Disorder-Induced Bose-Einstein Condensate in the Quantum Magnet DTNX at High Magnetic Fields

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The high magnetic field regime of the disordered (Br-doped) quasi-one-dimensional S=1 antiferromagnetic material DTNX, $Ni(Cl_{1-x}Br_x)_2$-$4SC(NH_2)$, was believed to provide the first experimental realization of the elusive *Bose-Glass* phase in a quantum magnet [1]. However, the recent experimental and theoretical works [2-5] revealed a much richer scenario where *impurity-induced* localized bosonic degrees of freedom (building blocks for the putative Bose-Glass) form a new kind of Bose-Einstein condensate at low temperature: the BEC* phase (Fig. 1). This is a purely many-body effect where interactions and disorder cooperate to restore a phase coherence via an "order-by-disorder" mechanism [6].

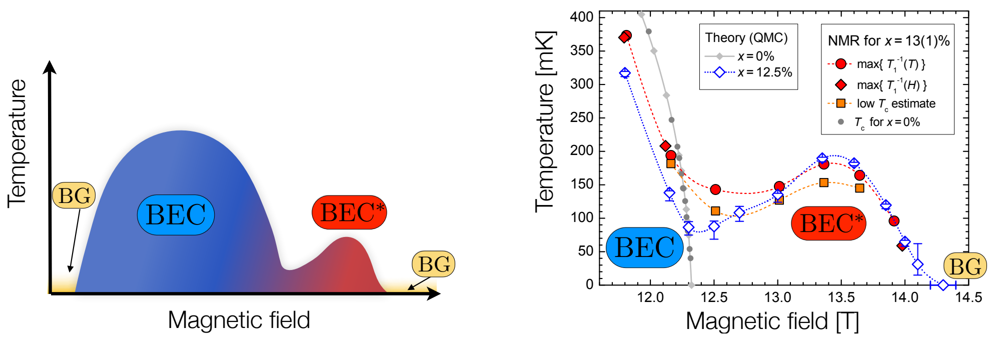

Figure 1: Left: Sketch of the global phase diagram of DTNX, where colors denote the BEC (blue) and BEC* (red) phases, and the Bose-glass (BG, yellow) regime. Right: Focus on the higher field regime. The critical temperature determined from quantum Monte Carlo simulations for $x = 12.5\%$ doping (blue open diamonds) is compared to T_c estimates from $1/T_1$ NMR data in an $x = 13 \pm 1\%$ doped sample. Adapted from [5].

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