Electronic Supplementary Information (ESI)

**Cu(II)-Dy(III) and Co(III)-Dy(III) based single molecule magnets with multiple slow magnetic relaxation processes in Cu(II)-Dy(III) complex**

Malay Dolai, Mahammad Ali, Ján Titiš and Roman Boča

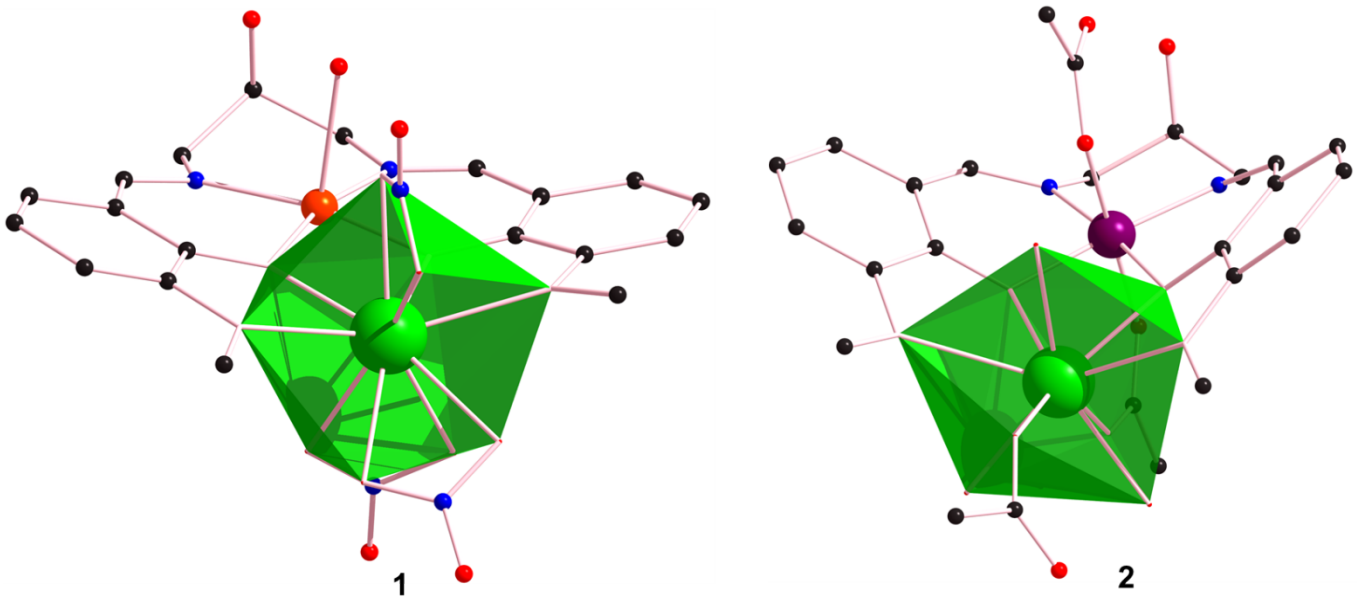


**Figure S1.** Distorted bicapped square antiprism geometry and monocapped square antiprism geometry of the complex **1** and **2** respectively.

**H-bonding, π–π and C–H···π stacking interactions**

The non-covalent interactions e.g. hydrogen bonding, π–π and C–H···π stacking have been taken into account to clarification of possible supramolecular topologies. The nature of the supramolecular interaction in which the non-coordinated alcoholic –OH group and one of the three coordinated nitrate ion along with the axial aqua ligand bonded to the Cu(II) centre, are involved in the hydrogen bonding to assembled the supramolecular 1D chains along the crystallographic *a* axis (Figure S2) and these 1D chains are moreover extended to 2D network via the inter-locking of C–H···π stacking among themselves in the crystallographic *bc* plane in complex **1**. On the other hand, this 2D framework with the combination of H-bonding as well as C–H···π stacking extended to form 3D network along crystallographic *a* axis (Figure S3) in complex **1**.

Simultaneously in complex **2**, the non-coordinated alcoholic –OH group and three coordinated aqua ligands along with the axial acetate ligand to the Co(III) centre, are involved in the hydrogen bonding to assembled the supramolecular 1D chains along the crystallographic *c* axis (Figure S4) and these 1D chains are moreover extended to 2D network via the inter-locking of π-π stacking among themselves in the crystallographic *ab* plane in complex 1. On the other hand, this 2D framework with the combination of H-bonding as well as π-π stacking extended to form 3D network along crystallographic *a* axis (Figure S5) in complex **1**.

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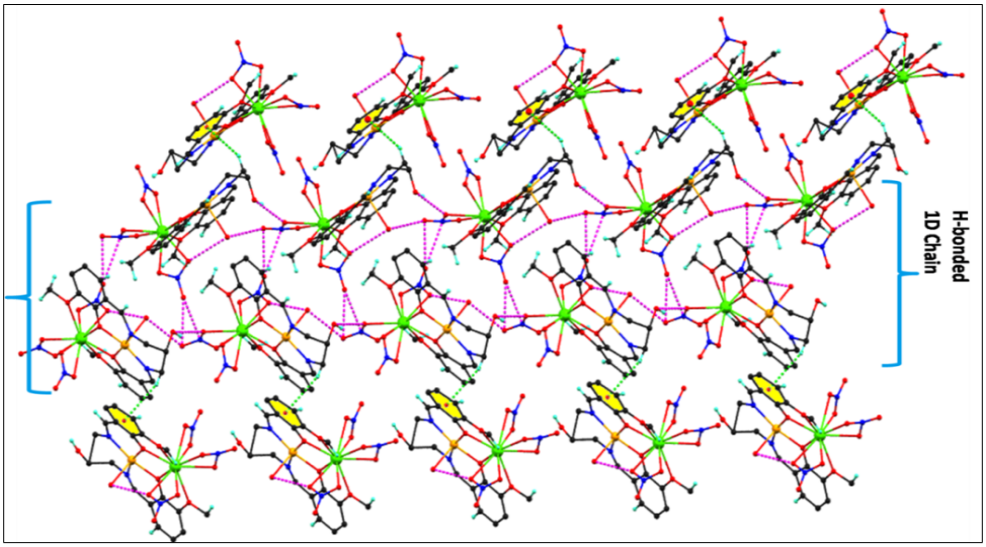


**Figure S2.** The H bonding interaction (magenta color dash line) as well as CH-π interaction (green color dash line) leads to formation of 2D supramolecular framework in crystallographic *bc* plane in complex **1**.

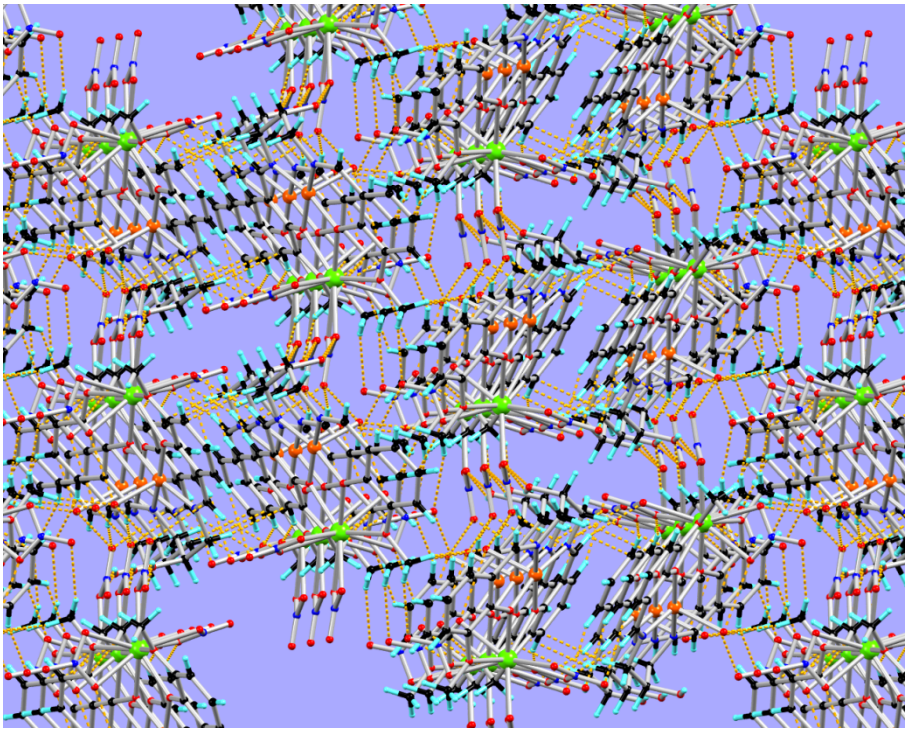

**Figure S3.** The H bonding interaction as well as C–H···π interaction leads to formation of 3D supramolecular network along crystallographic *a* axis in complex **1**.

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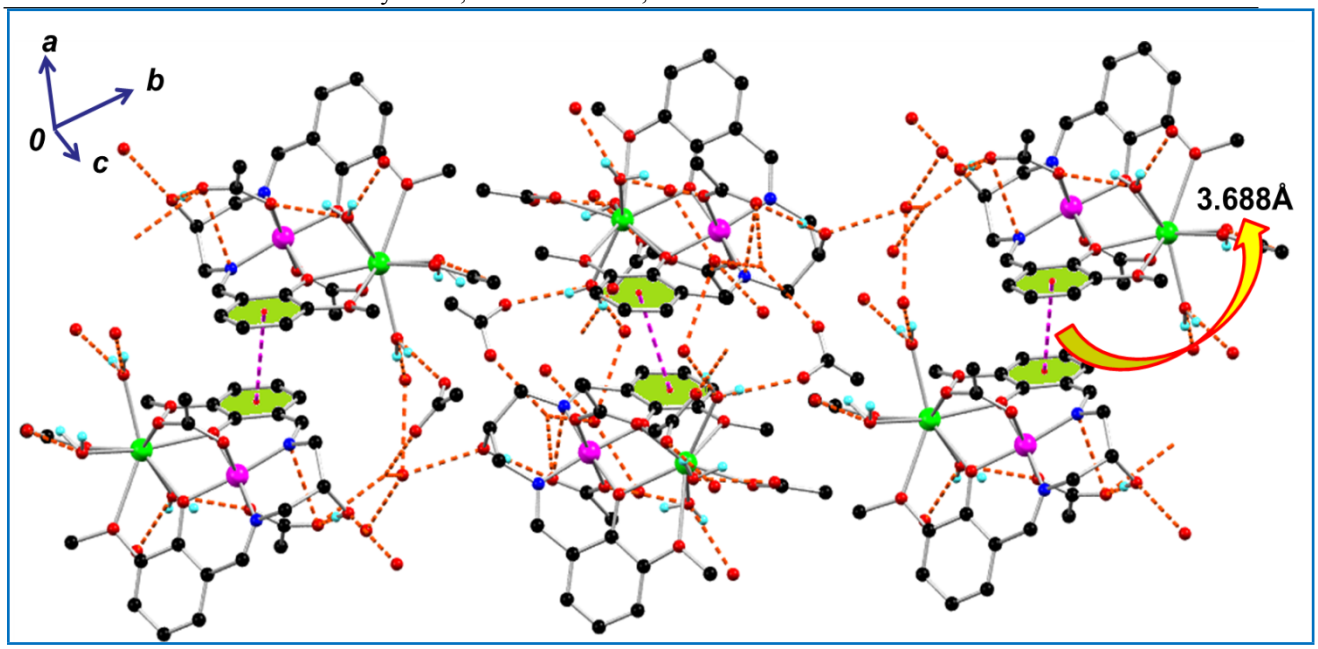


**Figure S4.** The H bonding interactions (brown color dash line) as well as π-π interaction (magenta color dash line) leads to formation of 2D supramolecular framework in crystallographic *ab* plane in complex **2**.

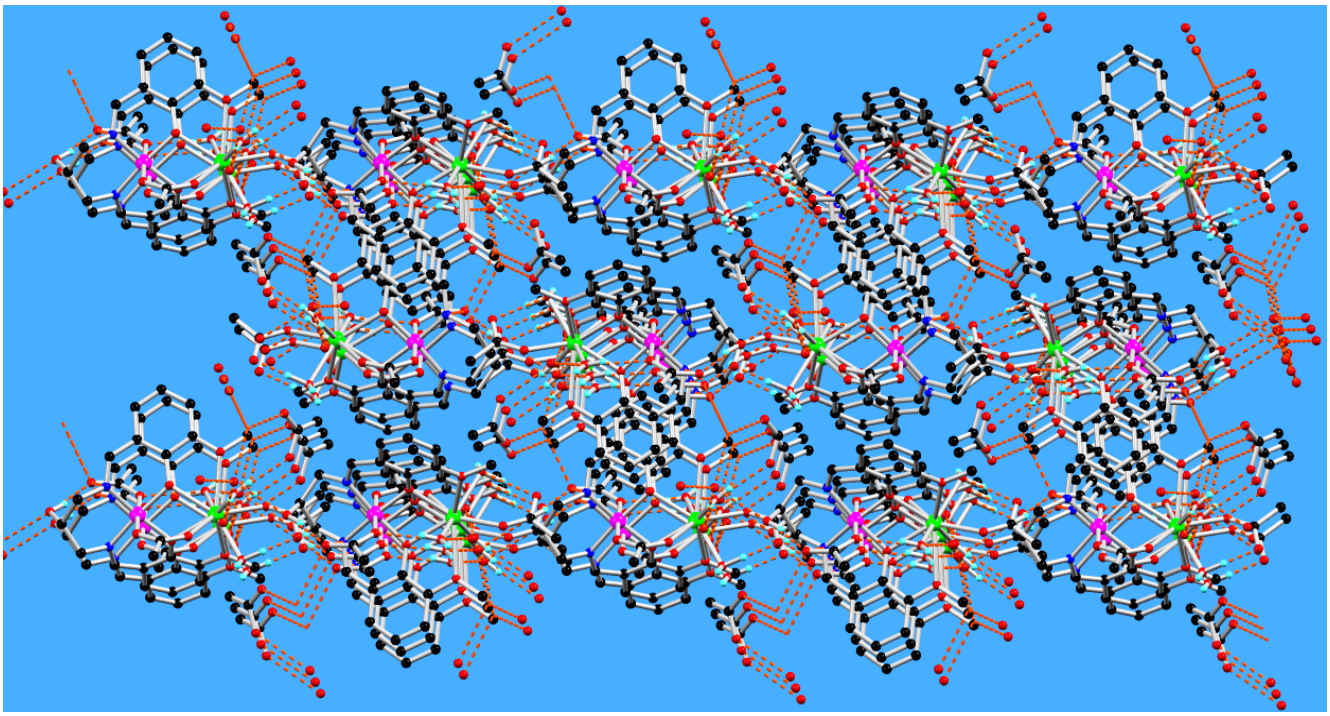

**Figure S5.** The H bonding interaction as well as π-π interaction leads to the formation of 3D supramolecular network along crystallographic *a* axis in complex **2**.

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**Table S1**. Selected bond lengths (Å) and bond angles (°) of complex **1**

| | | | |
|---|---|---|---|
| Dy1 –O1 | 2.502(5) | O1 -Dy1-O2 | 64.85(16) |
| Dy1 –O2 | 2.345(5) | O1 -Dy1-O3 | 127.15(17) |
| Dy1 –O3 | 2.343(5) | O1 -Dy1-O4 | 147.06(17) |
| Dy1 –O4 | 2.494(5) | O1 -Dy1 -O7 | 77.03(19) |
| Dy1 –O7 | 2.458(5) | O1 -Dy1 -O8 | 71.86(18) |
| Dy1 –O8 | 2.452(5) | O1 -Dy1 -O10 | 132.2(3) |
| Dy1 –O10 | 2.461(9) | O1 -Dy1 -O11 | 84.0(3) |
| Dy1 –O11 | 2.478(10) | O1 -Dy1 -O13 | 71.5(2) |
| Dy1 –O13 | 2.491(7) | O1 -Dy1 –O14 | 108.9(2) |
| Dy1 –O14 | 2.599(8) | O2 -Dy1 –O3 | 63.90(17) |
| Cu1 –O2 | 1.963(5) | O2 -Dy1 –O4 | 125.03(16) |
| Cu1 –O3 | 1.946(5) | O2 -Dy1 –O7 | 72.65(18) |
| Cu1 –O5 | 2.329(7) | O2 -Dy1 –O8 | 114.92(17) |
| Cu1 -N1 | 1.999(6) | O2 -Dy1 -O10 | 107.4(3) |
| Cu1 -N2 | 1.980(6) | O2 -Dy1 -O11 | 70.5(3) |
| | | O2 -Dy1 –O13 | 120.7(2) |
| | | O2 -Dy1 -O14 | 168.4(2) |
| | | O3 -Dy1 –O4 | 64.95(16) |
| | | O3 -Dy1 –O7 | 76.47(18) |
| | | O3 -Dy1 –O8 | 120.49(17) |
| | | O3 -Dy1 –O10 | 76.1(3) |
| | | O3 -Dy1 –O11 | 90.7(3) |
| | | O3 -Dy1 –O13 | 150.5(2) |
| | | O3 -Dy1 -O14 | 123.8(2) |
| | | O4 -Dy1 -O7 | 77.26(19) |
| | | O4 -Dy1 –O8 | 76.08(18) |
| | | O4 -Dy1 –O10 | 78.1(3) |
| | | O4 -Dy1 -O11 | 128.6(3) |
| | | O4 -Dy1 -O13 | 113.6(2) |
| | | O4-Dy1 -O14 | 65.8(2) |
| | | O7 -Dy1 –O8 | 51.49(17) |
| | | O7-Dy1 -O10 | 148.9(3) |
| | | O7 -Dy1 -O11 | 142.9(3) |
| | | O7-Dy1 -O13 | 132.9(2) |
| | | O7 -Dy1 –O14 | 116.5(3) |
| | | O8 -Dy1 –O10 | 137.7(3) |
| | | O8 -Dy1 –O11 | 148.1(3) |
| | | O8 -Dy1 –O13 | 85.4(2) |
| | | O8 -Dy1 -O14 | 70.0(3) |
| | | O10 -Dy1 -O11 | 51.5(4) |
| | | O10 -Dy1 -O13 | 75.0(3) |
| | | O10 -Dy1 –O14 | 68.9(3) |
| | | O11 -Dy1 –O13 | 66.9(3) |
| | | O11 -Dy1 –O14 | 99.7(3) |
| | | O13 -Dy1 -O14 | 48.0(3) |
| | | O2 -Cu1 -N1 | 167.9(2) |
| | | O2 -Cu1 -N2 | 91.4(2) |
| | | O2 -Cu1 -O3 | 78.8(2) |
| | | O2 -Cu1 -O5 | 93.8(2) |
| | | O3 -Cu1 -O5 | 91.4(3) |
| | | N1 -Cu1 -N2 | 97.3(3) |
| | | O3 -Cu1 -N1 | 91.6(2) |
| | | O3 -Cu1 -N2 | 168.4(2) |
| | | O5 -Cu1 -N1 | 93.7(3) |
| | | O5 -Cu1 -N2 | 95.5(3) |
| | | Dy1 -O2 -Cu1 | 108.3(2) |
| | | Dy1 -O3 -Cu1 | 109.0(2) |

**Table S2**. Hydrogen bonding interactions in **1** (Å, º).

| D−H•••A | Distances (Å) | | | Angles (º) |
|---|---|---|---|---|
| | D−H | H•••A | D•••A | D−H•••A |
| O6 -H6 •••O13$^{i}$ | 0.82 | 2.19 | 2.855(12) | 138 |
| C16 -H5 •••O11$^{ii}$ | 0.93 | 2.54 | 3.327(13) | 143 |
| C19 -H7A •••O6$^{iii}$ | 0.96 | 2.59 | 3.380(14) | 140 |
| C19 -H7B •••O8 | 0.96 | 2.53 | 3.187(11) | 126 |
| C19 -H7B •••O14 | 0.96 | 2.44 | 2.783(12) | 101 |
| C5 -H15•••O9$^{iv}$ | 0.93 | 2.46 | 3.343(11) | 159 |
| C1 -H19A •••O5$^{v}$ | 0.96 | 2.55 | 3.415(11) | 151 |
| C1 -H19B •••O13 | 0.96 | 2.47 | 2.996(12) | 114 |

Symmetry code: (i) = x,y,-1+z; (ii) = 1+x,y,z; (iii) = 1+x,y,1+z; (iv) = x,1/2-y,1/2+z; (v) = -1+x,1/2-y,-1/2+z.

**Table S3.** π–π interactions and C–H•••π interaction in complex **1**$^{a,b}$

| Ring(i)...ring(j) | Distance of centroid(i) from ring(j) (Å) | Dihedral angle (i, j) (°) | Distance between the (i, j) ring centroids (Å) |
|---|---|---|---|
| R(1)...R(2)$^{i}$ | 4.414(5) | 22.9(4) | 3.664(4) |
| R(2)...R(1)$^{ii}$ | 4.414(5) | 22.9(4) | 3.664(4) |
| C–H...ring(j) | H…R distance (Å) | C–H…R angle (°) | C…R distance (Å) |
| C11-H9A...R(2)$^{ii}$ | 2.95 | 141 | 3.751(9 |

[a] Symmetry code: (i) = -1+x,y,z; (ii) = 1+x,y,z; (iii) = 1-x,-y,-z.
[b] R(i)/R(j) denotes the ith/jth rings:
R(1) = C(2) C(3) C(4) C(5) C(6) C(7);
R(2) = C(13) C(14) C(15) C(16) C(17) C(18).

**Table S4**. Selected bond lengths (Å) and bond angles (°) of complex **2**

| | | | |
|---|---|---|---|
| Dy1 –O1 | 2.633(2) | O1 -Dy1-O2 | 63.04(6) |
| Dy1 –O2 | 2.3545(19) | O1 -Dy1-O3 | 121.12(7) |
| Dy1 –O3 | 2.373(2) | O1 -Dy1-O4 | 129.02(10) |
| Dy1 –O4 | 2.596(3) | O1 -Dy1 -O9 | 117.37(9) |
| Dy1 –O9 | 2.346(2) | O1 -Dy1 -O10 | 77.20(8) |
| Dy1 –O10 | 2.262(2) | O1 -Dy1 -O12 | 68.97(10) |
| Dy1 –O12 | 2.385(3) | O1 -Dy1 -O13 | 141.45(9) |
| Dy1 –O13 | 2.409(3) | O1 -Dy1 -O14 | 65.76(10) |
| Dy1 –O14 | 2.430(2) | O2 -Dy1 –O3 | 66.12(7) |
| Co1 –O2 | 1.9251(19) | O2 -Dy1 –O4 | 122.72(7) |
| Co1 –O3 | 1.914(2) | O2 -Dy1 –O9 | 72.39(7) |
| Co1 –O7 | 1.919(2) | O2 -Dy1 –O10 | 139.69(8) |
| Co1 –O8 | 1.886(2) | O2 -Dy1 –O12 | 91.48(8) |
| Co1 -N1 | 1.923(3) | O2 -Dy1 -O13 | 141.19(9) |
| Co1 -N2 | 1.917(2) | O2 -Dy1 -O14 | 73.79(8) |
| | | O3 -Dy1 –O4 | 62.75(7) |
| | | O3 -Dy1 –O9 | 70.66(7) |
| | | O3 -Dy1 –O10 | 138.95(8) |
| | | O3 -Dy1 –O12 | 139.67(9) |
| | | O3 -Dy1 –O13 | 97.21(8) |
| | | O3 -Dy1 –O14 | 73.36(8) |
| | | O4 -Dy1 –O9 | 111.39(8) |
| | | O4 -Dy1 –O10 | 77.18(8) |
| | | O4 -Dy1 –O12 | 145.29(9) |
| | | O4 -Dy1 –O13 | 70.21(10) |
| | | O4 -Dy1 –O14 | 68.53(9) |
| | | O9 -Dy1 –O10 | 137.38(8) |
| | | O9 -Dy1 -O12 | 70.70(9) |
| | | O9 -Dy1 -O13 | 68.97(9) |
| | | O9-Dy1 -O14 | 138.02(9) |
| | | O10 -Dy1 –O12 | 79.73(9) |
| | | O10-Dy1 -O13 | 76.04(9) |
| | | O10 -Dy1 -O14 | 84.52(9) |
| | | O12-Dy1 -O13 | 79.32(10) |
| | | O12 -Dy1 –O14 | 134.29(10) |
| | | O13 -Dy1 –O14 | 137.28(10) |
| | | O2 -Co1 -N1 | 90.64(9) |
| | | O2 -Co1 -N2 | 174.57(9) |
| | | O2 -Co1 -O3 | 84.41(8) |
| | | O2 -Co1 -O7 | 86.53(8) |
| | | O2 -Co1 -O8 | 92.78(9) |
| | | O3 -Co1 -O7 | 86.30(9) |
| | | O3 -Co1 -O8 | 91.97(9) |
| | | O3 -Co1 -N1 | 174.85(10) |
| | | O3 -Co1 -N2 | 90.17(10) |
| | | O7 -Co1 -N1 | 94.85(9) |
| | | O7 -Co1 -N2 | 92.98(9) |
| | | O7 -Co1 -O8 | 178.19(9) |
| | | O8 -Co1 - N1 | 86.83(10) |
| | | O8 -Co1 - N2 | 87.55(10) |
| | | N1 -Co1 -N2 | 94.79(11) |
| | | Dy1 -O2 -Co1 | 104.25(8) |
| | | Dy1 -O3 -Co1 | 103.91(9) |

**Table S5**. Hydrogen bonding interactions in **2** (Å, deg).

| D−H•••A | Distances (Å) | | | Angles (°) |
|---|---|---|---|---|
| | D−H | H•••A | D•••A | D−H•••A |
| O5 - H12•••O6 | 0.84 | 1.8200 | 2.652(4) | 171 |
| O12 - H57•••O15 | 0.75(4) | 2.09(4) | 2.837(7) | 172(5) |
| O12 - H58•••O3S | 0.94(5) | 1.78(5) | 2.695(6) | 166(4) |
| O13 - H64•••O11 | 1.05(7) | 1.76(7) | 2.617(4) | 136(6) |
| O14 - H66 •••O2S$^{i}$ | 0.83(5) | 1.94(5) | 2.685(5) | 150(4) |
| O14 - H70 ••• O7 | 0.82(6) | 2.08(6) | 2.835(4) | 153(7) |
| C1 - H7B ••• O10 | 0.98 | 2.42 | 3.098(4) | 125 |
| C9 - H9B •••O8 | 0.99 | 2.57 | 2.963(4) | 103 |
| C11 - H12A •••O8 | 0.99 | 2.55 | 2.956(4) | 104 |
| C3 - H16 •••O11$^{ii}$ | 0.95 | 2.51 | 3.448(4) | 171 |
| C19 - H18B •••O10 | 0.98 | 2.54 | 3.161(5) | 121 |
| C27 - H27A •••O3S$^{ii}$ | 0.98 | 2.45 | 3.265(8) | 141 |
| C27 - H27A •••O13$^{ii}$ | 0.98 | 2.56 | 3.092(7) | 114 |

Symmetry code: (i) = -1+x,y,z; (ii) = x,3/2-y,1/2+z.

**Table S6.** π–π interactions and C–H•••π interaction in complex **2**[c,d]

| Ring(i)...ring(j) | Distance of centroid(i) from ring(j) (Å) | Dihedral angle (i, j) (°) | Distance between the (i, j) ring centroids (Å) |
|---|---|---|---|
| R(1)...R(2)$^{i}$ | 3.6878(19) | 21.81 | 3.4239(13) |
| R(2)...R(1)$^{ii}$ | 3.9088(19) | 27.72 | 3.4603(13) |

[c] Symmetry code: (i) = 1-x,1-y,1-z; (ii) = -x,1-y,-z.
[d] R(i)/R(j) denotes the ith/jth rings:
R(1) = C(2) C(3) C(4) C(5) C(6) C(7);
R(2) = C(13) C(14) C(15) C(16) C(17) C(18).

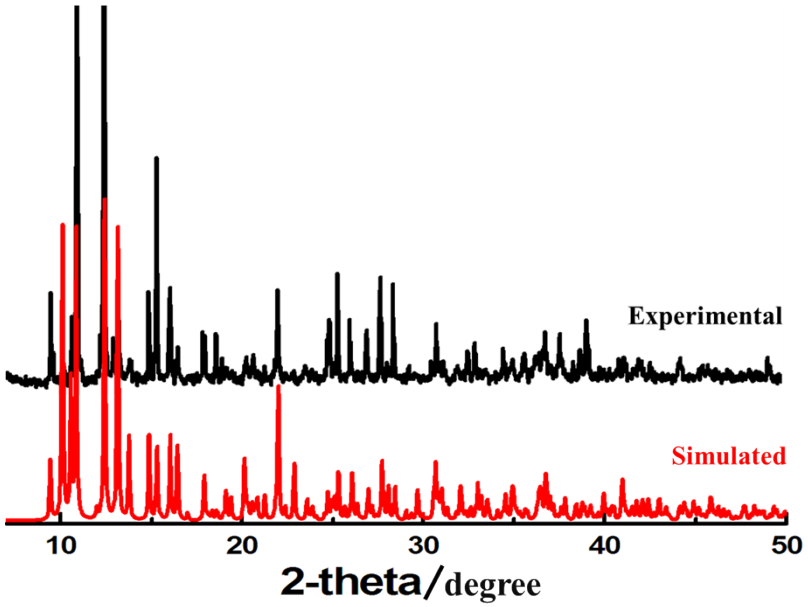


**Figure S6(a)**. The powder diffraction patterns confirming purity of **1**.

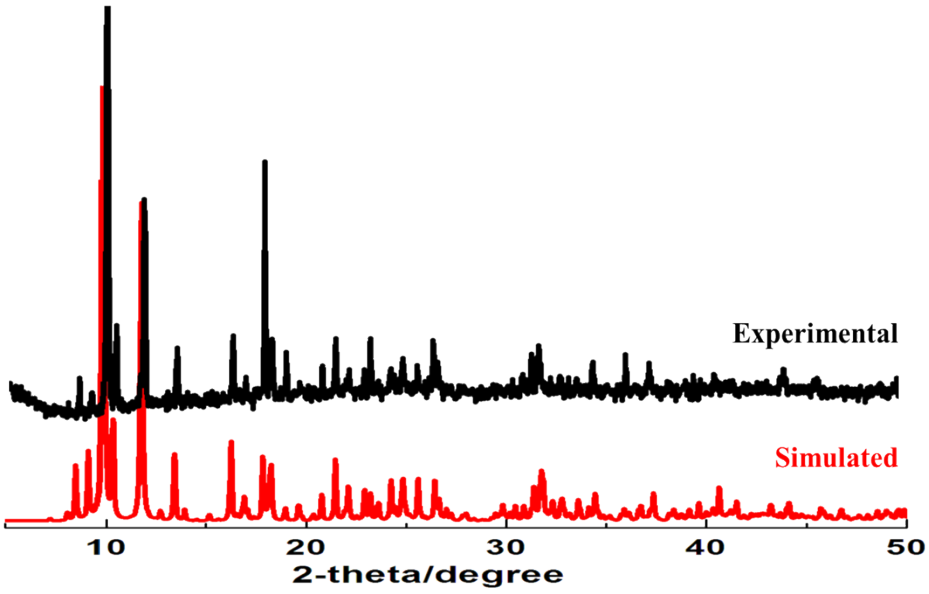


**Figure S6(b)**. The powder diffraction patterns confirming purity of **2**.

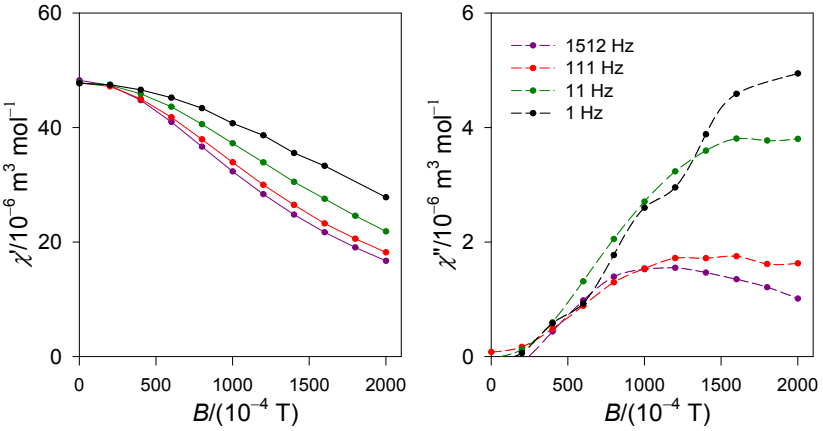


**Figure S7**. The in-phase $\chi'$ and out-of-phase $\chi''$ molar susceptibility (SI units) for **1** in dependence upon external magnetic field at $T = 2.0$ K. Lines serve as a guide for eyes.

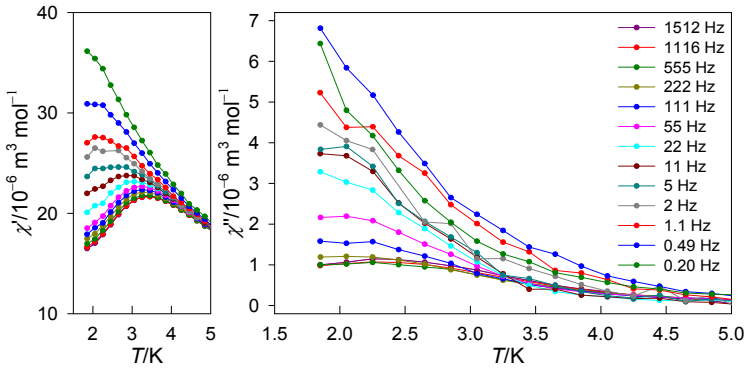


**Figure S8**. The AC susceptibility data for **1** at $B_{DC} = 0.2$ T. Left – temperature dependence of the in-phase molar susceptibility; right – temperature dependence of the out-of-phase molar susceptibility. Lines serve as a guide for eyes.

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**Table S7**. Parameters of the extended Debye model for **1** using data taken at $B_{DC}$ = 0.2 T. [a]

| | Low-frequency (LF) | | | | Intermediate frequency (IF) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $T$/K | $\chi_S$ | $\chi_{T1}$ | $\alpha_1$ | $\tau_1$ / s | $\chi_{T2}$ | $\alpha_2$ | $\tau_2$ / $10^{-3}$ s | $R(\chi')$/% | $R(\chi'')$/% |
| 1.85b | 16.7(4) | 28.9(24) | 0.00(8) | 0.528(38) | 40.7(8) | 0.33(7) | 17.9(52) | 1.3 | 2.0 |
| 2.05 | 17.1(3) | 27.2(16) | 0.00(6) | 0.440(28) | 38.1(5) | 0.29(5) | 15.4(30) | 0.91 | 3.0 |
| 2.25 | 17.6(3) | 27.8(17) | 0.07(7) | 0.383(31) | 37.1(5) | 0.30(7) | 11.3(27) | 0.92 | 2.5 |
| 2.45b | 19.0(3) | 28.1(11) | 0.09(5) | 0.349(23) | 34.7(4) | 0.20(7) | 7.69(158) | 0.56 | 2.9 |
| 2.65b | 19.9(2) | 27.8(9) | 0.12(5) | 0.289(18) | 32.9(3) | 0.28(6) | 5.98(111) | 0.42 | 3.3 |
| 2.85 | 20.7(2) | 27.3(10) | 0.18(6) | 0.293(26) | 31.2(3) | 0.30(10) | 4.91(121) | 0.45 | 3.8 |
| 3.05 | 21.4(2) | 26.5(7) | 0.13(6) | 0.272(21) | 29.5(2) | 0.30(10) | 4.34(108) | 0.32 | 4.8 |
| 3.25 | 21.7(2) | 25.5(5) | 0.05(4) | 0.298(16) | 27.7(1) | 0.30(10) | 3.16(60) | 0.32 | 4.6 |
| 3.45 | 21.5(5) | 24.8(8) | 0.10(8) | 0.309(32) | 26.5(2) | 0.29(22) | 1.38(70) | 0.50 | 6.7 |
| 3.65 | 21.3(3) | 24.1(4) | 0.10(5) | 0.308(19) | 25.4(12) | 0.30(15) | 1.26(47) | 0.17 | 7.8 |
| 3.85 | 21.0(5) | 22.9(7) | 0.00(9) | 0.329(37) | 24.1(17) | 0.30(27) | 1.15(93) | 0.52 | 4.5 |
| 4.05 | 20.6(3) | 22.1(3) | 0.02(5) | 0.336(23) | 23.1(2) | 0.30(16) | 1.04(52) | 0.24 | 3.8 |

[a] SI unit for the molar magnetic susceptibility [$10^{-6}$ m$^3$ mol$^{-1}$]. $R$ – discrepancy factor of the fit for dispersion $\chi'$ and absorption $\chi''$, respectively. Two components of the magnetic susceptibility:
a) in phase

$$\chi'(\omega) = \chi_S + (\chi_{T1} - \chi_S)\frac{1+(\omega\tau_1)^{1-\alpha_1}\sin(\pi\alpha_1/2)}{1+2(\omega\tau_1)^{1-\alpha_1}\sin(\pi\alpha_1/2)+(\omega\tau_1)^{2-2\alpha_1}} + (\chi_{T2} - \chi_{T1})\frac{1+(\omega\tau_2)^{1-\alpha_2}\sin(\pi\alpha_2/2)}{1+2(\omega\tau_2)^{1-\alpha_2}\sin(\pi\alpha_2/2)+(\omega\tau_2)^{2-2\alpha_2}} \quad \text{(S1)}$$

b) out of phase

$$\chi''(\omega) = (\chi_{T1} - \chi_S)\frac{(\omega\tau_1)^{1-\alpha_1}\cos(\pi\alpha_1/2)}{1+2(\omega\tau_1)^{1-\alpha_1}\sin(\pi\alpha_1/2)+(\omega\tau_1)^{2-2\alpha_1}} + (\chi_{T2} - \chi_{T1})\frac{(\omega\tau_2)^{1-\alpha_2}\cos(\pi\alpha_2/2)}{1+2(\omega\tau_2)^{1-\alpha_2}\sin(\pi\alpha_2/2)+(\omega\tau_2)^{2-2\alpha_2}} \quad \text{(S2)}$$

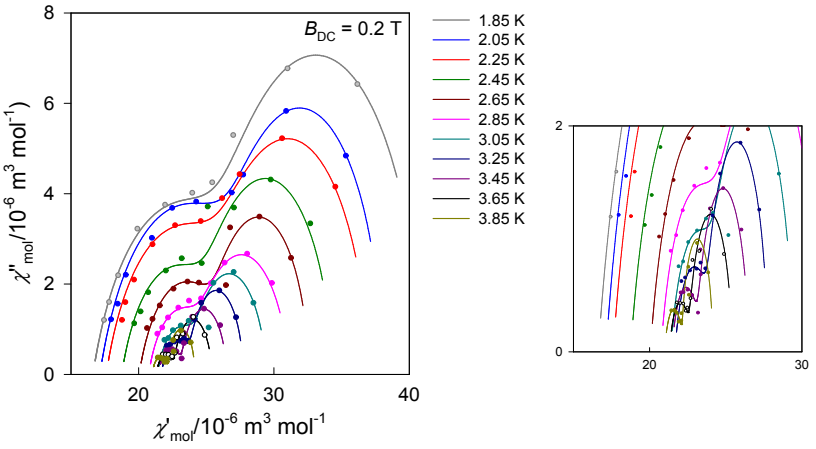


**Figure S9**. Zoomed Argand plot with experimental data and fitted lines for **1**.

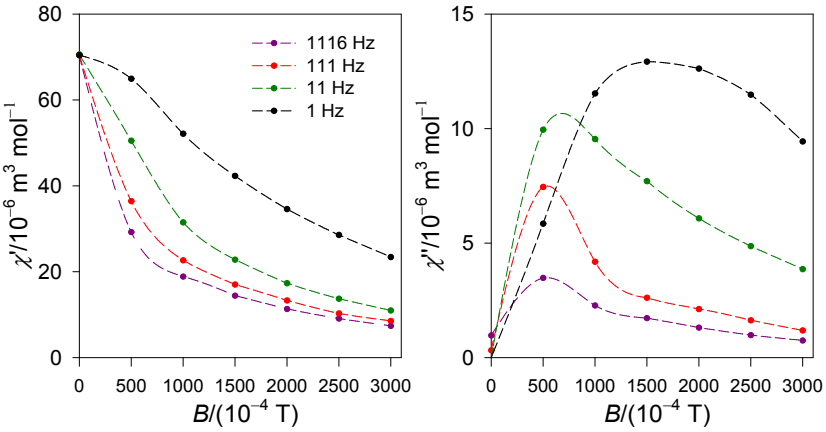


**Figure S10**. The in-phase $\chi'$ and out-of-phase $\chi''$ molar susceptibility (SI units) for **2** in dependence upon external magnetic field at $T$ = 2.0 K. Lines serve as a guide for eyes.

**Table S8**. Parameters of the extended Debye model for **2** at $B_{DC}$ = 0.2 T.

| $T$/K | $\chi_S$ | $\chi_T$ | $\alpha$ | $\tau$/s | $R(\chi')$/% | $R(\chi'')$/% |
|---|---|---|---|---|---|---|
| 1.9 | 10.9(3) | 66.6(12) | 0.44(1) | 0.268(19) | 2.3 | 6.7 |
| 2.3 | 11.3(2) | 58.1(8) | 0.44(1) | 0.158(9) | 1.9 | 6.9 |
| 2.7 | 11.5(3) | 50.6(7) | 0.45(1) | 0.055(6) | 2.1 | 7.7 |
| 3.1 | 11.2(3) | 45.0(7) | 0.47(2) | 0.066(5) | 2.2 | 8.4 |
| 3.5 | 10.7(3) | 40.3(5) | 0.48(2) | 0.041(3) | 2.2 | 8.7 |
| 3.9 | 10.2(2) | 37.6(3) | 0.48(1) | 0.029(1) | 0.8 | 7.4 |
| 4.3 | 9.9(2) | 33.8(2) | 0.46(1) | 0.0159(7) | 1.3 | 7.7 |
| 4.7 | 10.3(2) | 30.4(2) | 0.40(1) | 0.0107(5) | 1.4 | 9.3 |
| 5.1 | 10.6(2) | 27.9(1) | 0.33(1) | 0.0080(3) | 1.3 | 10.1 |
| 5.5 | 10.5(1) | 26.1(1) | 0.29(1) | 0.0064(2) | 0.97 | 8.5 |
| 5.9 | 10.1(1) | 24.4(1) | 0.27(1) | 0.0047(1) | 1.00 | 9.2 |
| 6.7 | 9.61(8) | 21.6(1) | 0.16(1) | 0.0026(1) | 0.72 | 6.2 |
| 7.1 | 9.27(6) | 20.6(1) | 0.13(1) | 0.00199(3) | 0.52 | 4.6 |
| 7.5 | 8.92(6) | 19.6(1) | 0.12(1) | 0.00149(2) | 0.51 | 4.0 |
| 8.7 | 8.21(6) | 17.1(1) | 0.07(1) | 0.00066(1) | 0.49 | 3.1 |
| 9.9 | 7.68(5) | 15.2(1) | 0.06(1) | 0.00028(0) | 0.13 | 3.1 |

[a] SI unit for the molar magnetic susceptibility [$10^{-6}$ m$^3$ mol$^{-1}$]. $R$ – discrepancy factor of the fit for dispersion $\chi'$ and absorption $\chi''$, respectively.

**Table S9**. Calculated energy levels by DFT (UHF) truncated after 200 levels

| | | Spin up | | Spin down |
|---|---|---|---|---|
| NO | OCC | E(eV) | OCC | E(eV) |
| 0.000 | 1.000 | -57143.380 | 1.000 | -57143.380 |
| 1.000 | 1.000 | -9095.699 | 1.000 | -9095.684 |
| 2.000 | 1.000 | -8992.068 | 1.000 | -8992.063 |
| 3.000 | 1.000 | -8064.062 | 1.000 | -8064.052 |
| 4.000 | 1.000 | -8064.012 | 1.000 | -8064.003 |
| 5.000 | 1.000 | -8063.986 | 1.000 | -8063.977 |
| 6.000 | 1.000 | -2026.624 | 1.000 | -2024.447 |
| 7.000 | 1.000 | -1712.892 | 1.000 | -1710.566 |
| 8.000 | 1.000 | -1712.588 | 1.000 | -1710.351 |
| 9.000 | 1.000 | -1712.431 | 1.000 | -1710.236 |
| 10.000 | 1.000 | -1310.176 | 1.000 | -1308.055 |
| 11.000 | 1.000 | -1310.002 | 1.000 | -1307.905 |
| 12.000 | 1.000 | -1309.670 | 1.000 | -1307.857 |
| 13.000 | 1.000 | -1309.610 | 1.000 | -1307.787 |
| 14.000 | 1.000 | -1309.565 | 1.000 | -1307.772 |
| 15.000 | 1.000 | -1083.957 | 1.000 | -1083.390 |
| 16.000 | 1.000 | -935.877 | 1.000 | -935.233 |
| 17.000 | 1.000 | -935.811 | 1.000 | -935.202 |
| 18.000 | 1.000 | -935.135 | 1.000 | -934.977 |
| 19.000 | 1.000 | -523.167 | 1.000 | -523.168 |
| 20.000 | 1.000 | -522.896 | 1.000 | -522.897 |
| 21.000 | 1.000 | -522.197 | 1.000 | -522.199 |
| 22.000 | 1.000 | -522.116 | 1.000 | -522.117 |
| 23.000 | 1.000 | -522.066 | 1.000 | -521.998 |
| 24.000 | 1.000 | -521.756 | 1.000 | -521.756 |
| 25.000 | 1.000 | -521.732 | 1.000 | -521.732 |
| 26.000 | 1.000 | -521.656 | 1.000 | -521.656 |
| 27.000 | 1.000 | -521.605 | 1.000 | -521.536 |
| 28.000 | 1.000 | -521.336 | 1.000 | -521.336 |
| 29.000 | 1.000 | -521.082 | 1.000 | -521.081 |
| 30.000 | 1.000 | -520.656 | 1.000 | -520.658 |
| 31.000 | 1.000 | -520.636 | 1.000 | -520.634 |
| 32.000 | 1.000 | -520.566 | 1.000 | -520.565 |
| 33.000 | 1.000 | -518.436 | 1.000 | -518.435 |
| 34.000 | 1.000 | -412.758 | 1.000 | -407.477 |
| 35.000 | 1.000 | -397.166 | 1.000 | -397.166 |
| 36.000 | 1.000 | -396.097 | 1.000 | -396.097 |
| 37.000 | 1.000 | -396.022 | 1.000 | -396.022 |
| 38.000 | 1.000 | -392.277 | 1.000 | -392.205 |
| 39.000 | 1.000 | -391.964 | 1.000 | -391.880 |
| 40.000 | 1.000 | -309.222 | 1.000 | -303.600 |
| 41.000 | 1.000 | -308.740 | 1.000 | -303.339 |
| 42.000 | 1.000 | -308.486 | 1.000 | -303.193 |
| 43.000 | 1.000 | -279.814 | 1.000 | -279.817 |
| 44.000 | 1.000 | -279.793 | 1.000 | -279.800 |
| 45.000 | 1.000 | -279.711 | 1.000 | -279.711 |
| 46.000 | 1.000 | -279.693 | 1.000 | -279.697 |
| 47.000 | 1.000 | -279.580 | 1.000 | -279.575 |
| 48.000 | 1.000 | -279.476 | 1.000 | -279.477 |
| 49.000 | 1.000 | -279.440 | 1.000 | -279.435 |

| | | | | |
|---|---|---|---|---|
| 50.000 | 1.000 | -279.082 | 1.000 | -279.081 |
| 51.000 | 1.000 | -278.457 | 1.000 | -278.455 |
| 52.000 | 1.000 | -278.241 | 1.000 | -278.237 |
| 53.000 | 1.000 | -278.210 | 1.000 | -278.208 |
| 54.000 | 1.000 | -278.065 | 1.000 | -278.065 |
| 55.000 | 1.000 | -277.798 | 1.000 | -277.799 |
| 56.000 | 1.000 | -277.586 | 1.000 | -277.586 |
| 57.000 | 1.000 | -277.475 | 1.000 | -277.476 |
| 58.000 | 1.000 | -277.459 | 1.000 | -277.459 |
| 59.000 | 1.000 | -277.395 | 1.000 | -277.395 |
| 60.000 | 1.000 | -277.366 | 1.000 | -277.366 |
| 61.000 | 1.000 | -277.175 | 1.000 | -277.174 |
| 62.000 | 1.000 | -168.173 | 1.000 | -161.859 |
| 63.000 | 1.000 | -167.811 | 1.000 | -161.366 |
| 64.000 | 1.000 | -167.024 | 1.000 | -161.285 |
| 65.000 | 1.000 | -166.862 | 1.000 | -161.152 |
| 66.000 | 1.000 | -166.815 | 1.000 | -161.131 |
| 67.000 | 1.000 | -124.325 | 1.000 | -123.134 |
| 68.000 | 1.000 | -81.061 | 1.000 | -79.346 |
| 69.000 | 1.000 | -80.936 | 1.000 | -79.328 |
| 70.000 | 1.000 | -79.543 | 1.000 | -79.135 |
| 71.000 | 1.000 | -54.979 | 1.000 | -52.667 |
| 72.000 | 1.000 | -37.935 | 1.000 | -37.931 |
| 73.000 | 1.000 | -35.066 | 1.000 | -35.061 |
| 74.000 | 1.000 | -33.693 | 1.000 | -33.687 |
| 75.000 | 1.000 | -31.406 | 1.000 | -31.399 |
| 76.000 | 1.000 | -30.630 | 1.000 | -30.629 |
| 77.000 | 1.000 | -30.043 | 1.000 | -29.769 |
| 78.000 | 1.000 | -29.852 | 1.000 | -29.304 |
| 79.000 | 1.000 | -29.720 | 1.000 | -29.190 |
| 80.000 | 1.000 | -29.309 | 1.000 | -28.998 |
| 81.000 | 1.000 | -29.055 | 1.000 | -28.884 |
| 82.000 | 1.000 | -28.886 | 1.000 | -28.492 |
| 83.000 | 1.000 | -28.741 | 1.000 | -28.195 |
| 84.000 | 1.000 | -28.480 | 1.000 | -27.890 |
| 85.000 | 1.000 | -28.305 | 1.000 | -27.594 |
| 86.000 | 1.000 | -27.965 | 1.000 | -27.561 |
| 87.000 | 1.000 | -27.636 | 1.000 | -27.478 |
| 88.000 | 1.000 | -27.553 | 1.000 | -27.142 |
| 89.000 | 1.000 | -27.062 | 1.000 | -26.954 |
| 90.000 | 1.000 | -25.719 | 1.000 | -25.634 |
| 91.000 | 1.000 | -25.369 | 1.000 | -25.330 |
| 92.000 | 1.000 | -24.462 | 1.000 | -24.444 |
| 93.000 | 1.000 | -24.239 | 1.000 | -24.225 |
| 94.000 | 1.000 | -23.097 | 1.000 | -23.084 |
| 95.000 | 1.000 | -21.970 | 1.000 | -21.963 |
| 96.000 | 1.000 | -21.654 | 1.000 | -21.644 |
| 97.000 | 1.000 | -21.475 | 1.000 | -21.461 |
| 98.000 | 1.000 | -21.409 | 1.000 | -21.386 |
| 99.000 | 1.000 | -20.838 | 1.000 | -20.821 |
| 100.000 | 1.000 | -20.534 | 1.000 | -20.529 |
| 101.000 | 1.000 | -19.986 | 1.000 | -19.982 |
| 102.000 | 1.000 | -19.397 | 1.000 | -19.380 |
| 103.000 | 1.000 | -18.845 | 1.000 | -18.790 |
| 104.000 | 1.000 | -18.448 | 1.000 | -18.413 |
| 105.000 | 1.000 | -17.892 | 1.000 | -17.863 |
| 106.000 | 1.000 | -17.663 | 1.000 | -17.641 |

| | | | | |
|---|---|---|---|---|
| 107.000 | 1.000 | -17.438 | 1.000 | -17.406 |
| 108.000 | 1.000 | -17.134 | 1.000 | -17.104 |
| 109.000 | 1.000 | -16.766 | 1.000 | -16.762 |
| 110.000 | 1.000 | -16.630 | 1.000 | -16.607 |
| 111.000 | 1.000 | -16.274 | 1.000 | -16.257 |
| 112.000 | 1.000 | -16.061 | 1.000 | -16.025 |
| 113.000 | 1.000 | -15.851 | 1.000 | -15.818 |
| 114.000 | 1.000 | -15.734 | 1.000 | -15.713 |
| 115.000 | 1.000 | -15.540 | 1.000 | -15.517 |
| 116.000 | 1.000 | -15.368 | 1.000 | -15.336 |
| 117.000 | 1.000 | -15.256 | 1.000 | -15.240 |
| 118.000 | 1.000 | -15.168 | 1.000 | -15.110 |
| 119.000 | 1.000 | -15.096 | 1.000 | -15.078 |
| 120.000 | 1.000 | -14.957 | 1.000 | -14.910 |
| 121.000 | 1.000 | -14.805 | 1.000 | -14.771 |
| 122.000 | 1.000 | -14.656 | 1.000 | -14.633 |
| 123.000 | 1.000 | -14.575 | 1.000 | -14.551 |
| 124.000 | 1.000 | -14.504 | 1.000 | -14.459 |
| 125.000 | 1.000 | -14.451 | 1.000 | -14.421 |
| 126.000 | 1.000 | -14.343 | 1.000 | -14.320 |
| 127.000 | 1.000 | -14.144 | 1.000 | -14.122 |
| 128.000 | 1.000 | -14.087 | 1.000 | -14.031 |
| 129.000 | 1.000 | -14.046 | 1.000 | -13.960 |
| 130.000 | 1.000 | -13.969 | 1.000 | -13.947 |
| 131.000 | 1.000 | -13.849 | 1.000 | -13.829 |
| 132.000 | 1.000 | -13.832 | 1.000 | -13.809 |
| 133.000 | 1.000 | -13.707 | 1.000 | -13.688 |
| 134.000 | 1.000 | -13.613 | 1.000 | -13.553 |
| 135.000 | 1.000 | -13.555 | 1.000 | -13.418 |
| 136.000 | 1.000 | -13.446 | 1.000 | -13.291 |
| 137.000 | 1.000 | -13.298 | 1.000 | -13.238 |
| 138.000 | 1.000 | -13.238 | 1.000 | -13.054 |
| 139.000 | 1.000 | -12.872 | 1.000 | -12.841 |
| 140.000 | 1.000 | -12.786 | 1.000 | -12.728 |
| 141.000 | 1.000 | -12.662 | 1.000 | -12.593 |
| 142.000 | 1.000 | -12.604 | 1.000 | -12.558 |
| 143.000 | 1.000 | -12.571 | 1.000 | -12.524 |
| 144.000 | 1.000 | -12.264 | 1.000 | -12.185 |
| 145.000 | 1.000 | -12.202 | 1.000 | -11.807 |
| 146.000 | 1.000 | -12.165 | 1.000 | -11.759 |
| 147.000 | 1.000 | -12.134 | 1.000 | -11.617 |
| 148.000 | 1.000 | -12.055 | 1.000 | -11.531 |
| 149.000 | 1.000 | -11.939 | 1.000 | -11.439 |
| 150.000 | 1.000 | -11.869 | 1.000 | -11.289 |
| 151.000 | 1.000 | -11.685 | 1.000 | -11.015 |
| 152.000 | 1.000 | -11.660 | 1.000 | -10.696 |
| 153.000 | 1.000 | -11.599 | 1.000 | -10.533 |
| 154.000 | 1.000 | -11.505 | 1.000 | -10.517 |
| 155.000 | 1.000 | -11.398 | 1.000 | -10.448 |
| 156.000 | 1.000 | -11.382 | 1.000 | -10.341 |
| 157.000 | 1.000 | -11.214 | 1.000 | -10.138 |
| 158.000 | 1.000 | -11.094 | 1.000 | -10.064 |
| 159.000 | 1.000 | -10.939 | 1.000 | -9.900 |
| 160.000 | 1.000 | -10.798 | 1.000 | -9.870 |
| 161.000 | 1.000 | -10.715 | 1.000 | -9.846 |
| 162.000 | 1.000 | -10.559 | 1.000 | -9.645 |
| 163.000 | 1.000 | -10.409 | 1.000 | -9.531 |

| | | | | |
|---|---|---|---|---|
| 164.000 | 1.000 | -10.342 | 1.000 | -9.388 |
| 165.000 | 1.000 | -10.261 | 1.000 | -9.287 |
| 166.000 | 1.000 | -10.133 | 1.000 | -9.077 |
| 167.000 | 1.000 | -9.987 | 1.000 | -8.872 |
| 168.000 | 1.000 | -9.920 | 1.000 | -8.818 |
| 169.000 | 1.000 | -9.786 | 1.000 | -8.704 |
| 170.000 | 1.000 | -9.665 | 1.000 | -8.673 |
| 171.000 | 1.000 | -9.607 | 1.000 | -8.505 |
| 172.000 | 1.000 | -9.406 | 1.000 | -8.495 |
| 173.000 | 1.000 | -9.209 | 1.000 | -8.343 |
| 174.000 | 1.000 | -9.046 | 1.000 | -8.324 |
| 175.000 | 1.000 | -8.824 | 1.000 | -8.231 |
| 176.000 | 1.000 | -8.764 | 1.000 | -8.068 |
| 177.000 | 1.000 | -8.684 | 1.000 | -7.976 |
| 178.000 | 1.000 | -8.645 | 1.000 | -7.847 |
| 179.000 | 1.000 | -8.552 | 1.000 | -7.742 |
| 180.000 | 1.000 | -8.461 | 1.000 | -7.563 |
| 181.000 | 1.000 | -8.293 | 1.000 | -7.486 |
| 182.000 | 1.000 | -8.118 | 1.000 | -7.413 |
| 183.000 | 1.000 | -7.966 | 1.000 | -7.208 |
| 184.000 | 1.000 | -7.768 | 1.000 | -7.099 |
| 185.000 | 1.000 | -7.604 | 1.000 | -6.705 |
| 186.000 | 1.000 | -7.494 | 1.000 | -6.553 |
| 187.000 | 1.000 | -7.442 | 1.000 | -6.282 |
| 188.000 | 1.000 | -7.379 | 1.000 | -5.541 |
| 189.000 | 1.000 | -7.252 | 1.000 | -4.767 |
| 190.000 | 1.000 | -7.104 | 0.000 | -3.160 |
| 191.000 | 1.000 | -6.737 | 0.000 | -2.748 |
| 192.000 | 1.000 | -6.559 | 0.000 | -2.058 |
| 193.000 | 1.000 | -6.263 | 0.000 | -1.925 |
| 194.000 | 1.000 | -5.547 | 0.000 | -1.815 |
| 195.000 | 1.000 | -4.771 | 0.000 | -1.458 |
| 196.000 | 0.000 | -2.822 | 0.000 | -1.362 |
| 197.000 | 0.000 | -2.115 | 0.000 | -1.083 |
| 198.000 | 0.000 | -1.457 | 0.000 | -0.687 |
| 199.000 | 0.000 | -0.696 | 0.000 | -0.655 |
| 200.000 | 0.000 | -0.475 | 0.000 | -0.439 |