NMR studies of BEC-type quantum spin systems close to quantum critical points

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In antiferromagnetic quantum spin systems a magnetic field can induce a phase transition from a gapped into a gapless state, which at low temperature turns into a 3D ordered state that can be described as Bose-Einstein condensation (BEC). However, the true nature of real compounds is often more complicated and/or incompatible with the canonical BEC. NMR T_1^{-1} measurements, reflecting the low-energy excitations, are particularly suitable to monitor the critical behaviour around the corresponding critical field H_c, and to reveal whether the expected gapless behaviour is perturbed by some residual gap. Along these lines, we present results in two quasi-1D model systems, the spin-1/2 ladder compound $CuBr_4(C_5H_{12}N)_2$ (BPCB) [1] and the compound $NiCl_2$–$4SC(NH_2)_2$ (DTN) containing chains of $S = 1$ spins subject to a single-ion anisotropy. Both compounds exhibit the same scalable critical behaviour, not yet described theoretically [2]. In DTN we discuss the relevance of the observed residual gap. We also briefly report the latest results from the 2D dimer compound $BaCuSi_2O_6$ (Han purple), in which a special, layered BEC state is observed [3].

[1] M. Klanjšek *et al.*, Phys. Rev. Lett. **101** (2008) 137207

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[3] N. Laflorencie, F. Mila, Phys. Rev. Lett. **102** (2009) 060602; arXiv:1009.5978