# Electronic Supplementary Information

# Modulate the relaxation dynamics of linear-shaped tetranuclear rare-earth clusters through utilizing different solvents

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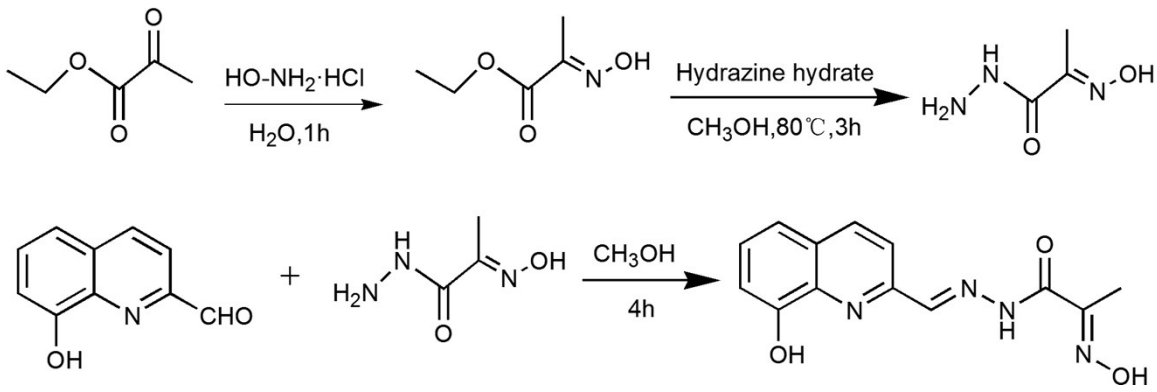


**Scheme S1.** The synthesis route for HL.

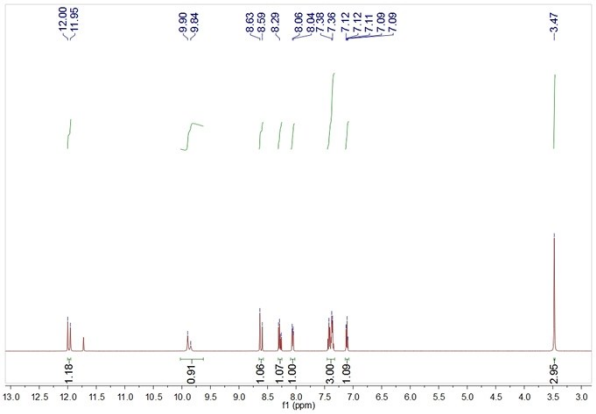

**Fig S1.** The $^{1}$H NMR spectrum of 2-[(2-(hydroxyimino)-propanehydrazide)methyl]-8-hydroxyquinoline.

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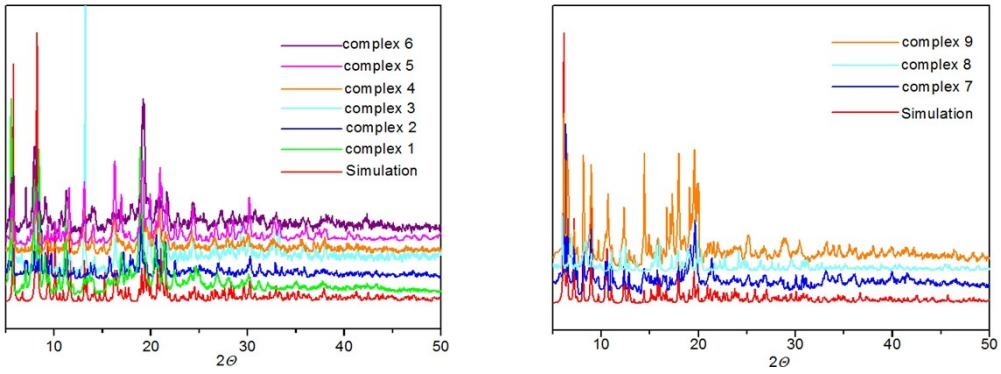


**Fig S2.** The experimental and simulated PXRD patterns of complexes **1**−**9**.

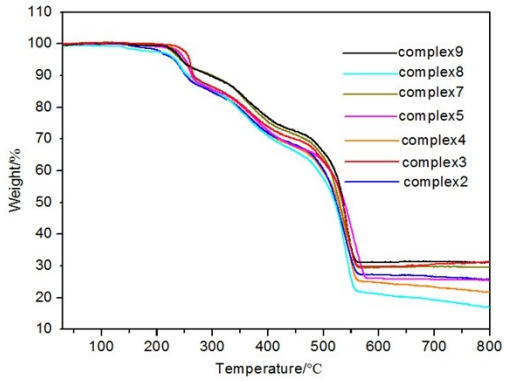


**Fig S3.** TG curves of complexes.

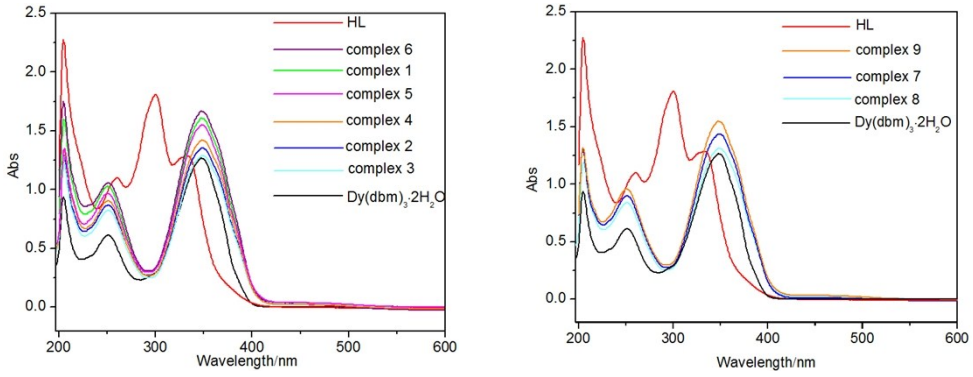


**Fig S4.** UV-vis absorption spectra of complexes **1**−**9**, HL and $Dy(dbm)_3 \cdot 2H_2O$.

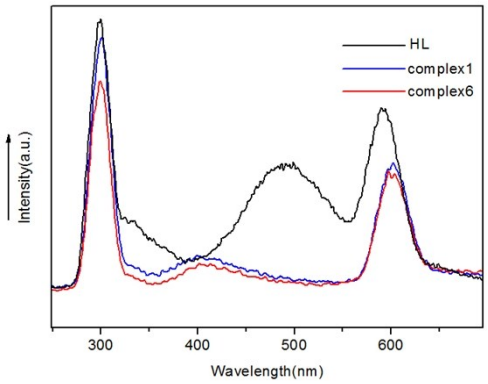


**Fig S5.** The luminescent spectra of HL, complexes **1** and **6**.

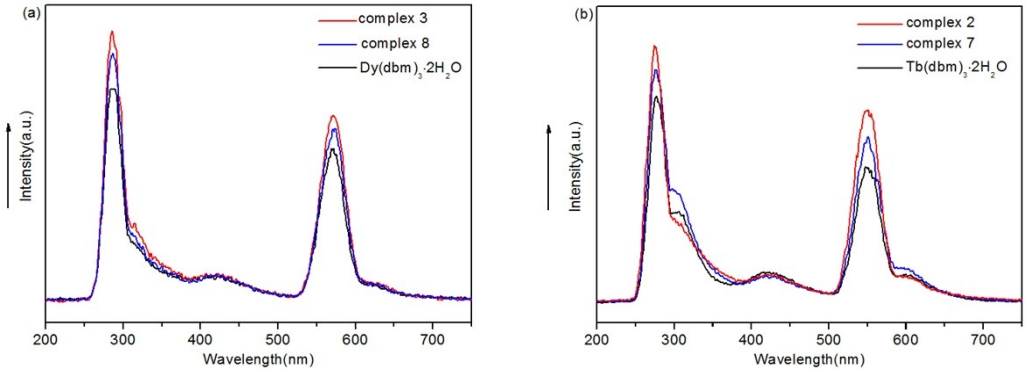


**Fig S6.** (a) The luminescent spectra of $Dy(dbm)_3 \cdot 2H_2O$, complexese **3** and **8**; (b) The luminescent spectra of $Tb(dbm)_3 \cdot 2H_2O$, complex **2** and **7**.

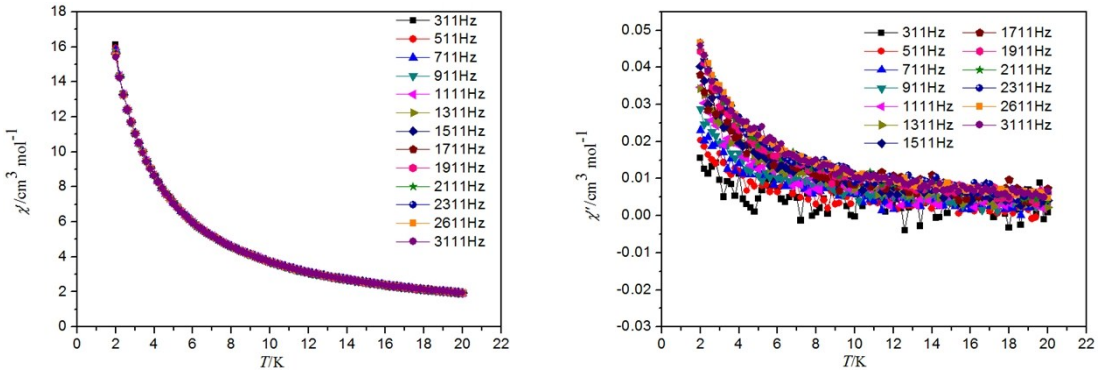


**Fig S7.** Temperature dependence of the *ac* susceptibility for complex **2** as a function of the temperature below 20 K under an oscillating *ac* field of 3 Oe.

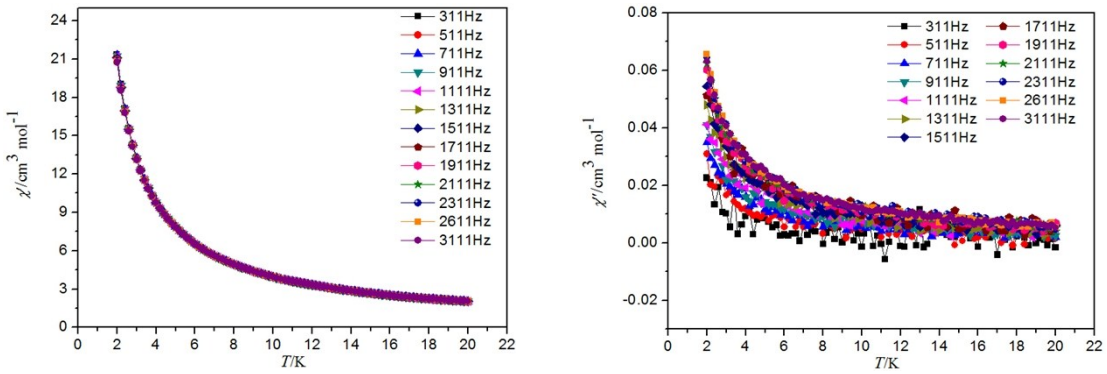


**Fig S8.** Temperature dependence of the *ac* susceptibility for complex **7** as a function of the temperature below 20 K under an oscillating *ac* field of 3 Oe.

**Table S1.** Selected bond lengths and angles for complexes **1**–**9**

| Complex | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| RE1–O4 | 2.288(4) | 2.316(8) | 2.280(2) | 2.294(3) | 2.261(2) | 2.222(8) | 2.303(5) | 2.3165(16) | 2.2754(15) |
| RE1–O5 | 2.299(4) | 2.329(8) | 2.307(2) | 2.306(3) | 2.289(2) | 2.260(8) | 2.304(5) | 2.3272(15) | 2.2843(15) |
| RE1–O2 | 2.300(4) | 2.312(8) | 2.338(2) | 2.313(3) | 2.318(2) | 2.286(9) | 2.352(5) | 2.3082(15) | 2.3348(15) |
| RE1–O12 | 2.336(4) | 2.335(9) | 2.356(2) | 2.343(3) | 2.344(2) | 2.307(8) | 2.460(5) | 2.4215(16) | 2.4328(16) |
| RE1–O1 | 2.341(3) | 2.357(7) | 2.386(2) | 2.343(3) | 2.367(2) | 2.342(8) | 2.400(5) | 2.3573(15) | 2.3704(15) |
| RE1–O1#1 | 2.367(3) | 2.370(7) | 2.3759(19) | 2.366(3) | 2.357(2) | 2.341(8) | 2.368(5) | 2.4392(15) | 2.3535(15) |
| RE1–N1 | 2.441(4) | 2.467(9) | 2.471(2) | 2.448(4) | 2.448(3) | 2.435(10) | 2.461(6) | 2.4665(18) | 2.4479(17) |
| RE1–N2 | 2.535(4) | 2.569(9) | 2.532(2) | 2.527(4) | 2.516(3) | 2.506(9) | 2.544(7) | 2.5430(18) | 2.5121(18) |
| RE1–RE1#1 | 3.8112(9) | 3.8600(10) | 3.8392(4) | 3.8210(4) | 3.8165(3) | 3.7777(11) | 3.8894(8) | 3.8277(4) | 3.8519(2) |
| RE2–O7 | 2.264(4) | 2.293(9) | 2.325(2) | 2.275(3) | 2.311(3) | 2.270(10) | 2.319(6) | 2.3214(16) | 2.2949(16) |
| RE2–O8 | 2.298(3) | 2.310(8) | 2.315(2) | 2.311(3) | 2.293(2) | 2.258(8) | 2.288(6) | 2.2933(16) | 2.2673(17) |
| RE2–O11 | 2.303(4) | 2.311(8) | 2.302(2) | 2.303(3) | 2.284(2) | 2.242(8) | 2.351(5) | 2.3201(15) | 2.3179(16) |
| RE2–O10 | 2.313(4) | 2.336(9) | 2.356(2) | 2.316(3) | 2.349(3) | 2.298(9) | 2.312(5) | 2.2999(15) | 2.2915(16) |
| RE2–O6 | 2.318(4) | 2.349(8) | 2.304(2) | 2.329(3) | 2.285(2) | 2.274(9) | 2.326(5) | 2.2954(15) | 2.3040(16) |
| RE2–O9 | 2.383(3) | 2.413(8) | 2.348(2) | 2.396(3) | 2.334(2) | 2.300(9) | 2.436(6) | 2.3514(15) | 2.4151(16) |
| RE2–N4 | 2.534(5) | 2.555(10) | 2.532(3) | 2.529(4) | 2.513(3) | 2.477(10) | 2.521(7) | 2.5629(19) | 2.5024(19) |
| RE2–N3 | 2.545(4) | 2.575(9) | 2.540(2) | 2.539(4) | 2.520(3) | 2.479(10) | 2.563(7) | 2.5872(18) | 2.5445(18) |
| O4-RE1-O5 | 71.94(13) | 71.2(3) | 72.58(7) | 72.32(11) | 73.37(8) | 73.7(3) | 72.69(19) | 72.76(6) | 73.08(6) |
| O4-RE1-O2 | 90.87(13) | 89.7(3) | 96.26(8) | 90.59(11) | 96.86(9) | 96.0(3) | 89.9(2) | 89.11(6) | 90.34(6) |
| O5-RE1-O2 | 79.85(13) | 79.7(3) | 82.58(7) | 79.23(11) | 81.64(8) | 80.8(3) | 84.92(19) | 86.81(5) | 83.94(6) |
| O4-RE1-O12 | 141.77(13) | 142.8(3) | 140.71(7) | 142.03(12) | 140.37(8) | 140.4(3) | 146.61(19) | 143.76(5) | 146.55(6) |
| O5-RE1-O12 | 144.57(13) | 143.7(3) | 145.83(7) | 143.39(12) | 145.36(8) | 144.6(3) | 138.02(19) | 143.47(5) | 137.69(6) |
| O2-RE1-O12 | 87.55(15) | 86.7(3) | 85.26(8) | 86.75(13) | 85.44(9) | 85.2(3) | 82.22(18) | 93.10(6) | 82.50(6) |
| O4-RE1-O1 | 93.16(12) | 94.5(3) | 88.89(7) | 93.61(11) | 88.67(9) | 90.0(3) | 91.58(19) | 104.01(5) | 91.82(6) |
| O5-RE1-O1 | 89.06(12) | 90.6(3) | 88.29(7) | 89.59(10) | 88.05(8) | 87.9(3) | 83.93(19) | 89.04(5) | 83.84(5) |
| O2-RE1-O1 | 166.40(12) | 167.6(3) | 167.65(7) | 166.26(10) | 166.34(8) | 165.2(3) | 167.75(18) | 164.40(5) | 166.39(5) |
| O12-RE1-O1 | 97.20(13) | 96.8(3) | 97.87(7) | 97.83(12) | 98.26(8) | 98.8(3) | 102.85(18) | 81.37(5) | 102.72(5) |
| O4-RE1-O1#1 | 141.97(12) | 141.3(3) | 142.13(7) | 142.26(11) | 142.17(8) | 142.2(3) | 144.14(18) | 144.40(5) | 144.39(6) |
| O5-RE1-O1#1 | 73.02(12) | 73.4(3) | 74.12(7) | 73.07(10) | 73.64(8) | 72.4(3) | 74.56(18) | 71.67(5) | 74.31(5) |
| O2-RE1-O1#1 | 97.13(12) | 99.1(3) | 96.85(7) | 97.35(10) | 96.17(8) | 94.9(3) | 101.38(18) | 90.29(5) | 100.11(5) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| O12-RE1-O1#1 | 75.92(12) | 75.7(3) | 75.81(7) | 75.47(11) | 76.00(8) | 76.6(3) | 69.17(18) | 71.80(5) | 68.99(5) |
| O1-RE1-O1#1 | 71.90(13) | 70.5(3) | 72.54(8) | 71.52(11) | 72.21(9) | 72.5(3) | 70.70(19) | 74.13(6) | 70.75(6) |
| O7-RE2-O8 | 91.27(14) | 88.6(3) | 82.70(8) | 90.14(12) | 83.51(9) | 83.5(3) | 97.0(2) | 85.58(6) | 96.55(6) |
| O7-RE2-O11 | 147.93(14) | 147.1(3) | 143.53(8) | 147.62(12) | 144.37(9) | 143.6(3) | 152.46(19) | 142.83(5) | 152.21(6) |
| O8-RE2-O11 | 83.70(13) | 84.5(3) | 77.00(8) | 83.76(11) | 76.39(8) | 76.4(3) | 76.2(2) | 75.98(6) | 75.84(6) |
| O7-RE2-O10 | 139.39(14) | 140.6(3) | 143.37(9) | 139.63(12) | 142.17(9) | 142.3(4) | 135.6(2) | 145.12(5) | 135.34(6) |
| O8-RE2-O10 | 103.46(14) | 105.6(3) | 100.96(8) | 104.08(12) | 102.11(9) | 102.2(3) | 93.0(2) | 107.13(6) | 93.94(6) |
| O11-RE2-O10 | 72.17(13) | 71.9(3) | 71.08(8) | 72.39(11) | 71.75(9) | 72.5(3) | 71.88(19) | 71.93(5) | 72.35(6) |
| O7-RE2-O6 | 73.02(14) | 72.8(3) | 71.92(8) | 73.07(12) | 72.55(9) | 72.7(4) | 71.74(19) | 71.71(5) | 72.38(6) |
| O8-RE2-O6 | 74.81(13) | 73.8(3) | 79.57(8) | 74.50(11) | 78.37(9) | 79.2(3) | 85.3(2) | 82.03(6) | 83.92(6) |
| O11-RE2-O6 | 75.10(13) | 74.4(3) | 74.80(8) | 74.66(12) | 74.75(9) | 73.9(3) | 81.04(18) | 73.93(6) | 80.19(6) |
| O10-RE2-O6 | 147.20(14) | 146.2(3) | 144.72(8) | 146.95(11) | 145.27(9) | 145.0(3) | 152.45(19) | 140.96(5) | 152.09(6) |
| O7-RE2-O9 | 75.73(14) | 75.6(3) | 74.29(9) | 75.41(12) | 73.77(10) | 74.5(4) | 70.81(19) | 75.02(6) | 70.72(6) |
| O8-RE2-O9 | 71.04(13) | 71.0(3) | 72.11(8) | 71.37(11) | 72.67(8) | 72.8(3) | 71.5(2) | 72.47(6) | 72.01(6) |
| O11-RE2-O9 | 130.94(13) | 131.1(3) | 125.67(8) | 131.14(11) | 125.59(9) | 125.8(3) | 129.18(18) | 127.03(6) | 129.09(6) |
| O10-RE2-O9 | 73.86(13) | 74.9(3) | 72.38(9) | 73.91(11) | 72.48(9) | 71.9(4) | 71.76(19) | 78.15(5) | 71.67(6) |
| O6-RE2-O9 | 132.50(13) | 132.5(3) | 138.05(8) | 132.81(11) | 137.44(9) | 138.7(3) | 132.50(19) | 139.22(6) | 132.63(6) |

symmetry transformations used to generate equivalent atoms: #1 -x+1, -y+1, -z+1.

**Table S2.** The parameters obtained from Cole-Cole plots using the Debye model.

| Slow Relaxation (SR) | | | |
|---|---|---|---|
| $T$ / K | $\chi_1$ | $\chi_2$ | $\alpha$ |
| 2 | 3.11053 | 11.38135 | 0.39272 |
| 3 | 2.95191 | 8.15161 | 0.32036 |
| 4 | 2.63245 | 6.56515 | 0.28281 |
| 5 | 2.30308 | 5.54867 | 0.27096 |
| 6 | 2.04253 | 4.65953 | 0.24435 |
| 7 | 1.88189 | 4.02818 | 0.21125 |
| 8 | 1.74185 | 3.67406 | 0.18438 |
| 9 | 1.66481 | 3.21445 | 0.11875 |
| 10 | 1.49129 | 2.94716 | 0.15951 |
| 11 | 1.42416 | 2.68253 | 0.12803 |

[a] Fitting function

y = 0.5*($\chi_1$-$\chi_2$)/tan((1-$\alpha$)*1.5707)+sqrt((x-$\chi_1$)*($\chi_2$-x)+0.25*($\chi_2$-$\chi_1$)^2/(tan((1-$\alpha$)*1.5707))^2)