Supporting Information for

Weak exchange coupling effects leading to fast magnetic relaxations in a trinuclear dysprosium single-molecule magnet

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Table S1: Crystallographic data and refinement for **1Dy$_3$** and **2Dy**. (Note: The disordered toluene was squeezed using PLATON program, details are provided in the corresponding cif document)

	1Dy$_3$	**2Dy**
Mr	2072.93	653.67
formula	$C_{86}H_{109}B_3Dy_3N_{27}O_2$	$C_{23}H_{25}BDyN_{12}$
cryst syst	monoclinic	orthorhombic
space group	$P2_1/c$	*Pnma*
a, Å	14.6588(5)	25.1963(7)
b, Å	22.3712(7)	10.9647(4)
c, Å	28.6408(8)	11.6734(3)
V, Å^3	9211.4(5)	3225.03(18)
α, deg	90	90
β, deg	101.265(3)	90
γ, deg	90	90
Z	4	4
T, K	180(2)	180(2)
μ, mm^{-1}	2.470	2.348
λ, Å	0.71073	0.71073
Cryst size, mm^3	0.24 * 0.12 * 0.09	0.35 * 0.23 * 0.17
GOF	1.114	1.052
R_{int}	0.0780	0.0443
R_1, wR_2[I >2σ(I)]	0.0591, 0.0986	0.0274, 0.0389
R_1, wR_2[all data]	0.1383, 0.1601	0.0649, 0.0724

Table S2: Kramers doublets (KDs) energy spectrum (cm^{-1}), g-tensor of ground and excited KDs for each Dy ion in **1Dy$_3$** and **2Dy**.

KDs	**1Dy$_3$(1)**			**1Dy$_3$(2)**			**1Dy$_3$(3)**		
	E			E			E		
1	0.0			0.0			0.0		
2	186.6			194.0			197.8		
3	225.3			237.7			234.9		
4	262.5			279.0			280.2		
5	307.8			314.5			324.4		
6	360.7			348.8			374.6		
7	375.5			399.0			397.4		
8	479.0			543.6			493.1		
KDs	g_x	g_y	g_z	g_x	g_y	g_z	g_x	g_y	g_z
1	0.005	0.029	19.715	0.0006	0.018	19.730	0.001	0.0200	19.735
2	1.583	2.968	14.582	0.810	1.713	15.537	1.460	2.779	14.345
3	1.582	5.573	12.166	1.758	5.029	12.158	1.167	5.065	11.991
4	1.004	4.521	8.328	1.703	2.465	8.650	2.458	4.651	8.851
5	2.174	3.760	13.964	10.833	7.070	2.899	1.913	3.412	14.328
6	0.488	3.883	13.440	0.224	0.414	18.868	0.768	1.772	15.208
7	0.320	2.731	15.884	0.488	0.680	16.083	0.193	0.862	18.315
8	0.047	0.079	19.286	0.031	0.055	19.396	0.048	0.080	19.337
KDs	**2Dy**								
	E								
1	0.0								
2	187.6								
3	212.0								
4	225.7								
5	264.1								
6	299.8								
7	391.2								
8	628.8								
KDs	g_x	g_y	g_z						
1	0.005	0.033	19.757						
2	1.264	2.810	15.235						
3	10.648	7.263	3.395						
4	1.122	1.458	14.952						
5	2.455	4.852	9.333						
6	1.316	1.547	17.559						
7	0.425	0.514	16.336						
8	0.015	0.024	19.514						

Figure S1: (a) Cole-Cole plots fitting for the determination of the temperature dependence of τ for **2Dy** in the absence of dc field; (b) Cole-Cole plots fitting for the determination of the temperature dependence of τ for **2Dy'** in the absence of dc field

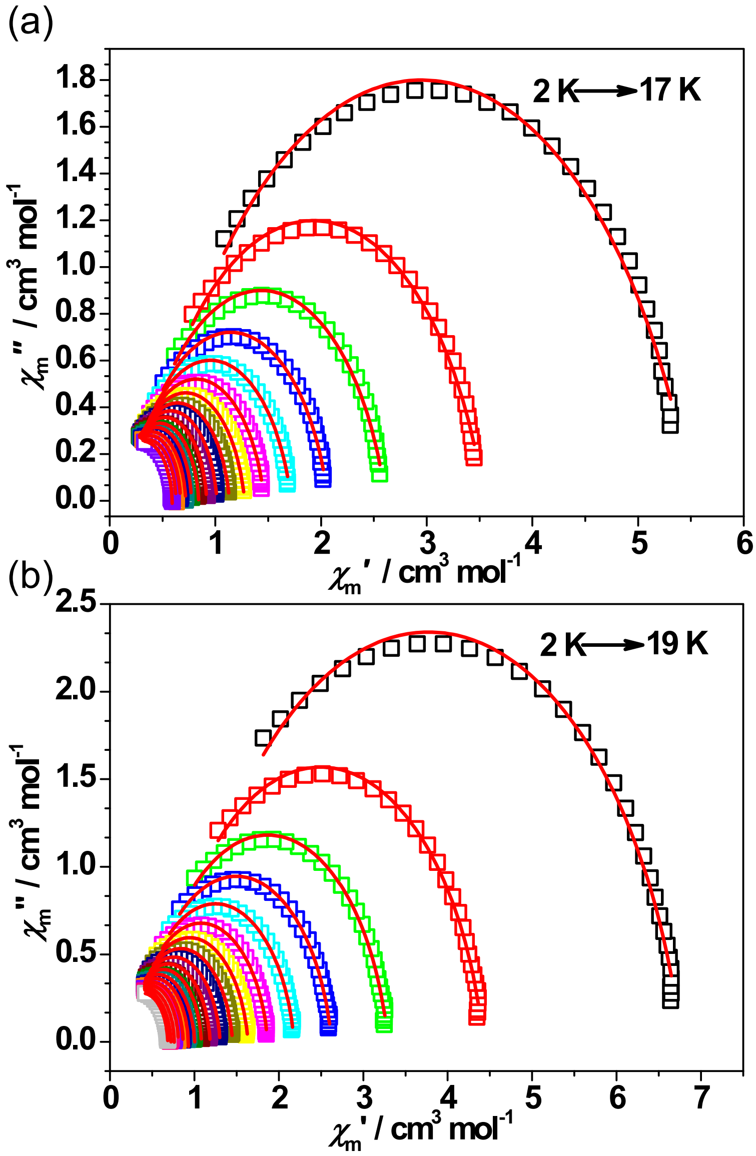


Figure S2. Frequency dependence ac susceptibility under 1 kOe dc field for **2Dy** (a) and **2Dy'** (b)

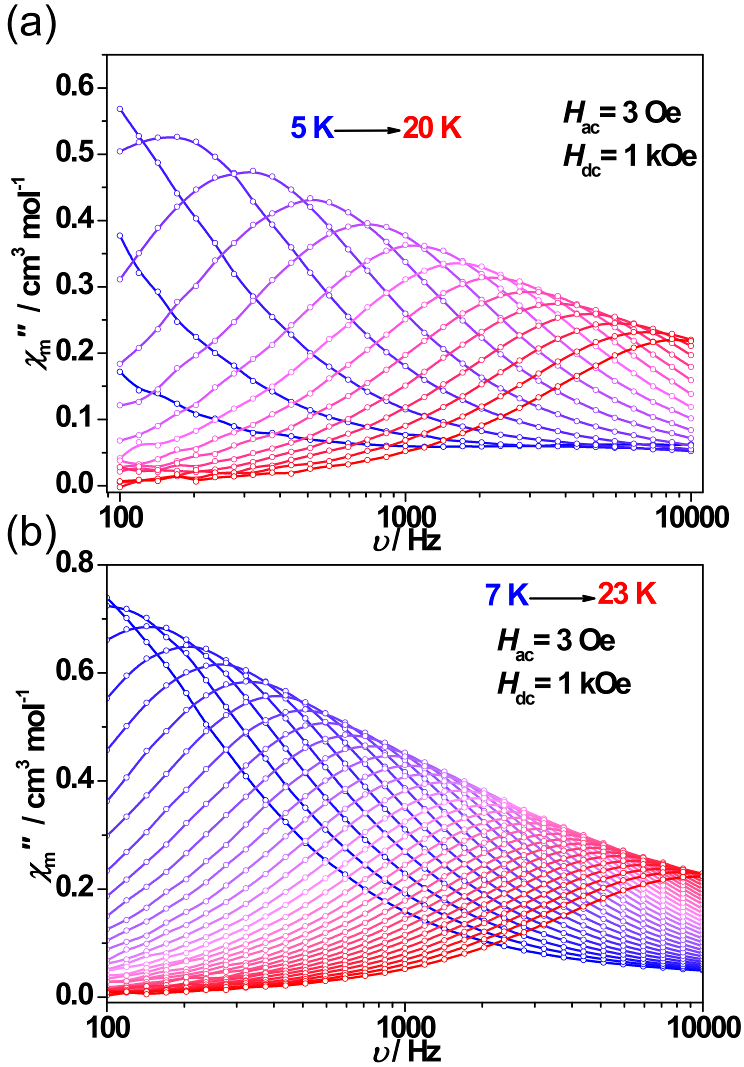
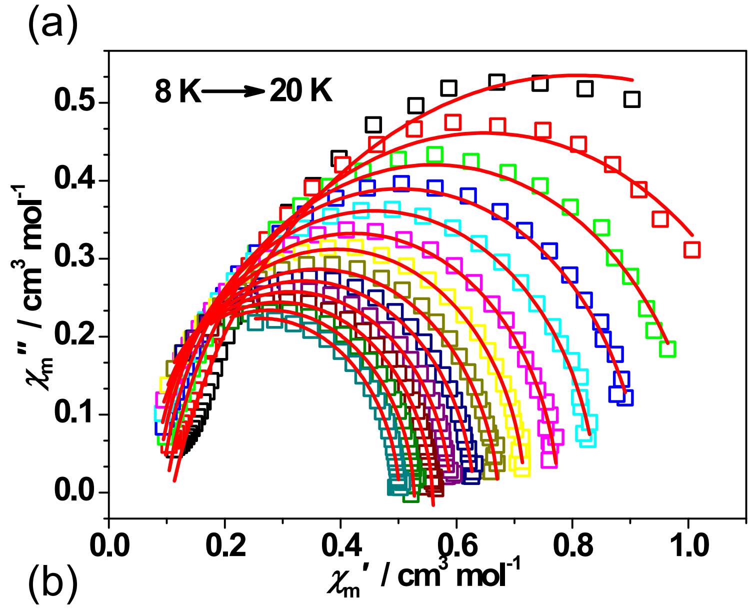


Figure S3: (a) Cole-Cole plots fitting for the determination of the temperature dependence of τ for **2Dy** under 1 kOe dc field; (b) Cole-Cole plots fitting for the determination of the temperature dependence of τ for **2Dy'** under 1 kOe dc field



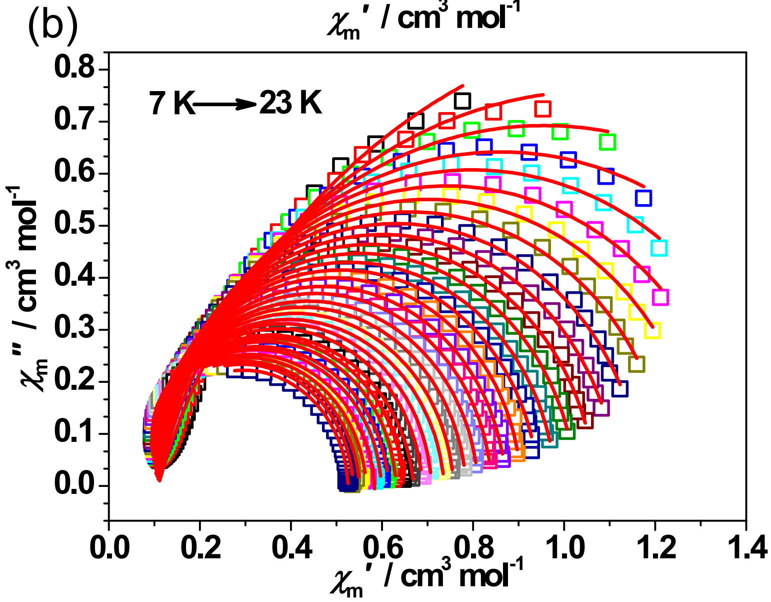


Figure S4. Out-of-phase signals (χ_m'') versus frequency (υ) plots for **$1Dy_3$** in the absence of dc field from 1 Hz to 1000 Hz. Cole-Cole plots fitting for the determination of the temperature dependence of τ for **$1Dy_3$** in the absence of dc field.

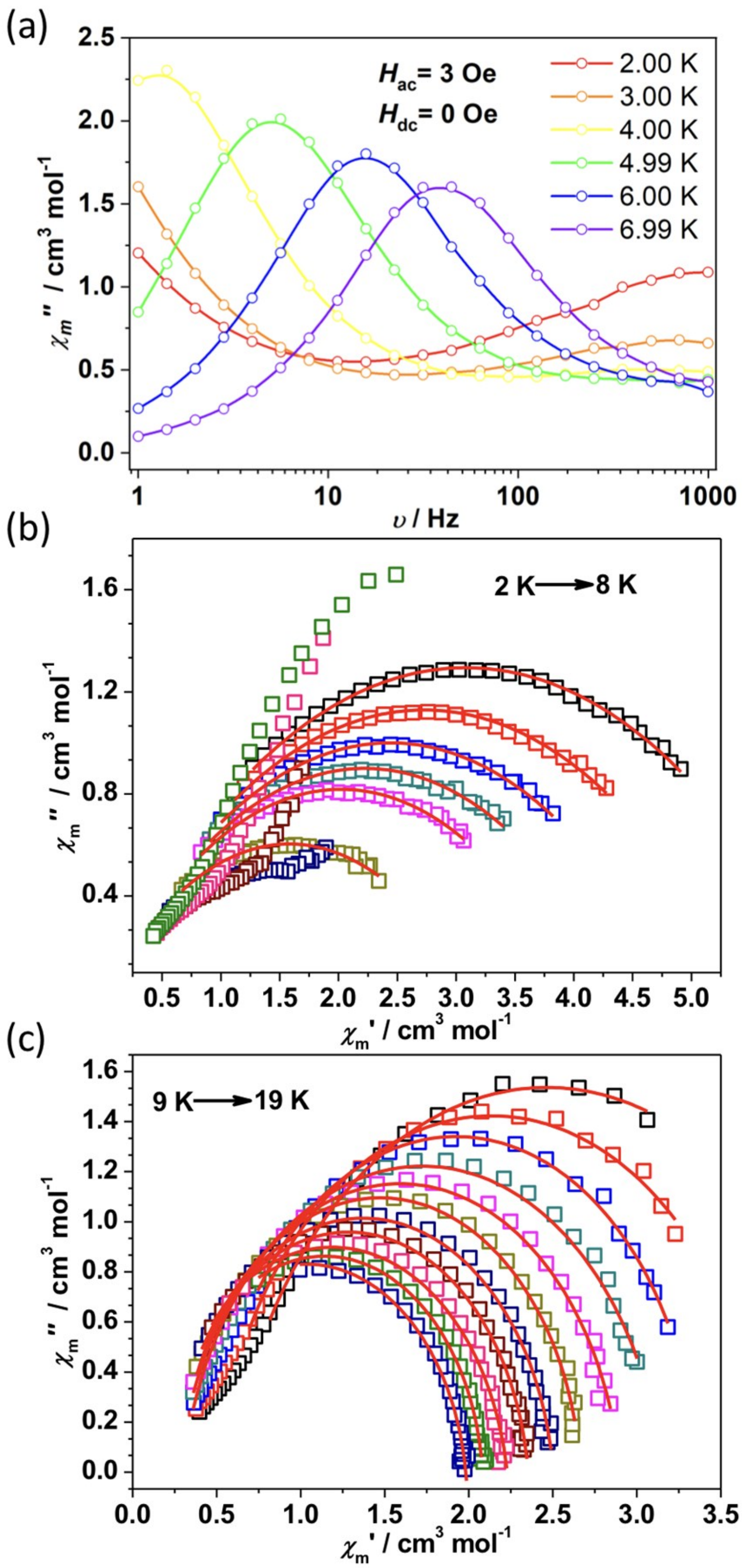


Figure S5. Temperature dependence ac susceptibility under 3 kOe dc field for **1Dy$_3$**.

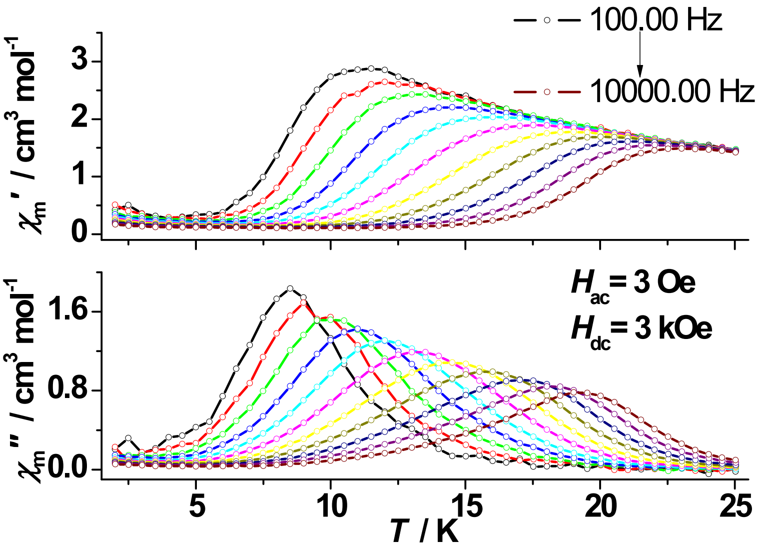


Figure S6. Frequency dependence ac susceptibility under 3 kOe dc field for **$1Dy_3$**.

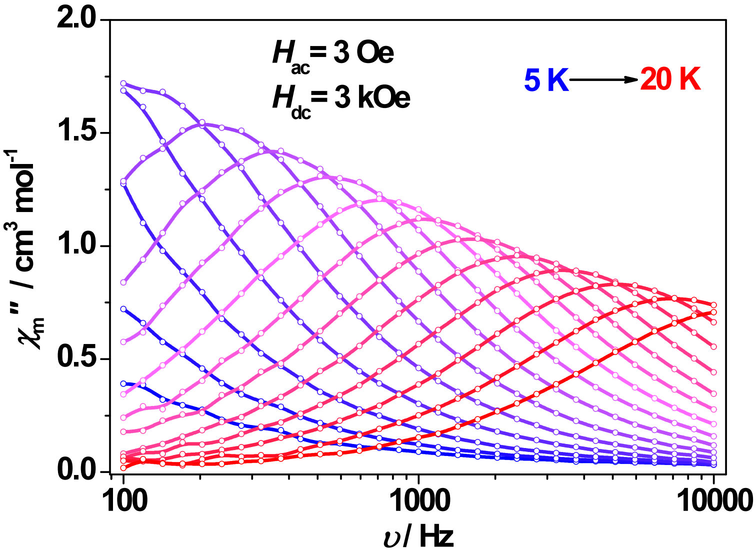


Figure S7. Frequency dependence ac susceptibility in the absence of dc field for magnetically diluted **1Dy₃**.

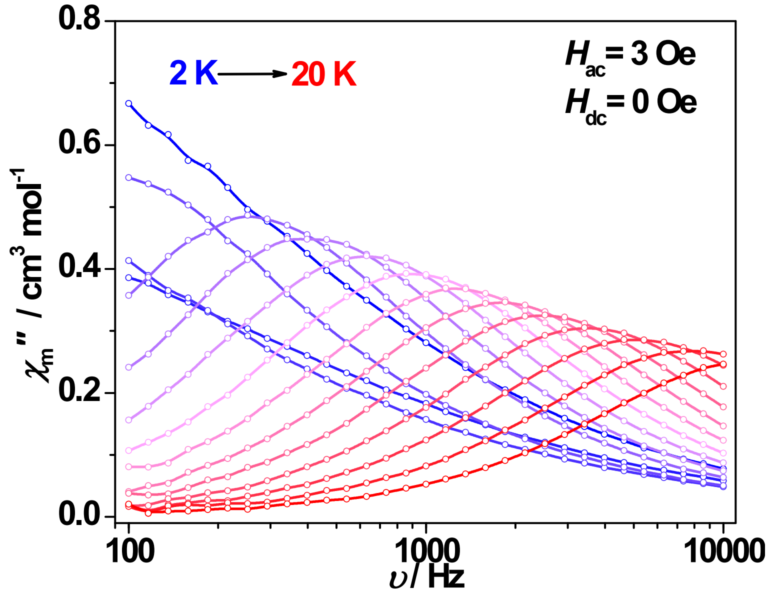


Figure S8. Frequency dependence ac susceptibility under 1 kOe dc field for magnetically diluted **1Dy₃**.

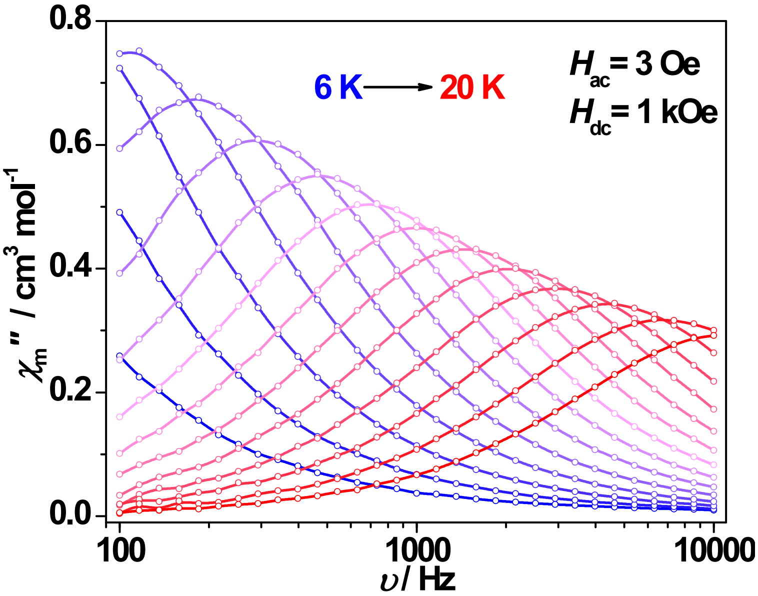


Figure S9. Cole-Cole plots fitting for the determination of the temperature dependence of τ for diluted **1Dy$_3$** in the absence of dc field (a) and under 1 kOe dc field.

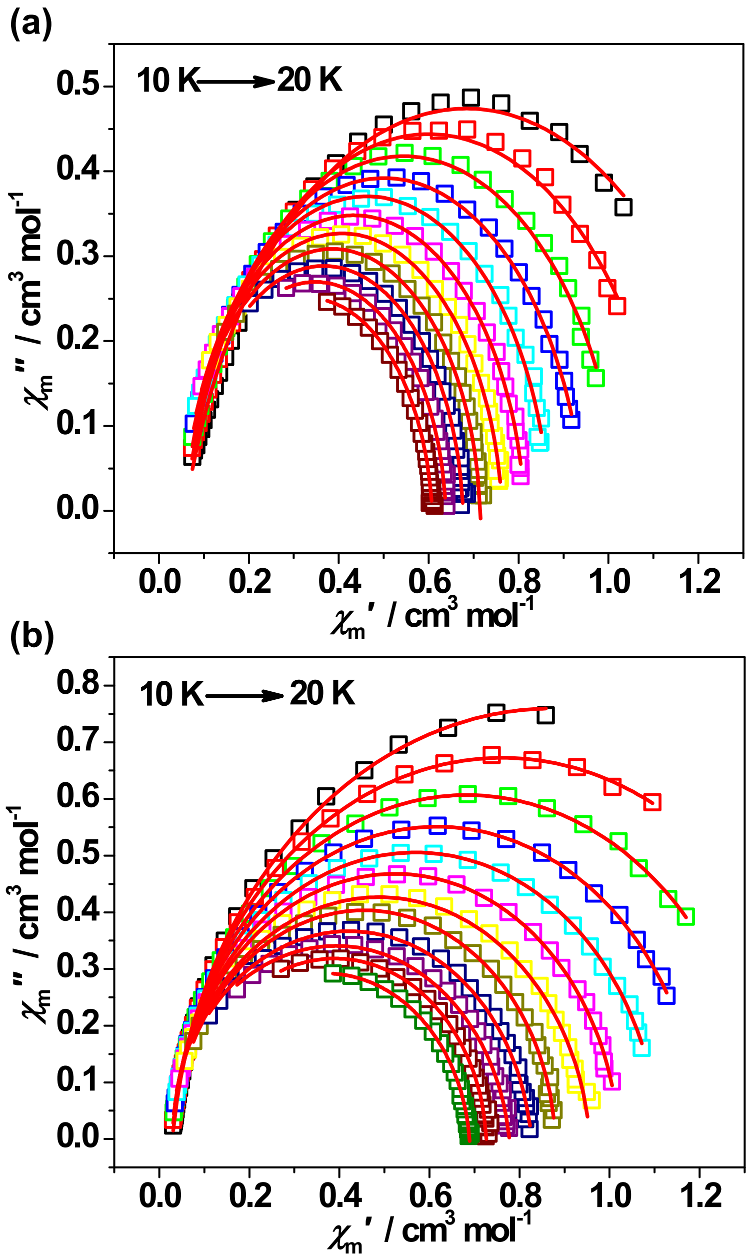


Figure S10. Relaxation times (τ) versus T^{-1} plots for diluted **$1Dy_3$**.

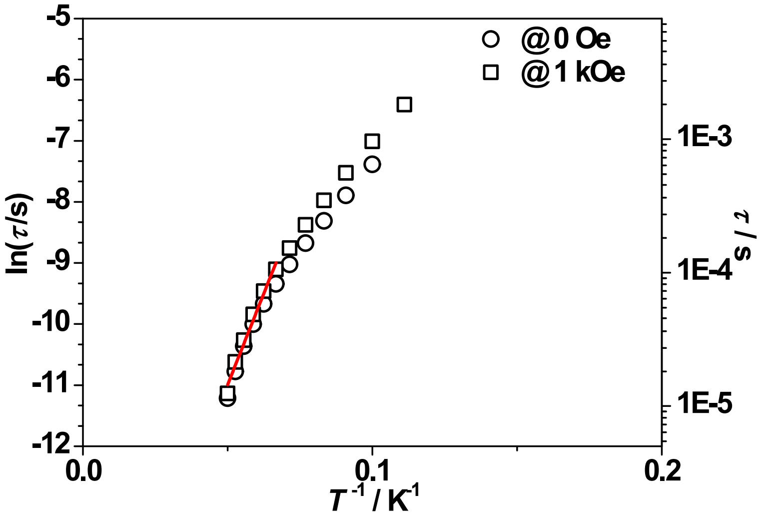


Figure S11. The magnetic susceptibility along corresponding rotation axes for **2Dy.**

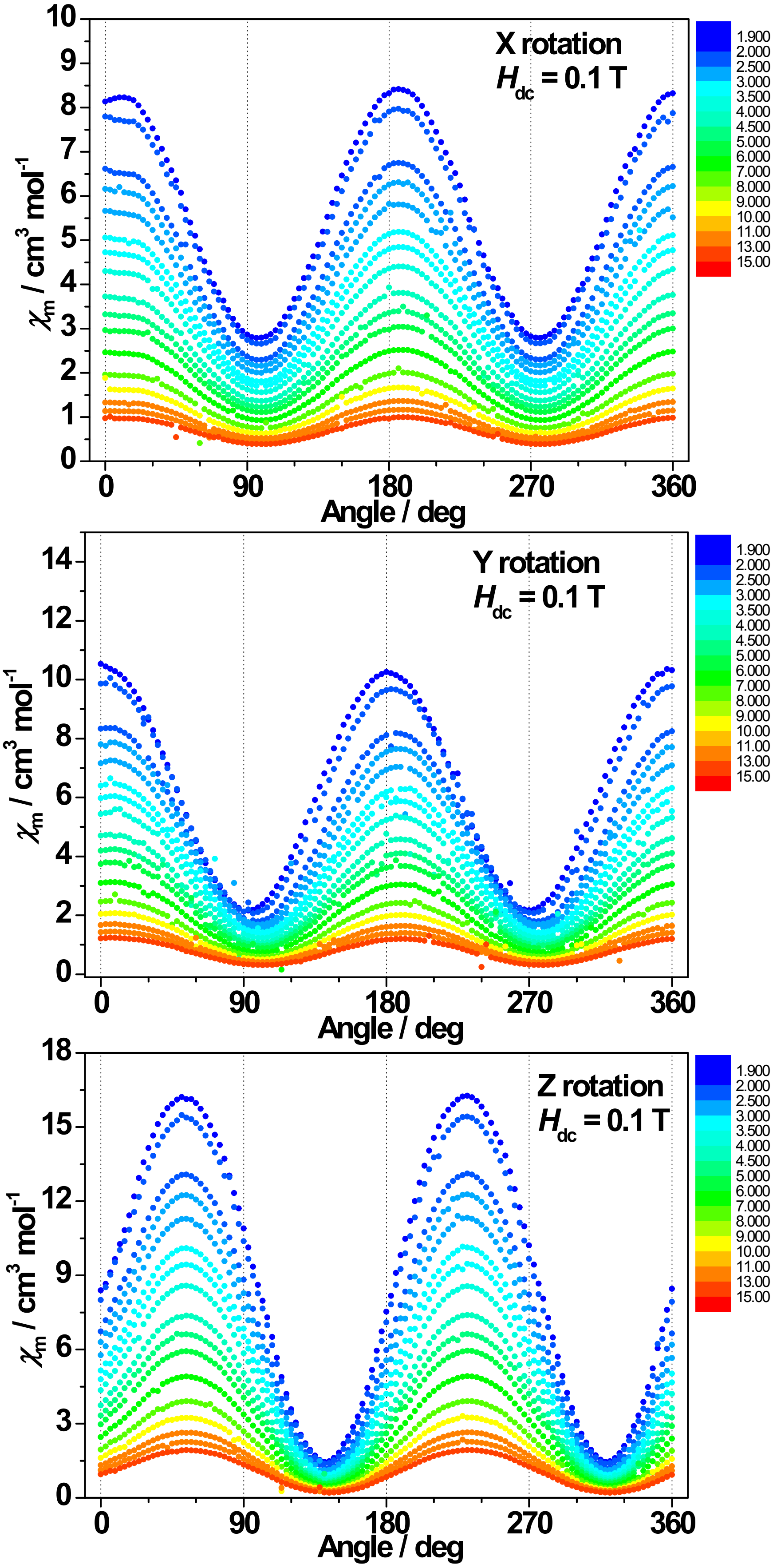


Figure S12. (a) The angular-dependent susceptibility plots and simultaneous fitting under 1 kOe dc field; (b) fitted g value along main magnetic axes using linear fitting function: y = ax corresponding to the equation: $g=\sqrt{\frac{32\chi_m T}{3}}$.