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Mechanical detection of nuclear spin relaxation in a micron-size crystal

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Abstract

A room temperature nuclear magnetic resonance force microscope (MRFM), fitted in a 1 tesla electromagnet, has been used to measure the nuclear spin relaxation of 1H in a micron-size (70 ng) crystal of ammonium sulfate. NMR sequences, combining both pulsed and continuous wave radio-frequency fields, have allowed us to measure mechanically T2 and T1, the transverse and longitudinal spin relaxation times. Because two spin species with different T1 values are measured in our 7 µm thick crystal, magnetic resonance imaging of their spatial distribution inside the sample section have been performed. To understand quantitatively the measured signal, we carefully study the influence of spin-lattice relaxation and non-adiabaticity of the continuous-wave sequence on the intensity and time dependence of the detected signal.