LOW-DIMENSIONAL QUANTUM MAGNETISM EXPLORED USING MOLECULAR BUILDING BLOCKS AND HIGH FIELD TECHNIQUES

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Coordination chemistry provides a versatile way to generate low-dimensional materials for the purpose of experimentally investigating quantum theories of magnetism. By knitting together transition metal ions with molecular ligands, interesting magnetic structures can be realized with interaction strengths sized so that the entire magnetic phase diagram can be readily explored using the fields available at the NHMFL. Moreover, the nature of the materials is such that numerous alterations can be made to the structure in a controlled manner [1,2].

To illustrate this, we will show the results of magnetometry and neutron scattering measurements on an isostructural family of materials, $[M(HF_2)(pyz)_2]SbF_6$ (where M = Cu, Ni, Co and Zn, and pyz = pyrazine), which consist of square planar metal-pyrazine networks bridged by robust HF_2 pillars [3,4].

In addition we will present new data on the layered spin-1/2 dimer system $Cu(pyz)(gly)ClO_4$ (where gly = glycine) [5]. In particular, we will compare results of pulsed-field magnetization, a radio-frequency technique for measuring differential magnetic susceptibility and magnetocaloric effect measurements performed in the tailored pulse-profiles of the 60 T Long Pulse Magnet.

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Category: LD
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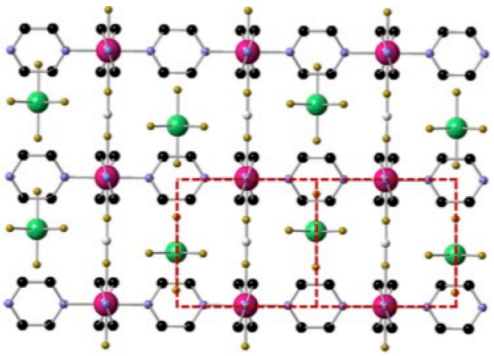

Figure 1. Low-temperature structure of $[Cu(HF_2)(pyz)_2]SbF_6$ (Cu=pink, C=black,N=blue, F=yellow, Sb=green, and H = white (pyrazine hydrogen atoms omitted for clarity) [3].

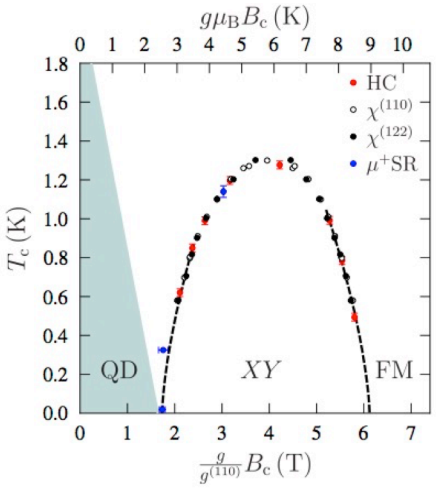

Figure 2. Phase diagram of the spin-1/2 dimer material $Cu(pyz)(gly)ClO_4$, mapped out using quasi-static magnetic fields [5].