Modulating magnetization dynamics of four phenoxo-O bridged Dy$_2$ complexes based on schiff base derived from 8-hydroxyquinoline

Dong-Fang Wu,$^a$ Hai-Yun Shen,$^a$ Xiao-Ya Chu,$^a$ Wen-Ju Chang,$^a$ Li-Hua Zhao,$^c$ Yao-Yao Duan,$^a$ Huan-Huan Chen,$^a$ Jian-Zhong Cui$^{*a,b}$ and Hong-Ling Gao$^{*a,b}$

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$^a$Department of Chemistry, Tianjin University, Tianjin, 300354, China.
$^*$Corresponding authors, E-mail: cuijianzhong@tju.edu.cn, ghl@tju.edu.cn.
$^b$Key Laboratory of Advanced Energy Materials Chemistry (Ministry of Education), Nankai University, Tianjin, 300071, China.
$^c$Renai College of Tianjin University, Tianjin, 301636, China.
Scheme S1 The synthesis of the H$_2$L ligand.

![Scheme S1](image)

Table S1 The selected bond lengths (Å) and angles (°) for 1.

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<th>Bond</th>
<th>Length (Å)</th>
<th>Angle (°)</th>
</tr>
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<td>Dy(1)-O(1) #1</td>
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<td>Dy(1)-O(3)</td>
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<td>Dy(1)-O(1)</td>
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The symmetry code: #1 = x+1, −y, −z+1.
### Table S2 The selected bond lengths (Å) and angles (°) for 2.

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<td>O(1)-Dy(1)-N(2)</td>
<td>129.23(7)</td>
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<td>N(1)-Dy(1)-N(2)</td>
<td>62.83(8)</td>
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<td>O(2)-Dy(1)-Dy(1) #1</td>
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<td>O(3)-Dy(1)-Dy(1) #1</td>
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The symmetry code: #1 –x, -y, -z+2.

### Table S3 The selected bond lengths (Å) and angles (°) for 3.

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<td>O(2)-Dy(1)-N(1)</td>
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<td>76.68(8)</td>
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Table S4 The selected bond lengths (Å) and angles (°) for 4.

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<td>O(1)-#1-Dy(1)-O(1)</td>
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<td>75.78(1)</td>
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<tr>
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<td>O(4)-#1-Dy(1)-N(2)</td>
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The symmetry code: #1 –x, -y+1, -z.

Table S5 The continuous symmetry measurement value calculated by SHAPE 2.0 for complexes 1-4.

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<tr>
<th>complex</th>
<th>$D_{2d}$SAPR</th>
<th>$D_{2d}$TDD</th>
<th>$C_{2v}$JBTPR</th>
<th>$C_{2v}$BTPR</th>
<th>$D_{2d}$JSD</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>3.879</td>
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<td>3.134</td>
<td>2.730</td>
<td>3.413</td>
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<td>2.884</td>
<td>3.451</td>
<td>3.040</td>
<td>3.748</td>
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<td>3</td>
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<td>1.574</td>
<td>2.445</td>
<td>1.976</td>
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<td>4.560</td>
<td>3.469</td>
<td>3.471</td>
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Table S6 Hydrogen Bonds in complex 1.

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<tr>
<th>D-H</th>
<th>$d$(D-H) (Å)</th>
<th>$d$(H--A) (Å)</th>
<th>$\angle$DHA (°)</th>
<th>$d$(D--A) (Å)</th>
<th>A</th>
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</thead>
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<tr>
<td>O7-H7A</td>
<td>0.840</td>
<td>1.923</td>
<td>158.39</td>
<td>2.722</td>
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<tr>
<td>O5-H5A</td>
<td>0.850</td>
<td>1.862</td>
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<td>O5-H5B</td>
<td>0.849</td>
<td>1.853</td>
<td>154.76</td>
<td>2.646</td>
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<tr>
<td>O6-H6</td>
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<td>1.907</td>
<td>173.27</td>
<td>2.743</td>
<td>N3 [ x-1, y+1, z ]</td>
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**Table S7** Hydrogen Bonds in complex 2.

<table>
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<tr>
<th>D-H</th>
<th>d(D-H) (Å)</th>
<th>d(H··A) (Å)</th>
<th>( \angle \text{DHA} ) (°)</th>
<th>d(D··A) (Å)</th>
<th>A</th>
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<tbody>
<tr>
<td>O5-H5A</td>
<td>0.858</td>
<td>1.836</td>
<td>165.69</td>
<td>2.676</td>
<td>O6 [ -x+1, -y+1, -z+2 ]</td>
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<td>O5-H5B</td>
<td>0.863</td>
<td>1.845</td>
<td>159.76</td>
<td>2.672</td>
<td>O7 [ x, y, z+1 ]</td>
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<tr>
<td>O6-H6</td>
<td>0.840</td>
<td>1.907</td>
<td>169.91</td>
<td>2.738</td>
<td>N3 [ x, y+1, z ]</td>
</tr>
<tr>
<td>O7-H7A</td>
<td>0.840</td>
<td>1.933</td>
<td>161.64</td>
<td>2.743</td>
<td>N4 [ x-1/2, -y+1/2, z-1/2 ]</td>
</tr>
</tbody>
</table>

**Table S8** Hydrogen Bonds in complex 3.

<table>
<thead>
<tr>
<th>D-H</th>
<th>d(D-H) (Å)</th>
<th>d(H··A) (Å)</th>
<th>( \angle \text{DHA} ) (°)</th>
<th>d(D··A) (Å)</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>O5-H5A</td>
<td>0.853</td>
<td>1.975</td>
<td>172.13</td>
<td>2.822</td>
<td>N4 [ -x+3/2, y+1/2, -z+1/2 ]</td>
</tr>
<tr>
<td>O5-H5B</td>
<td>0.850</td>
<td>1.953</td>
<td>163.58</td>
<td>2.779</td>
<td>O4 [ -x+3/2, -y+1/2, -z+1 ]</td>
</tr>
</tbody>
</table>

**Table S9** Hydrogen Bonds in complex 4.

<table>
<thead>
<tr>
<th>D-H</th>
<th>d(D-H) (Å)</th>
<th>d(H··A) (Å)</th>
<th>( \angle \text{DHA} ) (°)</th>
<th>d(D··A) (Å)</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>O5-H5A</td>
<td>0.854</td>
<td>2.018</td>
<td>165.36</td>
<td>2.852</td>
<td>O3 [ -x, -y+1, -z ]</td>
</tr>
<tr>
<td>O5-H5B</td>
<td>0.850</td>
<td>1.962</td>
<td>162.65</td>
<td>2.785</td>
<td>N4 [ x+1/2, -y+1/2, -z ]</td>
</tr>
</tbody>
</table>

**Fig. S1** \(^1\)H NMR spectrum (400 MHz, \( d_6\)-DMSO) of H\(_2\)L.
**Fig. S2** (a) Molecular structure for 2 (all hydrogen atoms and the lattice methanol molecules have been omitted for clarity); (b) coordination polyhedrons for the Dy$^{III}$ ions in complex 2.

**Fig. S3** 2D supramolecular plane of complex 1 (all bfa$^-$ ligands and all hydrogen atoms of the H$_2$L ligands are omitted for clarity). The red circle highlights where two lattice methanol molecules join three Dy$_2$ units.

**Fig. S4** 2D supramolecular plane of complex 2 (all TTA ligands and all hydrogen atoms of the H$_3$L ligands are omitted for clarity). The red circle highlights where two methanol molecules join three Dy$_2$ units.
**Fig. S5** 2D supramolecular plane of complex 3 (all acac⁻ ligands and all hydrogen atoms of the H₂L ligands are omitted for clarity). The red circle highlights where a coordinated water molecule joins two Dy₂ units.

**Fig. S6** 2D supramolecular plane of complex 4 (all PhCOO⁻ ligands and all hydrogen atoms of the H₂L ligands are omitted for clarity). The red circle highlights where a methanol molecule joins two Dy₂ units. The red circle highlights where a coordinated water molecule joins two Dy₂ units.
Fig. S7 PXRD patterns of complexes 1(a), 2(b), 3(c) and 4(d).

Fig. S8 TGA curves of complexes 1(a), 2(b), 3(c), 4(d).
Fig. S9 The UV-vis absorption spectra of Dy(bfa)$_3$·2H$_2$O, Dy(TTA)$_3$·2H$_2$O, Dy(acac)$_3$·2H$_2$O, Dy(PhCOO)$_3$·2H$_2$O, the ligand H$_2$L, and complexes 1–4.

**Magnetic properties**

The field dependencies of magnetization measurements were carried out in the range of 0-80 kOe at 2-7 K for 1 (Fig. S10), with $M$ values rapidly increasing at low magnetic fields. The magnetization of 1 increases steadily with the high applied fields and reaches 14.33 $N\beta$ at 2 K and 80 kOe, which is lower than the calculated value of 20.00 $N\beta$ for two Dy$^{III}$ ($J = 15/2$, $g = 4/3$), indicating unsaturation. This is most likely due to the crystal field effect on the Dy$^{III}$ ion that removes the 16-fold degeneracy of the $^6H_{15/2}$ ground state.$^{1,2}$ The $M$-$H/T$ curves at different temperatures are non-overlapping. These phenomena can be attributed to one or a combination of the following two features: (i) strong anisotropy of Dy$^{III}$ ions; (ii) Dy$^{III}$ ions being at a low exited state.$^3$
Fig. S10 Plot of the reduced magnetization $M$ versus $H/T$ for 1 at different temperatures.

Alternating current (ac) magnetism
Note and references