**Electronic Supplementary Information (ESI)**

**A Luminescent lyotropic liquid crystal with UV irradiation induced photochromism**

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1. Calculation of the lattice parameters ($D$) for lyotropic liquid crystals

The lattice parameters of LLC phases, $D$, denoting the distance between two adjacent cylinder centers for the hexagonal phase, can be obtained from the first Bragg scattering position ($q_1$) in SAXS curves according to eq. (1).

$$D = \frac{4\pi}{\sqrt{3}} q_1$$

Hexagonal phase: $D = \frac{4\pi}{\sqrt{3}} q_1$ \hspace{1cm} (1)

Table S1. The lattice parameters ($D$) for LLC samples before and after UV irradiation (4 h) with Eu(DBM)$_3$BQ or BQ doped or undoped at [C$_{12}$mim]Br concentration of 80%.

<table>
<thead>
<tr>
<th>Samples</th>
<th>$q_1$ (nm$^{-1}$)</th>
<th>Eu(DBM)$_3$BQ-H$_1$</th>
<th>Eu(DBM)$_3$BQ-4h-H$_1$</th>
<th>BQ-H$_1$</th>
<th>BQ-4h-H$_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_1$ (nm$^{-1}$)</td>
<td>1.957</td>
<td>1.912</td>
<td>1.912</td>
<td>1.957</td>
<td>1.957</td>
</tr>
<tr>
<td>$D$ (nm)</td>
<td>3.71</td>
<td>3.79</td>
<td>3.79</td>
<td>3.71</td>
<td>3.71</td>
</tr>
</tbody>
</table>

2. MS measurement for Eu(DBM)$_3$BQ and Eu(DBM)$_3$·2H$_2$O

Fig. S1 MS spectra for Eu(DBM)$_3$BQ (a) and Eu(DBM)$_3$·2H$_2$O (b).
3. Photograph of Eu(DBM)$_3$BQ in LLCs under UV light

![Photograph of Eu(DBM)$_3$BQ in LLCs under UV light](image)

**Fig. S2** Photographs taken under UV light at 305 nm for Eu(DBM)$_3$BQ in LLCs, which were irradiated under continuously UV light one month before.

4. UV/vis absorption spectra of BQ, DBM and Eu(DBM)$_3$BQ

![UV/vis absorption spectra](image)

**Fig. S3** UV/vis absorption spectra of Eu(DBM)$_3$BQ (blue), BQ (black) and DBM (red) in chloroform solution ($4.6 \times 10^{-3}$ mol·L$^{-1}$).

5. DFT calculation on ground energy of BQ conformations

Geometries of BQ molecule optimized as a function of the dihedral angle between the two quinoline planes using the DFT based the model at the B3LYP /6-31G(d,p) level. The result shows two stable conformers of BQ which one having a dihedral angle of about 90 ° (cis) and the other
being 180 ° (trans) (Fig. S3). Ground state energy of the cis and trans conformers are -222.471 eV and -222.786 eV respectively.

![Geometries of two conformers of BQ (180 ° and 90 °)](image)

**Fig. S4** Geometries of two conformers of BQ (180 ° and 90 °) using DFT based method with B3LYP/6-31G(d,p) basis sets.

### 6. Luminescence properties of Eu(DBM)$_3$·2H$_2$O

![Emission spectra](image)

**Fig. S5** Emission spectra Eu(DBM)$_3$·2H$_2$O in chloroform solutions (4.6×10$^{-3}$ mol·L$^{-1}$) before (black line) and after (red line) UV irradiation at 302 nm for 4 hours.
7. SAXS patterns for LLC samples doped with BQ

![SAXS patterns](image)

Fig. S6 SAXS patterns for LLC samples at [C_{12}mim]Br concentration of 80% before and after UV irradiation (4 h) with BQ doped or undoped.

8. Fluorescence life time of 2,2' biquinoline (BQ) in LLC

<table>
<thead>
<tr>
<th>Samples</th>
<th>τ₁ (ns)</th>
<th>Contribution (%)</th>
<th>τ₂ (ns)</th>
<th>Contribution (%)</th>
<th>χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>BQ (0h)</td>
<td>0.974</td>
<td>46.3</td>
<td>4.885</td>
<td>53.7</td>
<td>1.005</td>
</tr>
<tr>
<td>BQ (2h)</td>
<td>1.09</td>
<td>32.4</td>
<td>4.263</td>
<td>67.6</td>
<td>1.007</td>
</tr>
</tbody>
</table>

Table S2. Fluorescence life time of 2,2’ biquinoline (BQ) before and after UV irradiation