Broadband NMR at ultra high magnetic fields up to 34 Tesla

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NMR is a powerful method for investigating many problems in physics and materials science. In particular, NMR is applied to study properties of condensed matter like quantum phase transitions in strongly correlated electron systems. When these phenomena occur at higher magnetic fields than 17 T, NMR is currently the *only* microscopic technique that provides access to local magnetic properties. Recently, we extended the NMR options at the *Laboratoire National des Champs Magnétiques Intenses* in Grenoble to ultra high magnetic fields up to 34 T, frequencies up to 1.5 GHz and temperatures as low as 50 mK. We present an overview of our technical efforts and current high field research projects.

By ^{1}H and ^{63,65}Cu NMR at 15-34 T and down to 0.4 K we identified the spin structure of azurite, $Cu_3(CO_3)_2(OH)_2$, a model system for the frustrated antiferromagnetic Heisenberg spin-1/2 chain of "distorted diamond" geometry [1]. By ^{29}Si NMR down to 50 mK we found an exotic and modulated Bose-Einstein Condensate of magnetic triplet excitations in the Han purple compound ($BaCuSi_2O_6$) above 23.5 T that will be discussed within the framework of different theoretical concepts [2].

[1] F. Aimo *et al.*, Phys. Rev. Lett. **102**, 127205/1-4 (2009) and unpublished.

[2] S. Krämer *et al.*, Phys. Rev. B **76**, 100406(R)/1-4 (2007) and unpublished.