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Tuning spatial exchange and single-ion anisotropies in low-dimensional Ni(II) quantum magnets[1]

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Spatial exchange anisotropy is key to determining J'/J and T_N/J critical ratios and unveiling B/T phase diagrams in low-dimensional quantum magnets. Systematic design strategies have enabled us to synthesize a series of model S =1 Ni(II) systems whereby this anisotropy, in combination with the single-ion anisotropy, can be tuned by adjusting the nature of the coordinating ligands. For example, the coordination polymers $[NiL_x(pyz)_2]Y$ (pyz = pyrazine; L = HF_2, x = 1, Y = PF_6, SbF_6; L = Cl, Br, I, x = 2, Y = nil), possess 2D $[Ni(pyz)_2]^{2+}$ square lattices that are spaced apart by bridging or non-bridging L anions such that $1.7 \leq T_N \leq 12$ K depending on the magnitude of J'. Chemical substitution of pyz for other organic ligands leads to quasi-1D $[Ni(HF_2)(3\text{-}Clpy)_4]BF_4$ (Clpy = chloropyridine) and the 2D Kagome lattice $[Ni(H_3F_4)(3\text{-}Fpy)_4]SbF_6$ (Fpy = fluoropyridine) which contain HF_2^- or $H_3F_4^-$ bridges, respectively. Furthermore, the inherent flexibility of strong F•••H•••F and O-H•••F bonds also renders them highly sensitive to external stimuli such as high pressure. Time permitting, these examples and others will be presented.

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