submitted
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Detection of scalar coupling at zero magnetic field with an atomic magnetometer MICAH LEDBETTER, U.C. Berkeley, Department of Physics, CHARLES CRAWFORD, ALEX PINES, DAVE WEMMER, U.C. Berkeley, Department of Chemistry, JOHN KITCHING, SVENJA KNAPPE, National Institute of Standards and Technology, DMITRY BUDKER, U.C. Berkeley, Department of Physics — Nuclear magnetic resonance (NMR) is one of the most powerful analytical tools for elucidating molecular structure and function. Conventionally, NMR is detected using inductive pickup coils in high field environments, requiring expensive and immobile superconducting magnets. The signatures for chemical identification are chemical shift and scalar couplings between nuclei of the form $J\mathbf{I}_1 \bullet \mathbf{I}_2$, which typically lie between 1 Hz and 200 Hz. Here we demonstrate detection of both homonuclear and heteronuclear scalar couplings in a zero field environment (where the Zeeman interaction is entirely absent) using a millimeter scale microfabricated atomic magnetometer. We show that characteristic functional groups produce distinct spectra in a zero field environment and can be used for chemical identification. We obtain NMR linewidths of 0.1 Hz without using spin-echoes and measure scalar coupling parameters with a statistical uncertainty of 4 mHz. We also show that the zero field spectra of certain functional groups is remarkably simple compared to spectra obtained in low (earth) field environments. Progress towards multidimensional spectroscopy will be presented.

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