

Electronic Supplementary Information

Pillar[5]arene Noncovalent Assembly Boosting Full-color Lanthanide Luminescent Supramolecular Light Switch

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1. Synthetic Protocols

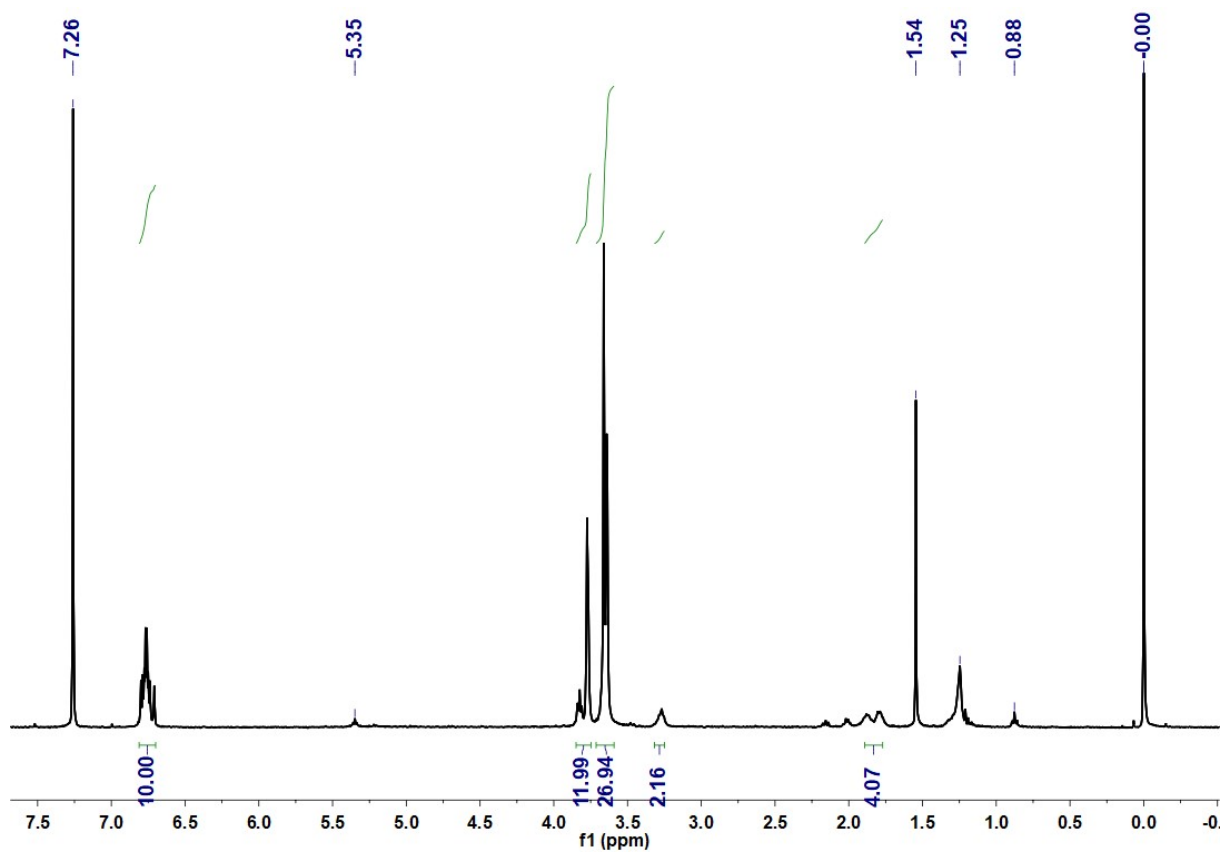


Fig. S1 ^1H NMR (400 MHz) spectrum of **1** in CDCl_3 at 25 $^\circ\text{C}$.

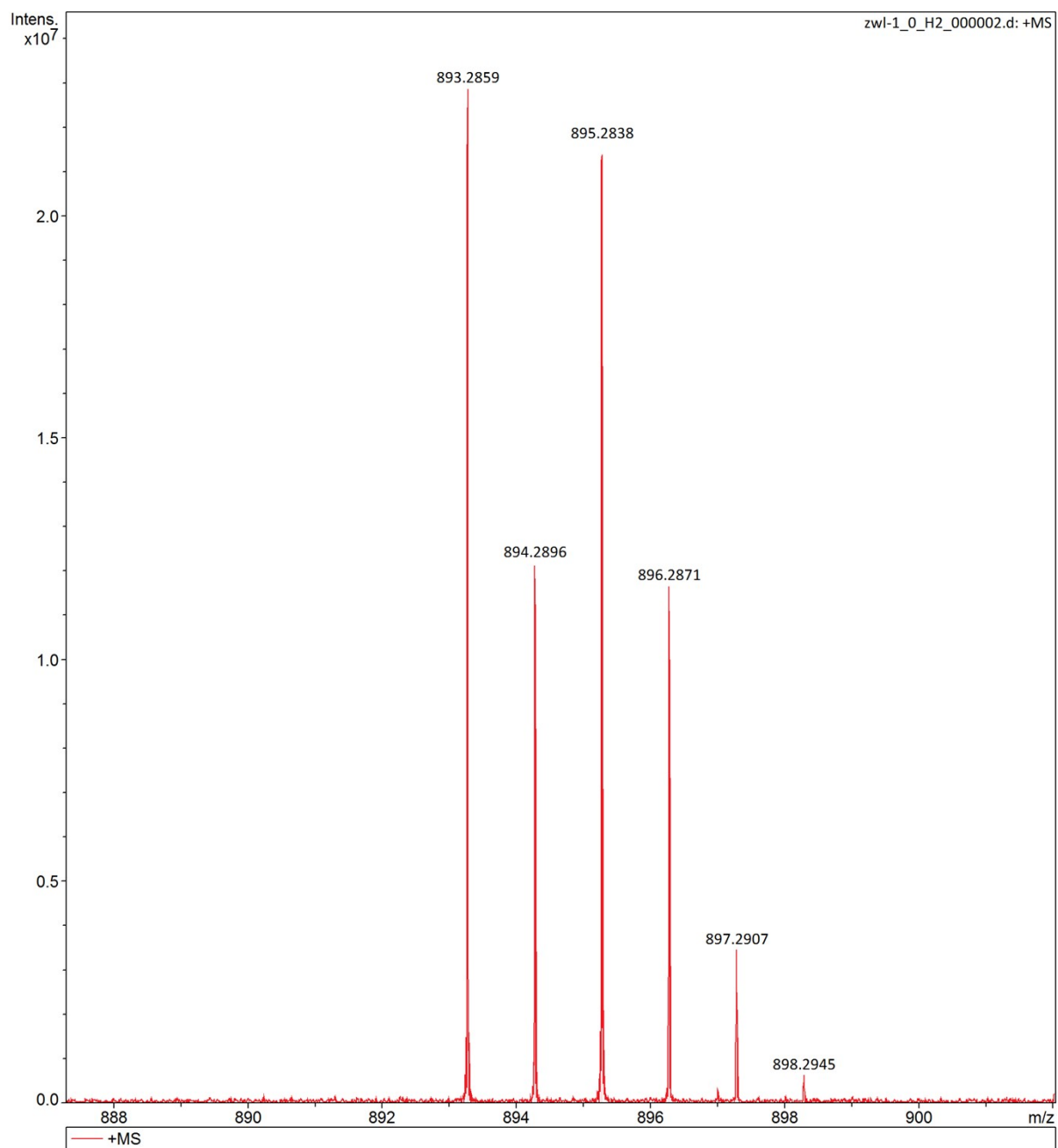


Fig. S2 HR-MS (ESI) spectrum of **1**.

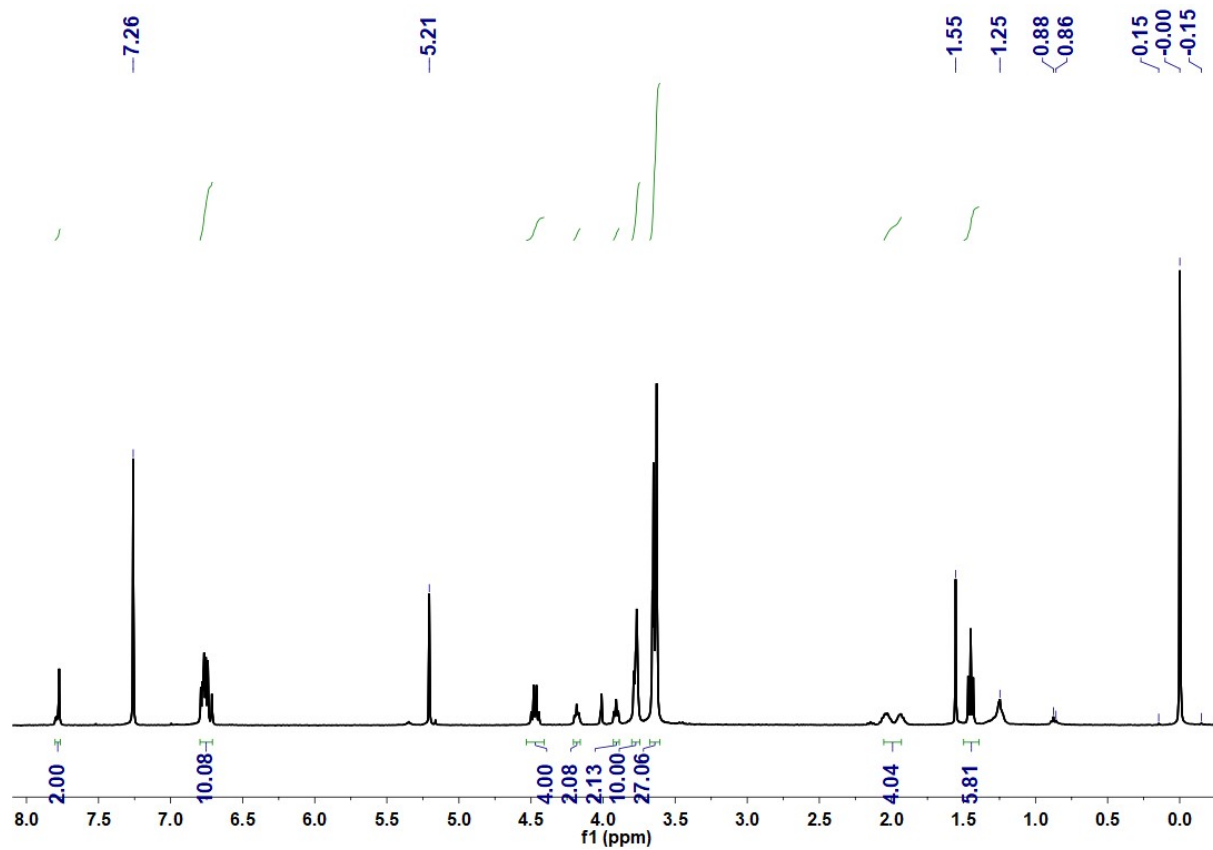


Fig. S3 ^1H NMR (400 MHz) spectrum of **2** in CDCl_3 at 25 $^\circ\text{C}$.

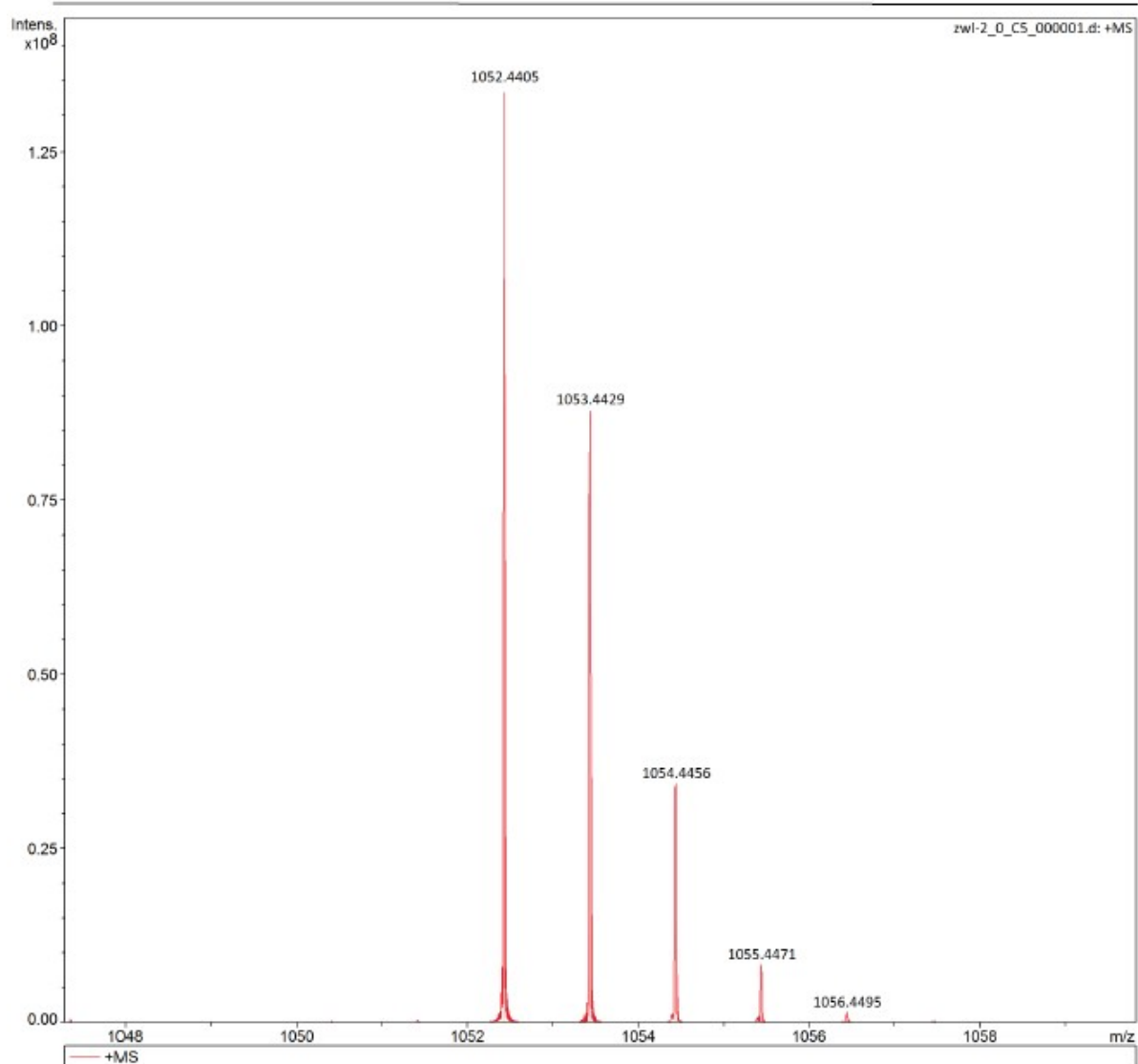


Fig. S4 HR-MS (ESI) spectrum of **2**.

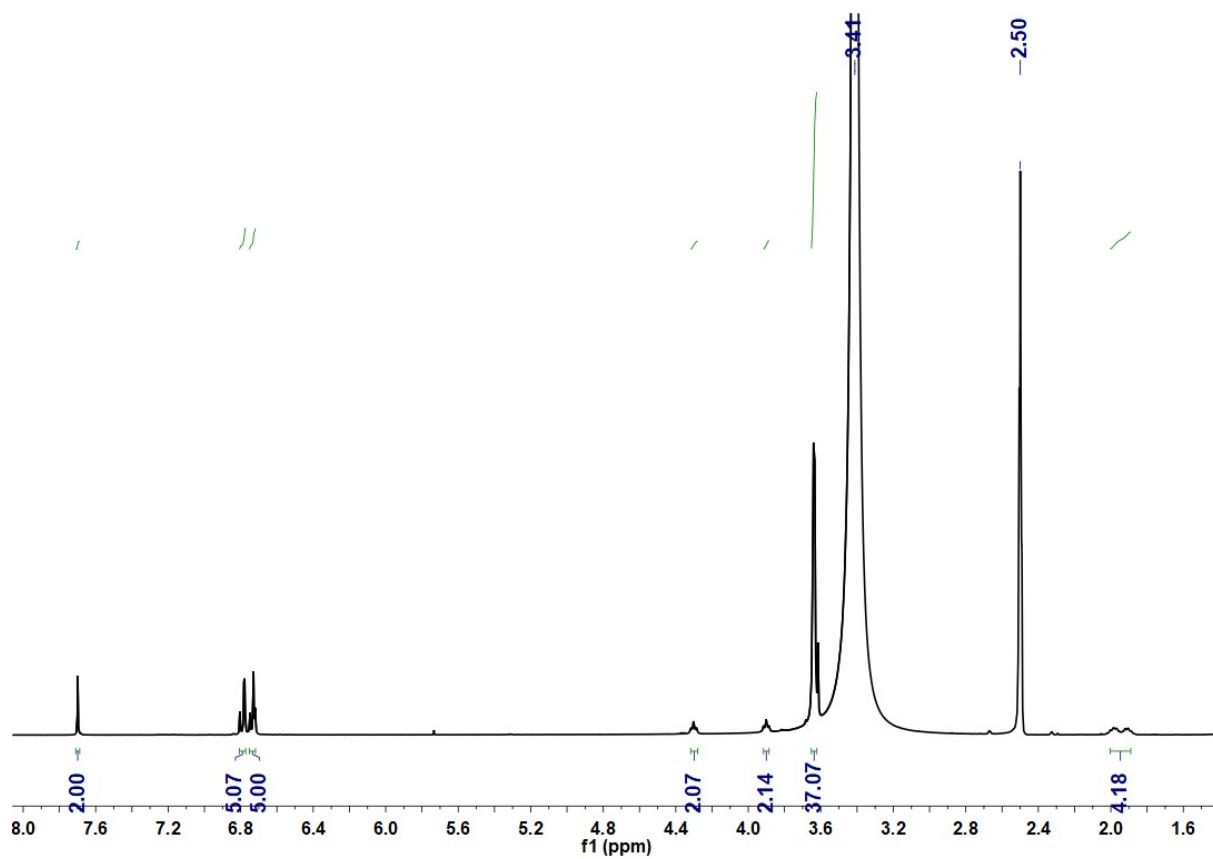


Fig. S5 ¹H NMR (400 MHz) spectrum of H in DMSO-d₆ at 25 °C.

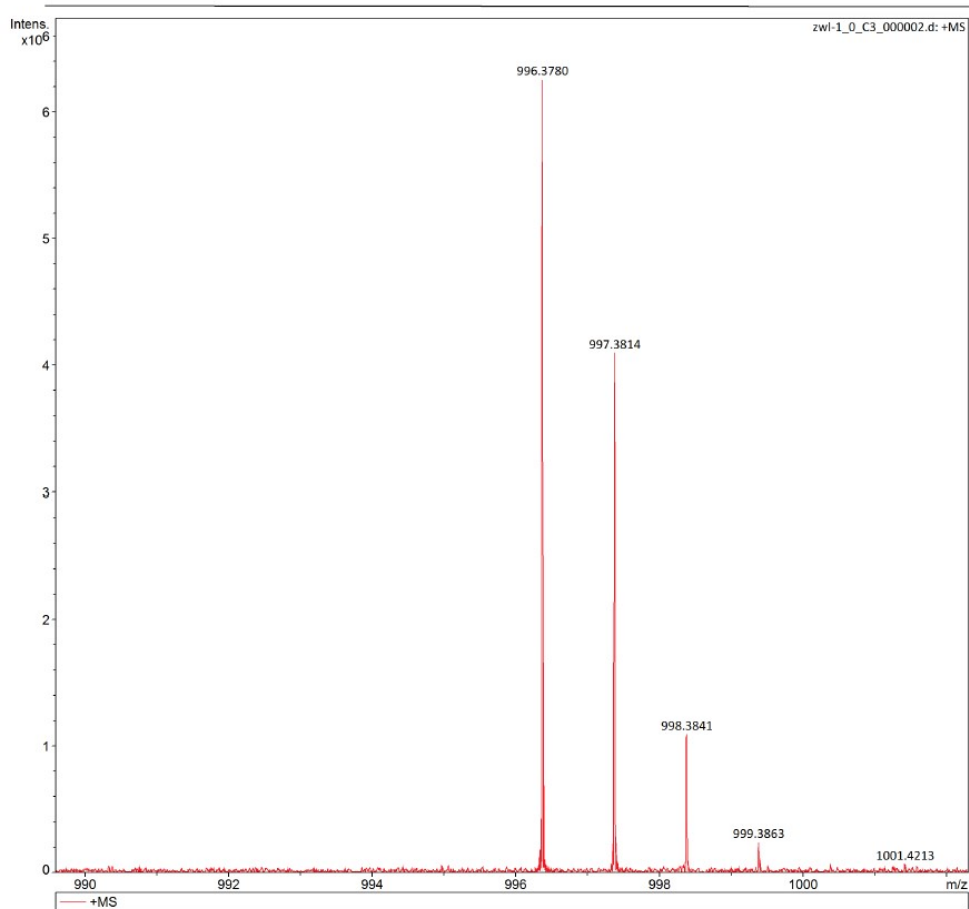


Fig. S6 HR-MS (ESI) spectrum of H.

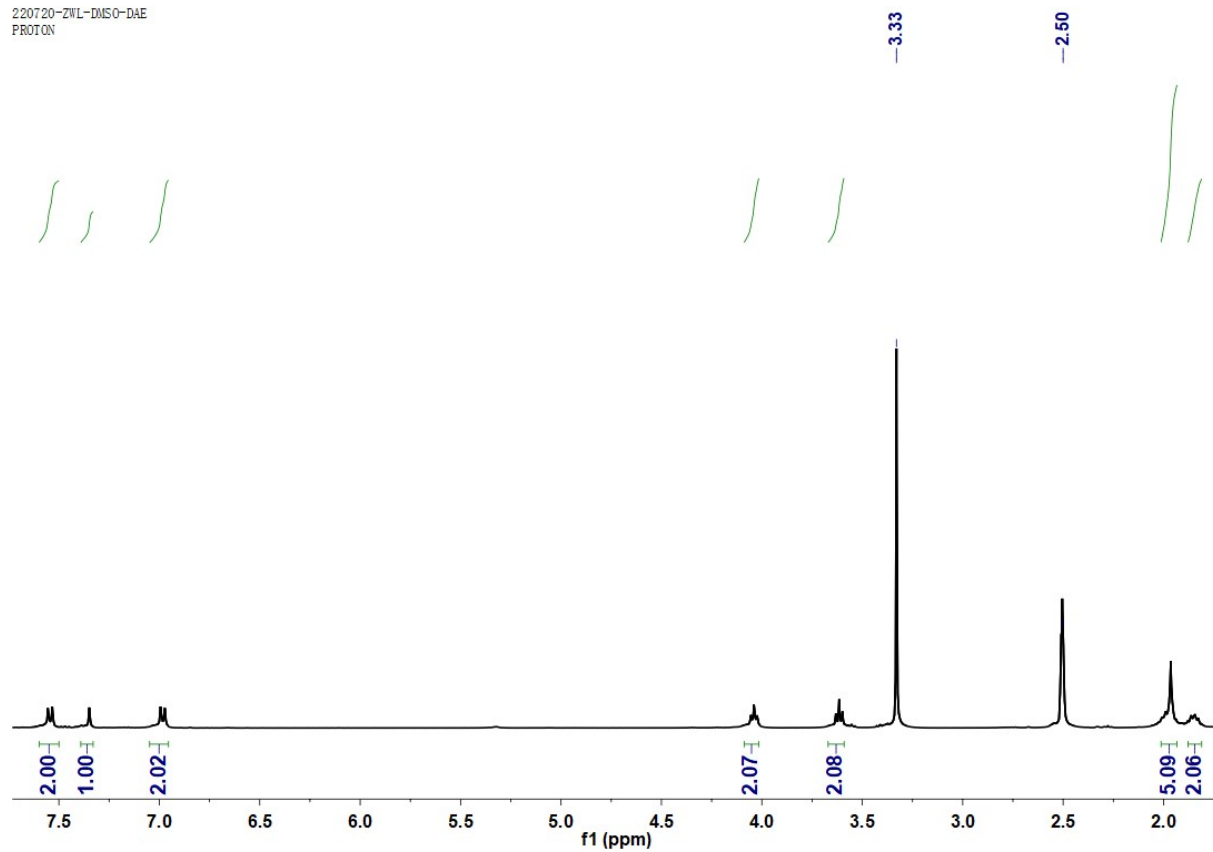


Fig. S7 ¹H NMR (400 MHz) spectrum of 4 in DMSO-d₆ at 25 °C.

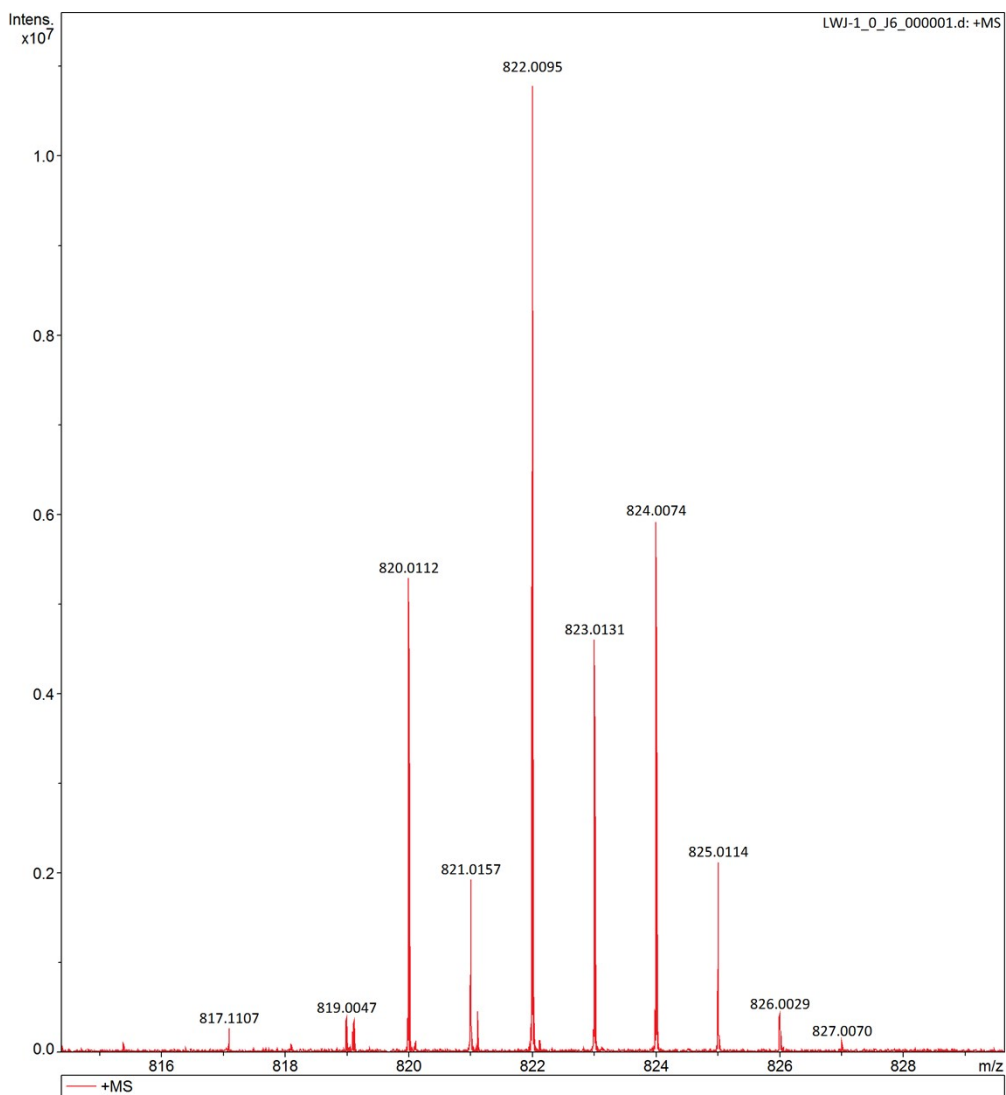


Fig. S8 HR-MS (ESI) spectrum of 4.

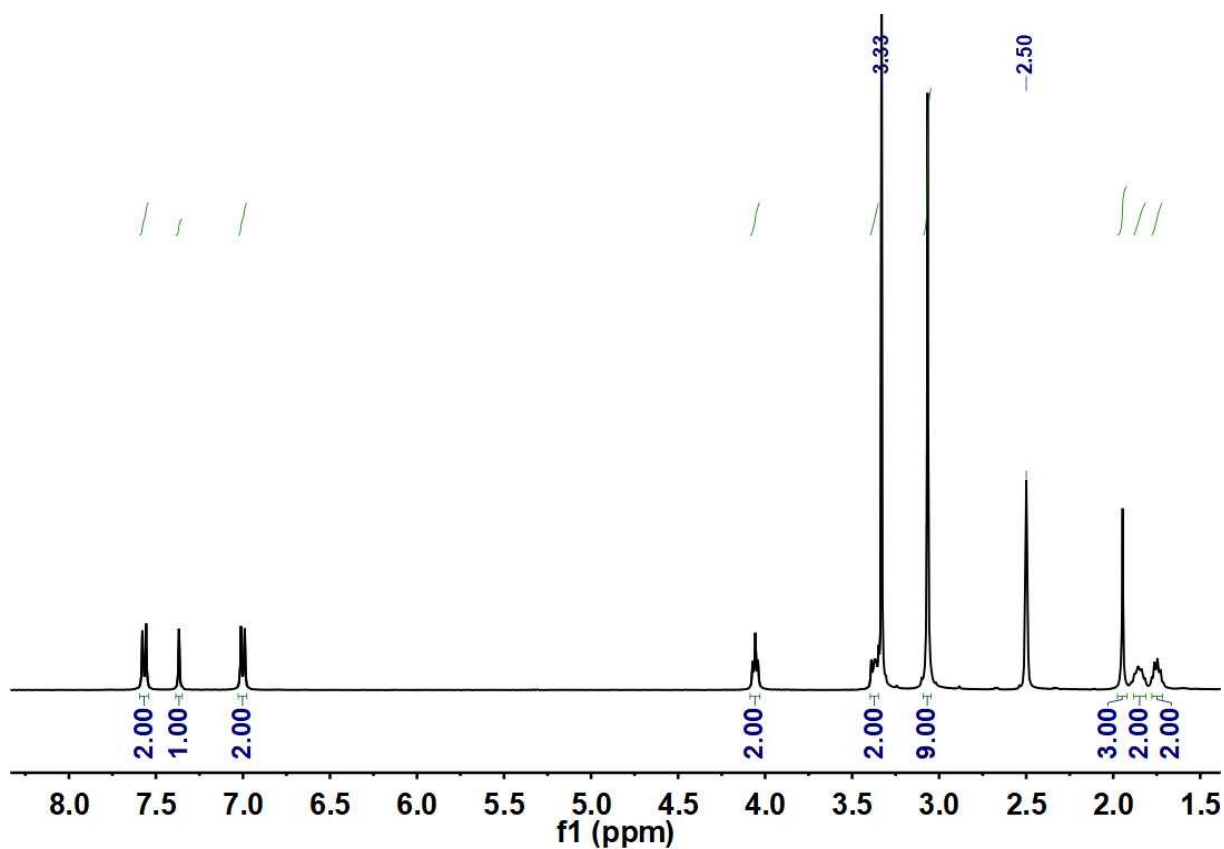


Fig. S9 ^1H NMR (400 MHz) spectrum of G_1 in DMSO-d_6 at 25 $^\circ\text{C}$.

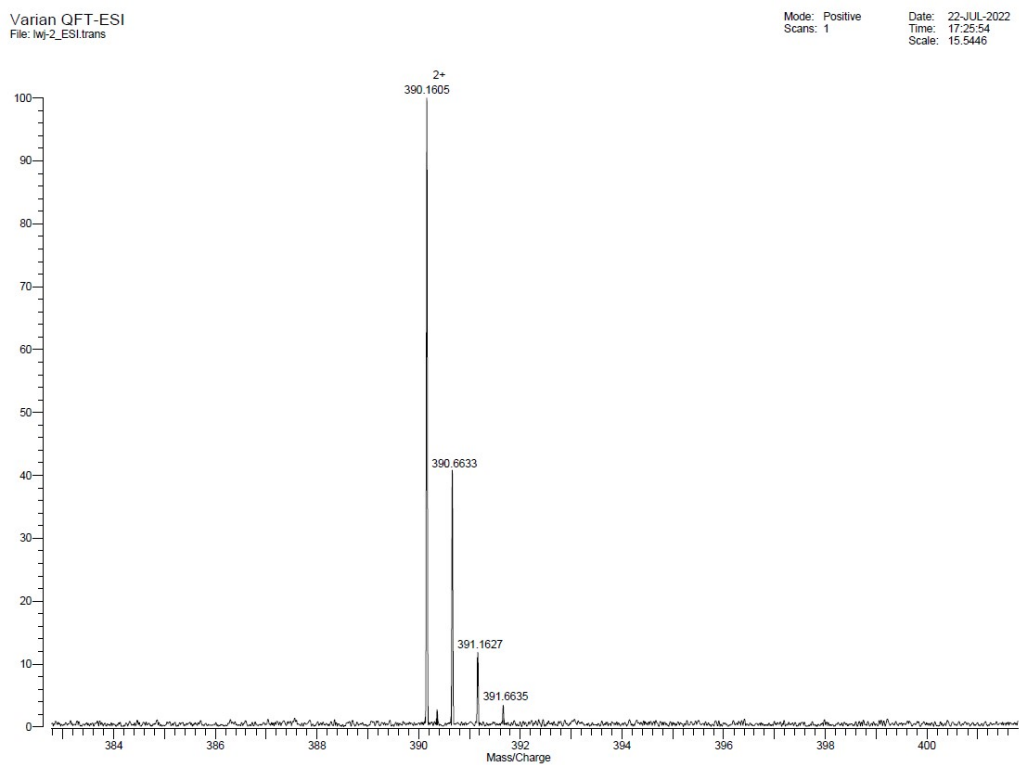


Fig. S10 HR-MS (ESI) spectrum of G_1 .

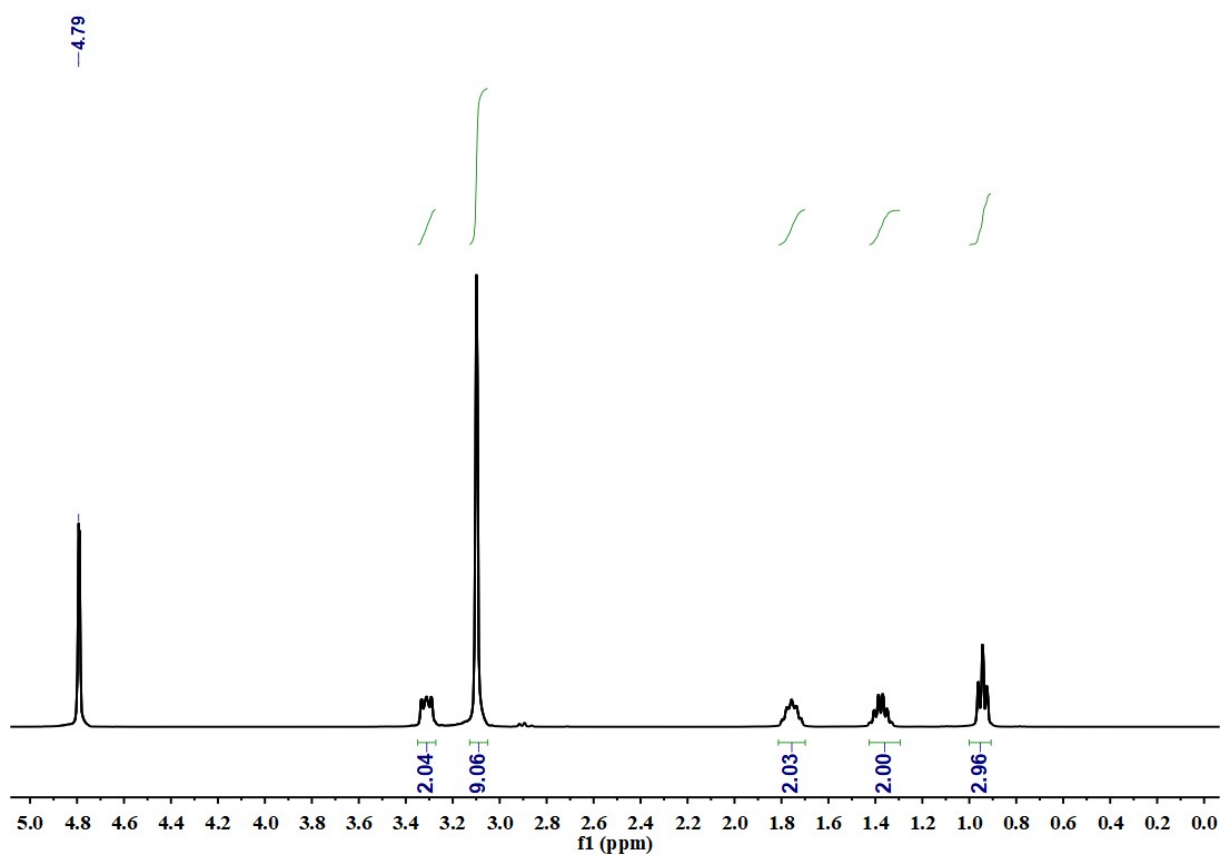


Fig. S11 ^1H NMR (400 MHz) spectrum of G_2 in D_2O at $25\text{ }^\circ\text{C}$.

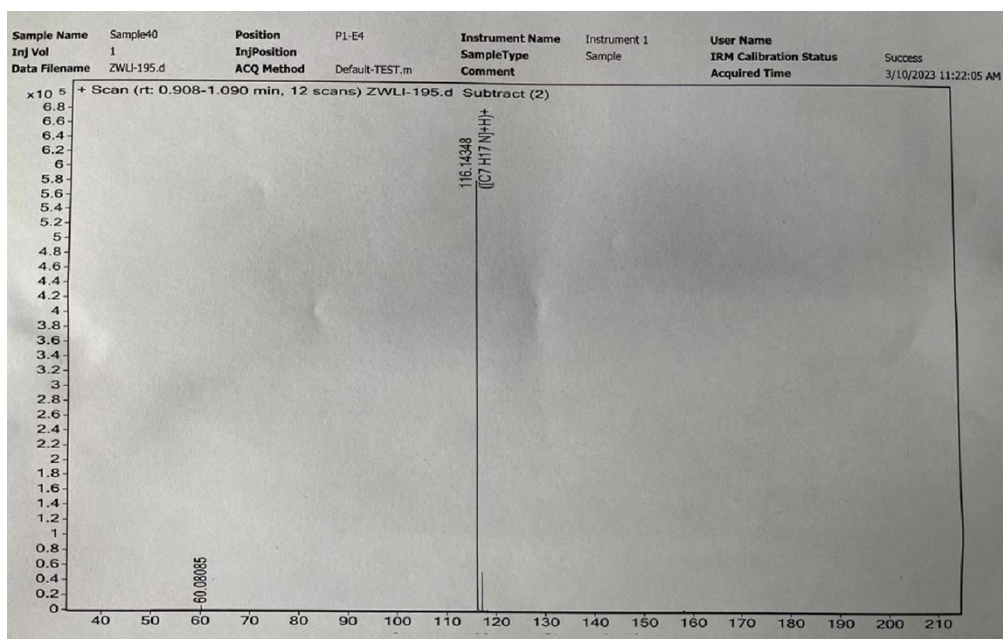


Fig. S12 HR-MS (ESI) spectrum of G_2 .

2. Characterization Data

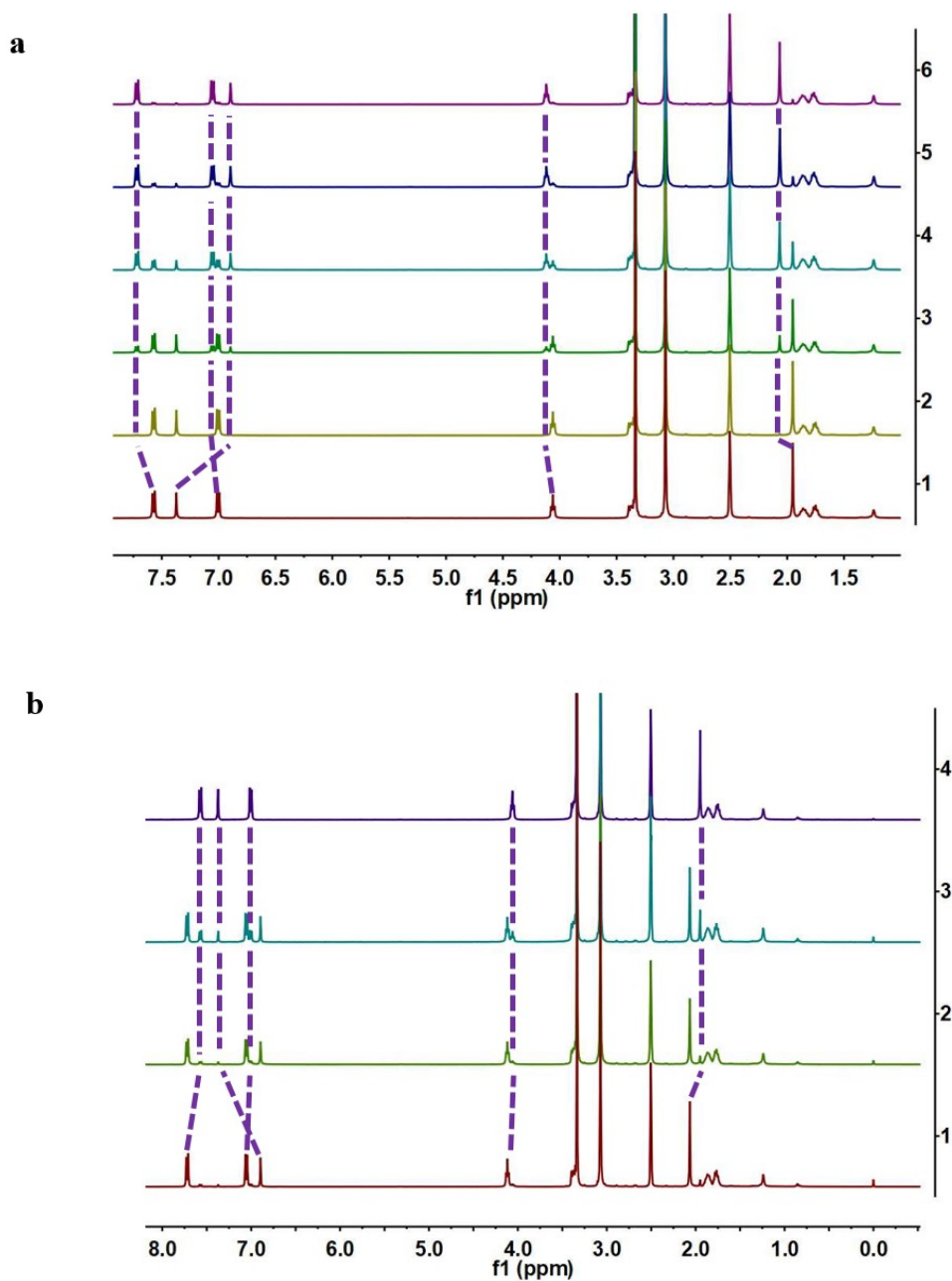


Fig. S13 (a) ¹H NMR spectral change from G₁ to G₁' upon irradiation with UV light (254 nm) and (b) a complete recovery from G₁' to G₁ upon subsequent irradiation with visible light (>450 nm) in DMSO-d₆ at 25 °C.

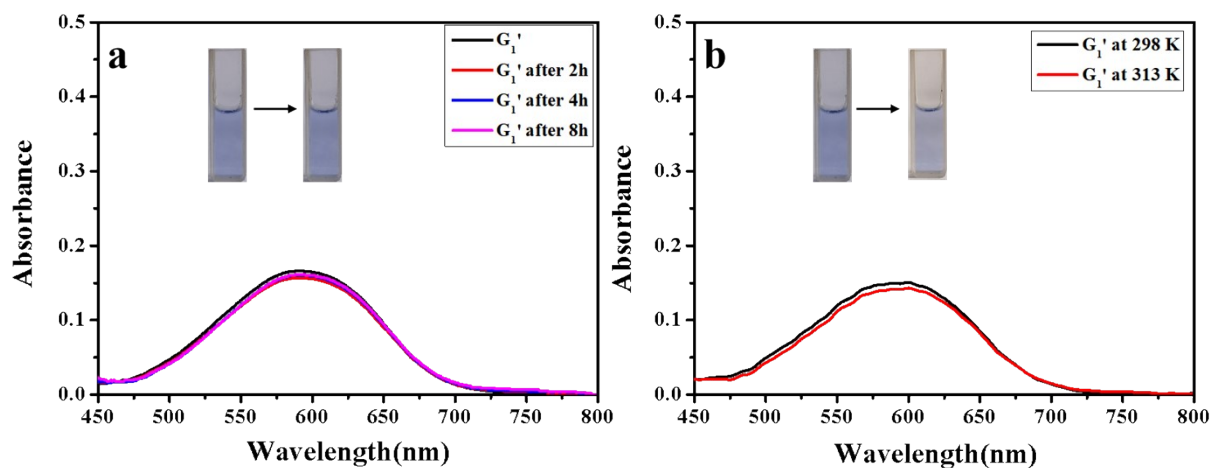


Fig. S14 Absorption spectra of the closed-ring state G_1' (a) at different time and (b) at different temperature in water ($[H] = 0.01 \text{ mM}$).

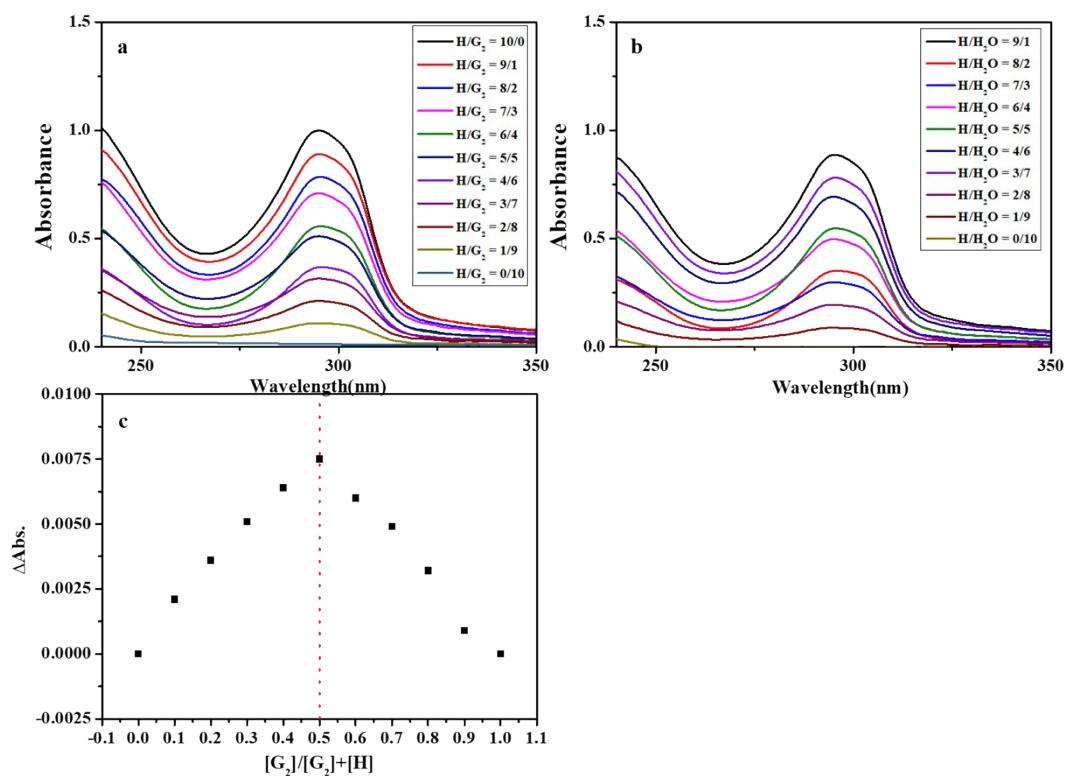


Fig. S15 Absorption spectra of (a) $H+G_2$, (b) $H+H_2O$ and (c) Job' plots for host molecule H and guest G_2 in aqueous solution (absorption changes at 295nm, $[H] + [G_2] = 0.05 \text{ mM}$).

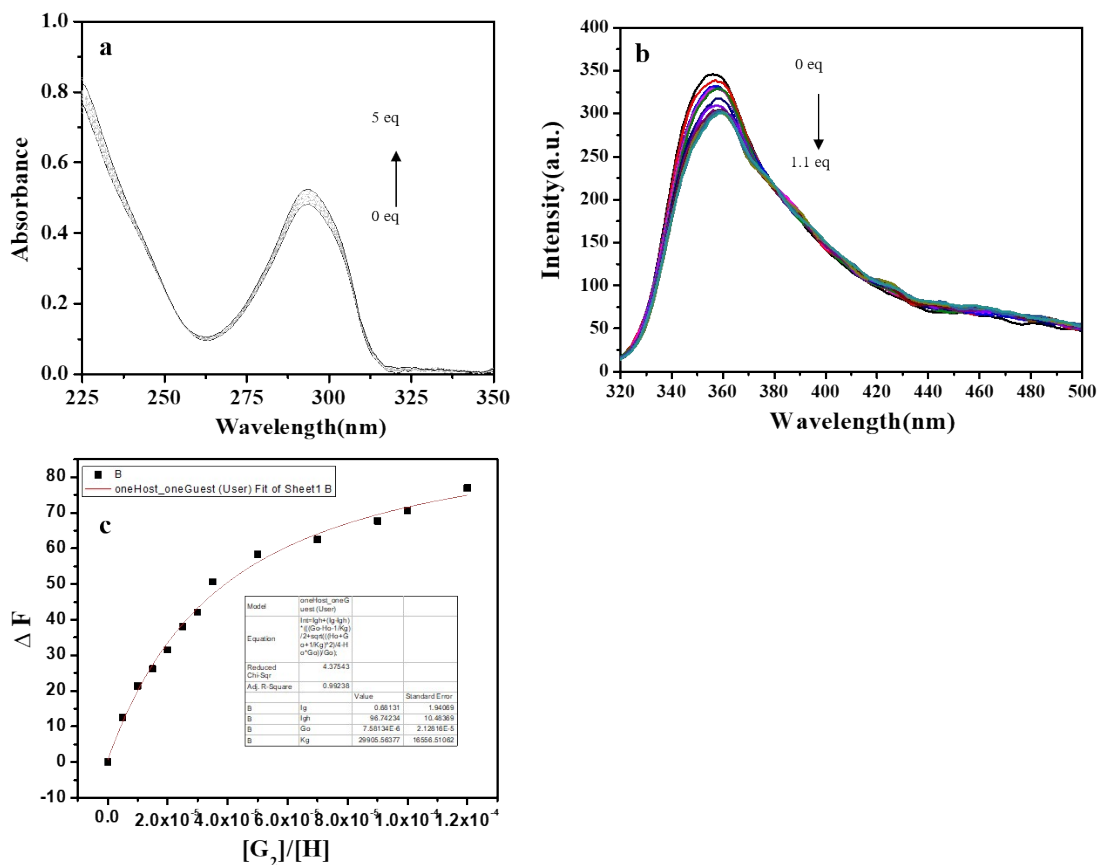


Fig. S16 (a) Absorption spectra of H (0.03 mM) upon addition of G_2 (from 0 to 5.0 eq) in water. (b) Emission spectra of H (0.05 mM) upon addition of G_2 (from 0 to 1.1 eq). Plots of the emission change at 355 nm versus H concentration in water.

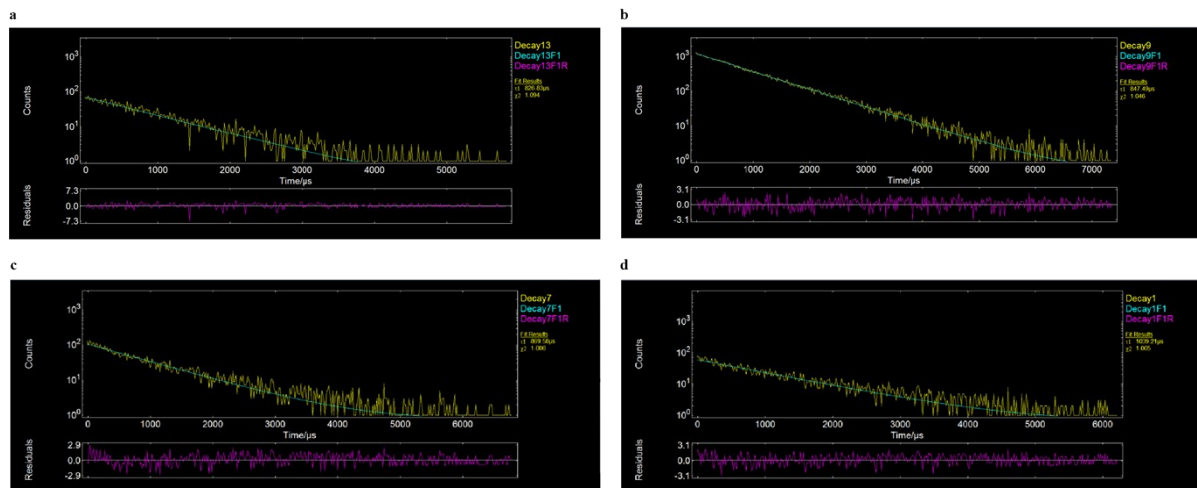


Fig. S17 Time-resolved photoluminescence decay fitting curves of (a) H/Tb³⁺; (b) H/Tb³⁺/G₁ measured for 545 nm and (c) H/Eu³⁺ (d) H/Eu³⁺/G₁ for 615 nm in aqueous solution at 298 K (H = 0.02 mM).

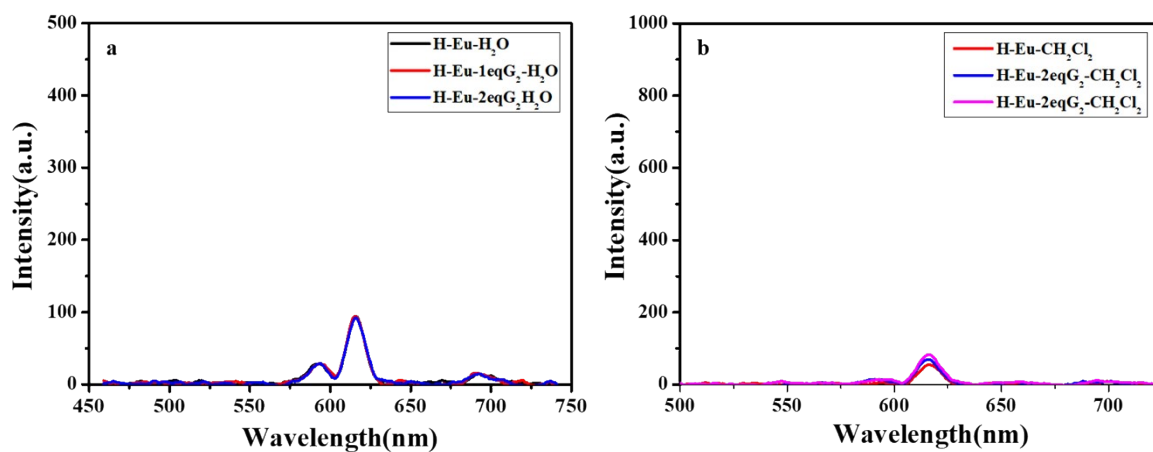


Fig. S18 The emission spectrum changes of reference G_2 in H (a) aqueous solution and (b) organic solution, respectively.

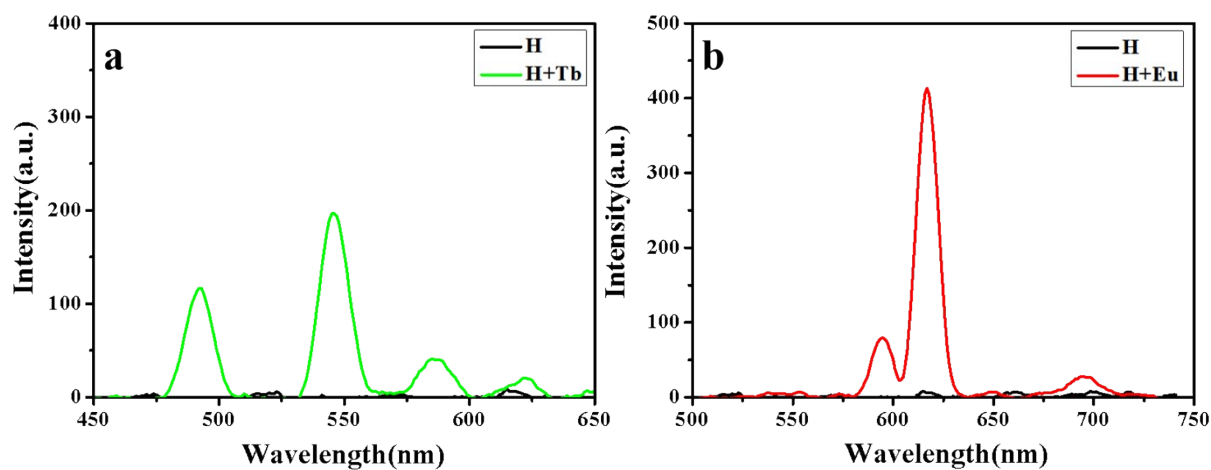


Fig. S19 Emission spectra of H (0.01 mM) upon addition of (a) Tb^{3+} and (b) Eu^{3+} in CH_2Cl_2 solution.

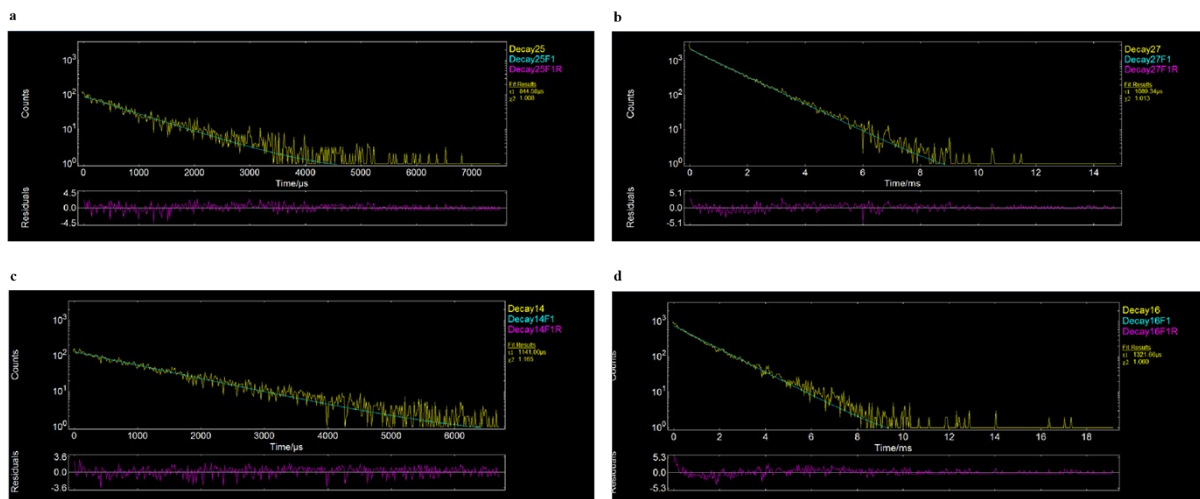


Fig. S20 Time-resolved photoluminescence decay fitting curves of (a) H/Tb^{3+} ; (b) $H/Tb^{3+}/G_1$ measured for 545 nm and (c) H/Eu^{3+} ; (d) $H/Eu^{3+}/G_1$ measured for 615 nm in CH_2Cl_2 solution ($H = 0.02$ mM).

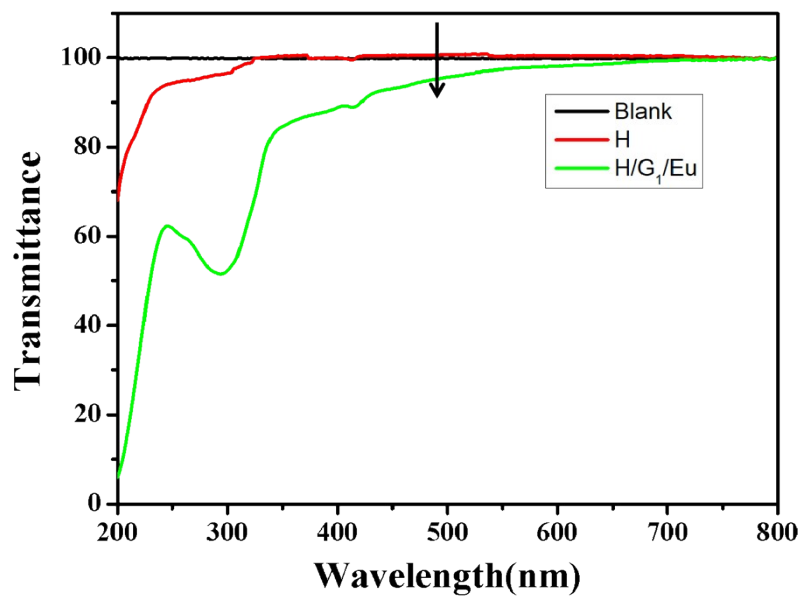


Fig. S21 The optical transmittance of H and H/Eu³⁺/G₁ at 500 nm in water ([H] = 1.0 × 10⁻⁴ M)

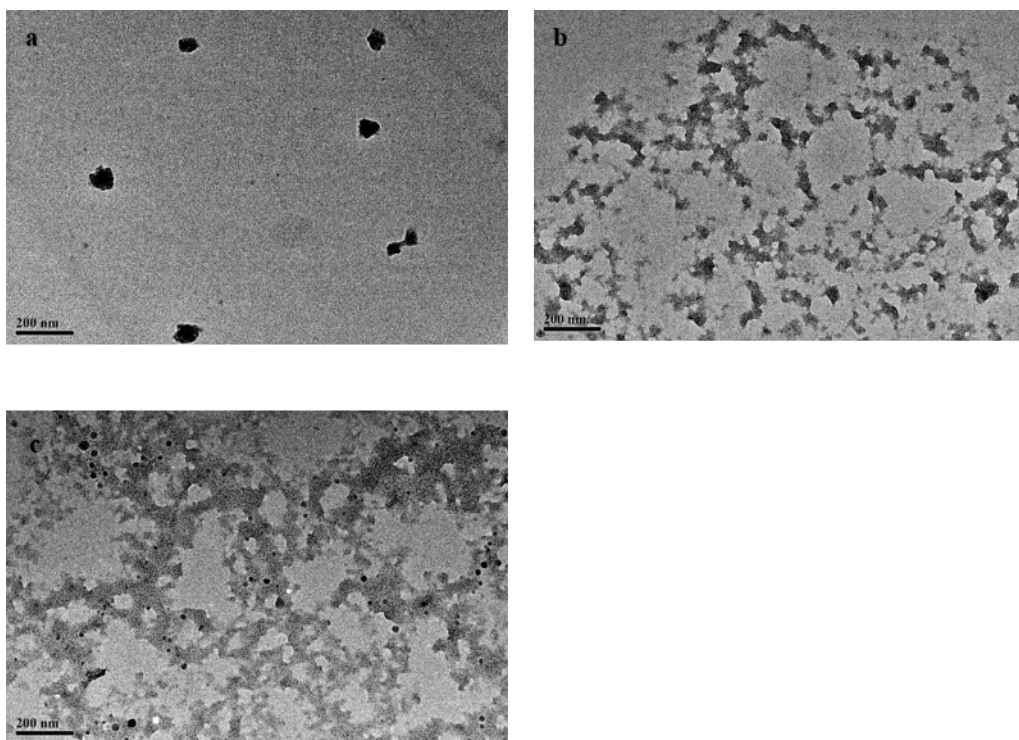


Fig. S22 TEM images of (a) H, (b) H/Eu³⁺ and (c) H/Eu³⁺/G₁.

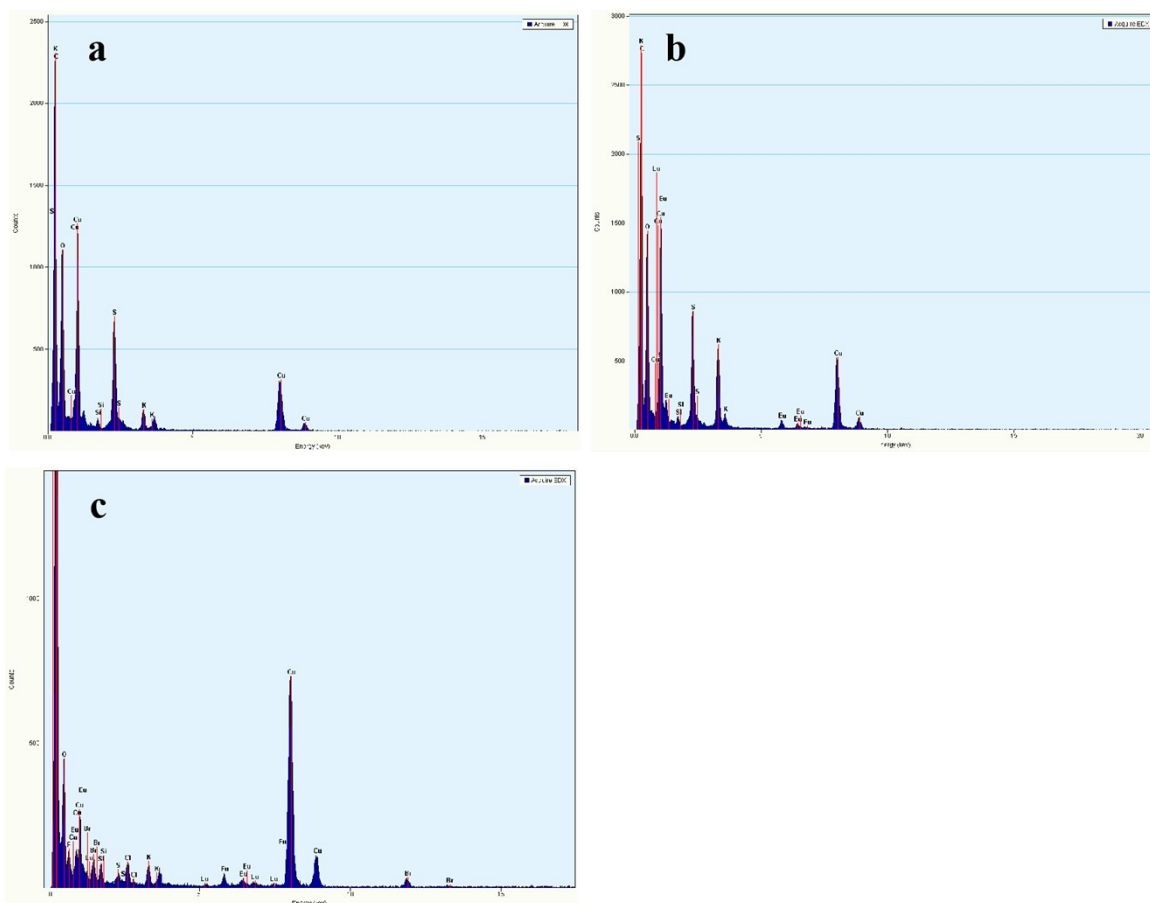


Fig. S23 The TEM-EDS spectrum of (a) H, (b) H/Eu³⁺ and (c) H/Eu³⁺/G₁.

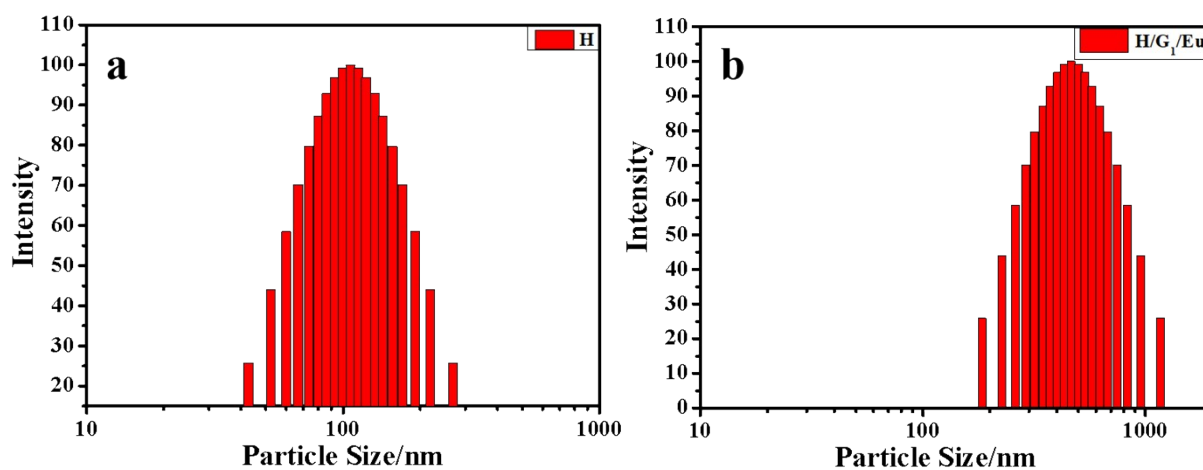


Fig. S24 The DLS data of (a) H and (b) H/Eu³⁺/G₁ assembly (H = 0.02 mM).

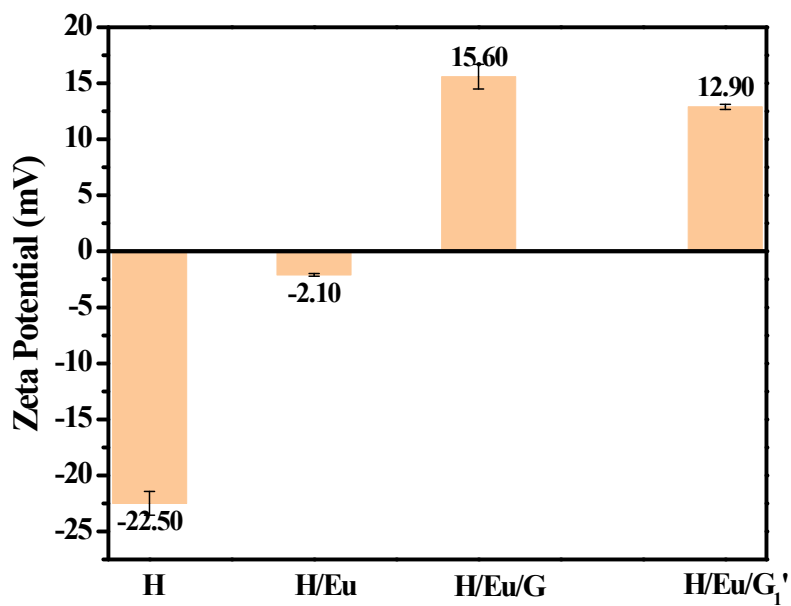


Fig. S25 Zeta potential results of H, H/Eu³⁺, H/Eu³⁺/G₁ and H/Eu³⁺/G₁' (pH = 6.8).

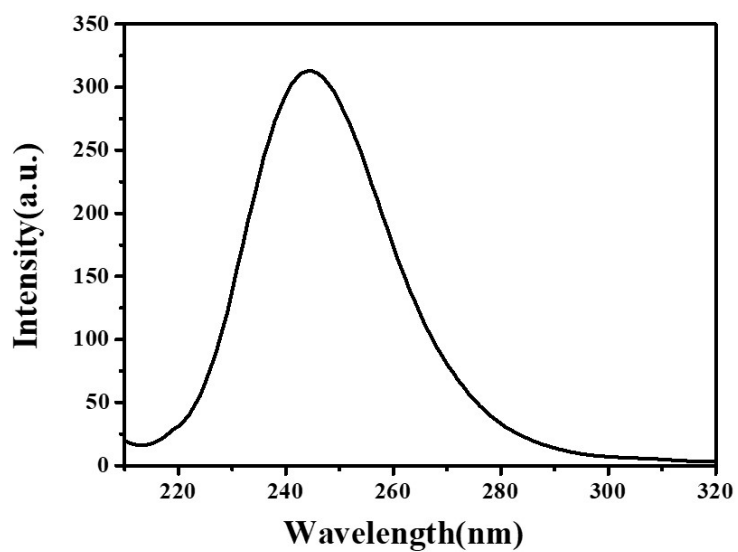


Fig. S26 The excitation spectra of H/Eu³⁺/G₁.

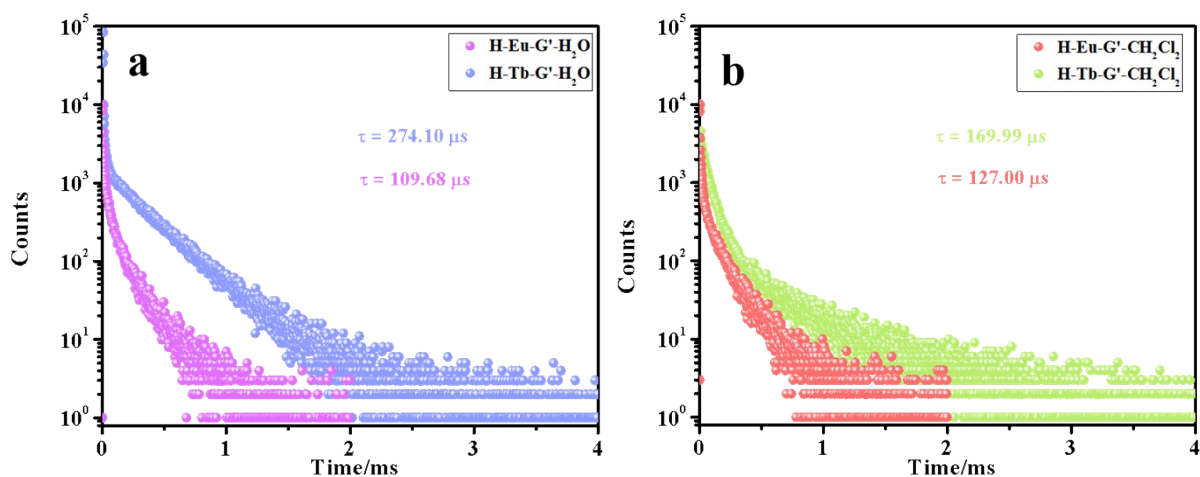


Fig. S27 Time-resolved photoluminescence decay curves of H/Ln³⁺/G₁ (a) in aqueous solution and (b) CH₂Cl₂ solution.

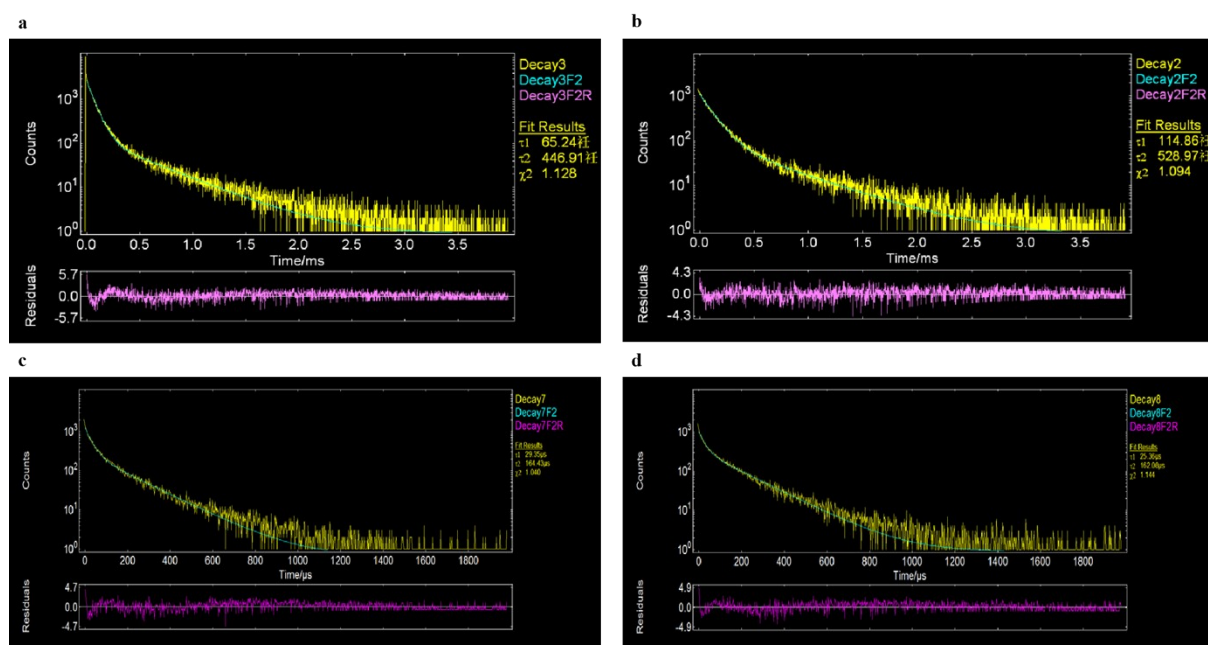


Fig. S28 Time-resolved photoluminescence decay fitting curves of H/Tb³⁺/G₁ (a) in aqueous solution; (b) CH₂Cl₂ solution, and H/Eu³⁺/G₁ (c) in aqueous solution; (d) CH₂Cl₂ solution.

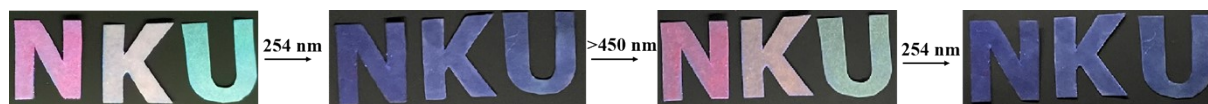


Fig. S29 Luminescent Cyclic images changes under UV light of characters "NKU" written by H/Eu³⁺/G₁ dichloride solution under alternant UV (254 nm) and visible (>450 nm).

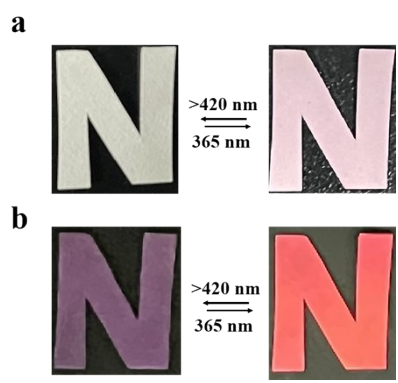


Fig. S30 (a) Colors change under nature light and (b) Luminescent images changes under UV light of characters “N” written by Commercially available 2-(3', 3'-Dimethyl-6-nitrospiro[chromene]-2,2'-indolin]-1'-yl)ethanol dye methanol solution (5.0×10^{-5} M).