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# Magnetic interaction between manganese (2+) atoms through aquo bridges and bifurcated cyano groups

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**Abstract**

The magnetic interaction between adjacent manganese atoms through aquo double bridges in $Mn_2[M(CN)_6]\cdot xH_2O$ where $x = 8$ and 2 and M = Fe, Ru, Os, was studied. Through these bridges a relatively weak antiferromagnetic interaction is established with an estimated Curie–Weiss temperature, $|\theta_{CW}|$, close to 4 K and a super exchange constant, $|J|$, of 0.27 $cm^{-1}$. When these materials are dehydrated the antiferromagnetic interaction between the Mn atoms undergoes a dramatic increase, with estimated values for $|\theta_{CW}|$ and $|J|$ of 61 K and 4.11 $cm^{-1}$, respectively. Such reinforcement in the magnetic interaction is accompanied by a shift of 32 $cm^{-1}$ for the $\nu$ (CN) vibration towards the low frequency region while for the iron compound the Mössbauer spectrum, initially a single line, becomes a quadrupole splitting doublet of relatively low isomer shift ($\delta$) value. The Curie constant of the involved Mn atoms shows a negative correlation with the observed shifts in $\nu$ (CN) and $\delta$ on dehydration. From the observed magnetic behaviour and the spectroscopic data a double coordination of an N end of the CN ligand to two Mn atoms is proposed. Such strong magnetic interaction through the N atom of the CN ligand could be used as a prototypical bridge to obtain high $T_c$ molecular magnets.

S Supplementary data are available from stacks.iop.org/JPhysCM/19/056202

## 1. Introduction

The magnetic interaction between transition metal ions in cyano complexes, mainly Prussian blue (PB) analogues, has been an active interdisciplinary research area in the last few

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