NMR low-field spectroscopy using atomic vapour as a sensor

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The significance and the utility of the NMR spectroscopy in areas spanning from the medical health care to the fundamental research is nowadays of no doubt. The continuous improvement of the NMR apparatuses in terms of sensitivity and spectral resolution is mainly due to the possibility to apply stronger and stronger polarization magnetic fields. This aspect however brings some practical disadvantages such as an increase of complexity, cost, and maintenance costs.

Alternative sensors as the optical atomic sensors (OASs) recently show competitive sensitivity, robustness, low cost, and no maintenance cost. The OASs are recently successfully applied for NMR spectroscopy and, unlike the traditional high-field NMR apparatuses, operate in low (or even vanishing) magnetic field. Such low-field regime is of interest as the interaction between individual nuclei can be the main interaction process. Moreover the low operation magnetic field offers field homogeneity such that the instrumentation linewidth is well below the spin relaxation time. We have developed an NMR spectrometer using Cs vapour cells. The apparatus has been applied in J coupling NMR spectroscopy and relaxometry.

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