Supplementary Materials

Slow relaxation of the magnetisation in a two-dimensional metal–organic framework with a layered square lattice

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Table S1. Main bond lengths (Å) in $(H_3O)[Eu(C_6O_4(CN)Cl)_2(H_2O)]\cdot 34H_2O$ (**1**).

Atom	Atom	Length (Å)	Atom	Atom	Length (Å)
Eu1	O11W	2.402(7)	Eu1	O12	2.423(4)
Eu1	O2 [1]	2.436(5)	Eu1	O12 [1]	2.423(4)
Eu1	O2	2.436(5)	Eu1	O13	2.436(4)
Eu1	O3	2.441(5)	Eu1	O13 [1]	2.436(4)
Eu1	O3 [1]	2.441(5)			

[1] 1/2 − x, +y, 1/2 − z

Table S2. Main bond angles (°) in $(H_3O)[Eu(C_6O_4(CN)Cl)_2(H_2O)]\cdot 34H_2O$ (**1**).

Atom	Atom	Atom	Angle (°)	Atom	Atom	Atom	Angle (°)
O11W	Eu1	O2	125.11(11)	O12 [1]	Eu1	O3	72.21(15)
O11W	Eu1	O2 [1]	125.11(11)	O12 [1]	Eu1	O3 [1]	131.35(15)
O11W	Eu1	O3	71.95(11)	O12	Eu1	O3	131.35(15)
O11W	Eu1	O3 [1]	71.95(11)	O12	Eu1	O3 [1]	72.22(15)
O11W	Eu1	O12	124.97(10)	O12	Eu1	O12 [1]	110.1(2)
O11W	Eu1	O12 [1]	124.97(10)	O12 [1]	Eu1	O13 [1]	65.27(15)
O11W	Eu1	O13	71.11(11)	O12	Eu1	O13 [1]	142.15(16)
O11W	Eu1	O13 [1]	71.11(11)	O12 [1]	Eu1	O13	142.15(16)
O2	Eu1	O2 [1]	109.8(2)	O12	Eu1	O13	65.27(15)
O2	Eu1	O3 [1]	141.85(15)	O13 [1]	Eu1	O2	132.39(15)
O2	Eu1	O3	64.54(15)	O13	Eu1	O2	72.44(16)
O2[1]	Eu1	O3 [1]	64.54(15)	O13 [1]	Eu1	O2 [1]	72.44(16)
O2[1]	Eu1	O3	141.85(15)	O13	Eu1	O2 [1]	132.39(15)
O3[1]	Eu1	O3	143.9(2)	O13 [1]	Eu1	O3 [1]	83.78(15)
O12	Eu1	O2	70.58(16)	O13 [1]	Eu1	O3	84.70(16)
O12[1]	Eu1	O2	70.93(15)	O13	Eu1	O3 [1]	84.71(16)
O12[1]	Eu1	O2 [1]	70.58(16)	O13	Eu1	O3	83.78(15)
O12	Eu1	O2 [1]	70.93(15)	O13 [1]	Eu1	O13	142.2(2)

[1] 1/2 − x, +y, 1/2 − z

Table S3. Main bond lengths (Å) in $(H_3O)[Dy(C_6O_4(CN)Cl)_2(H_2O)]\cdot 44H_2O$ (**2**).

Atom	Atom	Length (Å)	Atom	Atom	Length (Å)
Dy1	O2	2.392(4)	Dy1	O12 [1]	2.399(4)
Dy1	O2 [1]	2.392(4)	Dy1	O13 [1]	2.411(4)
Dy1	O3	2.396(4)	Dy1	O13	2.411(4)
Dy1	O3 [1]	2.396(4)	Dy1	O11W	2.433(6)
Dy1	O12	2.399(4)			

[1] 3/2 − x, +y, 3/2 − z.

Table S4. Main bond angles (°) in $(H_3O)[Dy(C_6O_4(CN)Cl)_2(H_2O)]\cdot 44H_2O$ (**2**).

Atom	Atom	Atom	Angle(°)	Atom	Atom	Atom	Angle(°)
O2	Dy1	O2 [1]	109.36(19)	O3 [1]	Dy1	O12	132.75(13)
O2 [1]	Dy1	O3	142.73(13)	O3 [1]	Dy1	O12 [1]	73.34(13)
O2 [1]	Dy1	O3 [1]	65.97(12)	O3 [1]	Dy1	O13 [1]	83.55(13)
O2	Dy1	O3	65.97(12)	O3 [1]	Dy1	O13	83.85(13)
O2	Dy1	O3 [1]	142.73(13)	O3	Dy1	O13 [1]	83.85(13)
O2	Dy1	O12	69.84(13)	O3	Dy1	O13	83.55(13)
O2	Dy1	O12 [1]	70.74(13)	O3	Dy1	O11W	70.36(9)
O2 [1]	Dy1	O12	70.74(13)	O3 [1]	Dy1	O11W	70.36(9)
O2 [1]	Dy1	O12 [1]	69.84(13)	O12	Dy1	O12 [1]	108.62(19)
O2	Dy1	O13	131.83(13)	O12	Dy1	O13	66.01(13)
O2 [1]	Dy1	O13 [1]	131.83(13)	O12	Dy1	O13 [1]	141.94(13)
O2	Dy1	O13 [1]	73.17(13)	O12 [1]	Dy1	O13 [1]	66.01(13)
O2 [1]	Dy1	O13	73.17(13)	O12 [1]	Dy1	O13	141.94(13)
O2 [1]	Dy1	O11W	125.32(10)	O12 [1]	Dy1	O11W	125.69(9)
O2	Dy1	O11W	125.32(10)	O12	Dy1	O11W	125.69(9)
O3	Dy1	O3 [1]	140.72(19)	O13	Dy1	O13 [1]	141.90(18)
O3	Dy1	O12 [1]	132.74(13)	O13 [1]	Dy1	O11W	70.95(9)
O3	Dy1	O12	73.34(13)	O13	Dy1	O11W	70.95(9)

[1] 3/2 − x, +y, 3/2 − z.

Table S5. Crystal data for compounds $(H_3O)[Eu(C_6O_4(CN)Cl)_2(H_2O)]\cdot 34H_2O$ (**1**) and $(H_3O)[Dy(C_6O_4(CN)Cl)_2(H_2O)]\cdot 44H_2O$ (**2**).

Compound	**1**	**2**
CCDC	2401611	2402436
Formula	$C_{14}H_2Cl_2EuN_2O_9$	$C_{14}H_2Cl_2DyN_2O_9$
$D_{calc.}$/ g cm^{-3}	0.919	0.933
μ/mm^{-1}	1.689	1.977
Formula Weight	565.04	575.58
Colour	red	pink
Shape	block	plate
Size/mm^3	0.09 × 0.05 × 0.03	0.20 × 0.10 × 0.06
T/K	119.6(8)	120.00(10)
Crystal System	monoclinic	monoclinic
Space Group	$P2/n$	$P2/n$
a/Å	11.973(3)	11.9237(4)
b/Å	13.885(6)	14.0496(8)
c/Å	12.285(4)	12.2263(5)
α/°	90	90
β/°	90.21(3)	90.254(4)
γ/°	90	90
V/Å^3	2042.3(12)	2048.17(16)
Z	2	2
Wavelength/Å	0.71073	0.71073
Radiation type	Mo K$_a$	Mo K$_a$
Θ_{min}/°	3.317	3.333
Θ_{max}/°	25.437	25.053
Measured Refl's.	10514	14733
Indep't Refl's	3554	3599
Refl's I ≥ 2 σ(I)	2486	3259
R_{int}	0.1133	0.0624
Parameters	138	138
Restraints	36	12
Largest Peak	1.413	4.449
Deepest Hole	−1.250	−1.336
GooF	0.959	1.076
wR_2 (all data)	0.1323	0.1455
wR_2	0.1252	0.1432
R_1 (all data)	0.0762	0.0535
R_1	0.0555	0.0506

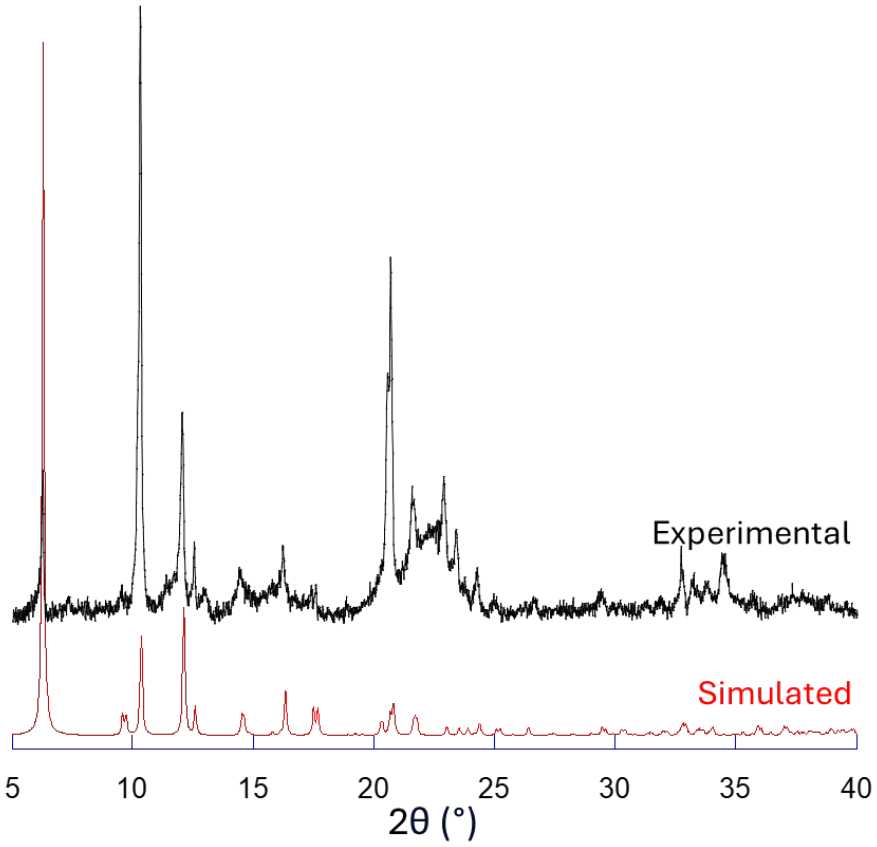

Figure S1. Simulated (red) and experimental (black) X-ray powder diffractograms for compound $(H_3O)[Dy(C_6O_4(CN)Cl)_2(H_2O)]\cdot 44H_2O$ (**2**).

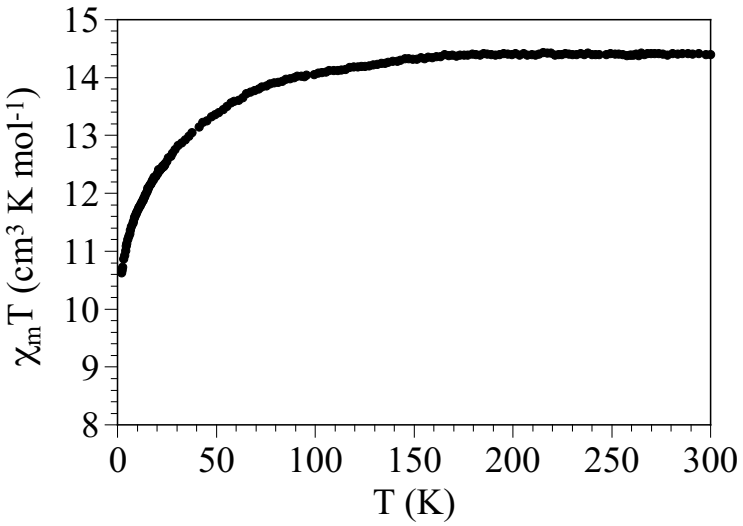

Figure S2. Thermal variation of the $\chi_m T$ product for compound $(H_3O)[Dy(C_6O_4(CN)Cl)_2(H_2O)]\cdot 44H_2O$ (**2**).

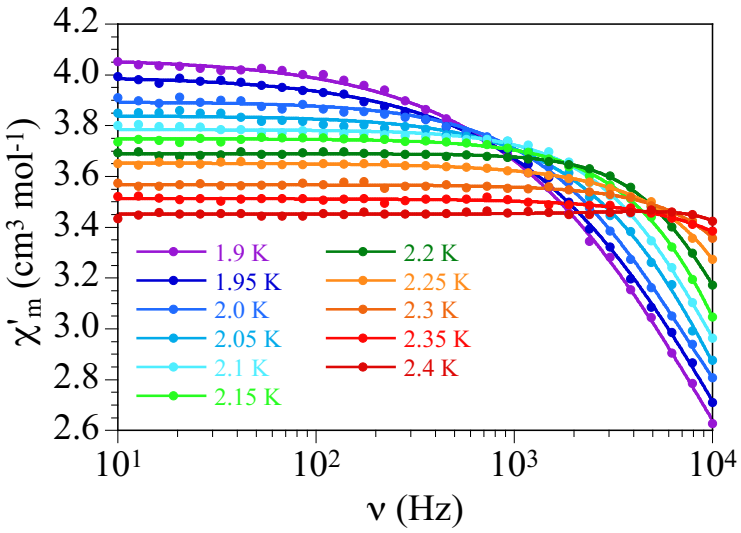

Figure S3. Frequency dependence of χ'_m at different temperatures with an applied DC field of 80 mT for compound **2**. Solid lines are the best fit to the Debye model.

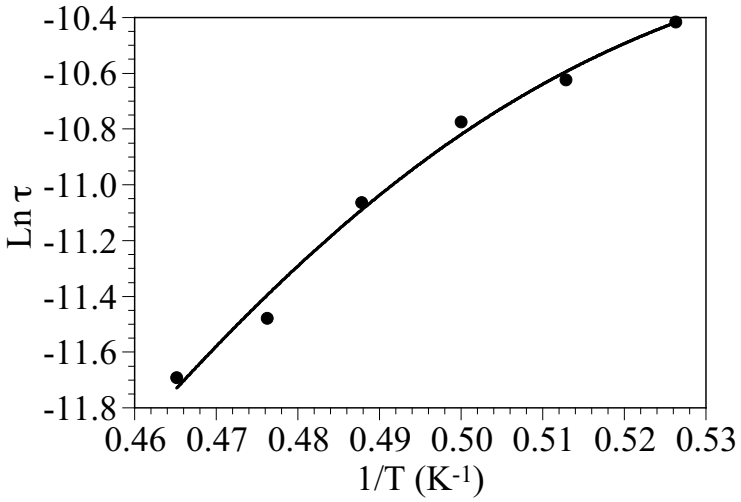

Figure S4. Arrhenius plot of the relaxation times (τ) obtained from the fit of χ'_m, with a DC field of 80 mT. The solid line is the best fit to a model with Orbach and Direct relaxation mechanisms (Equation (2)).