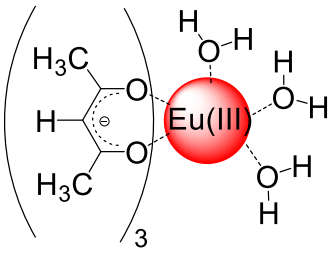
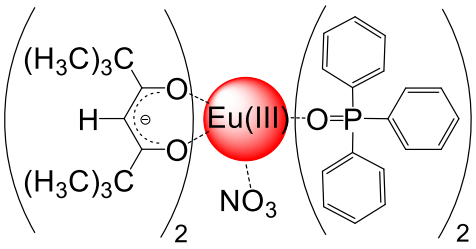
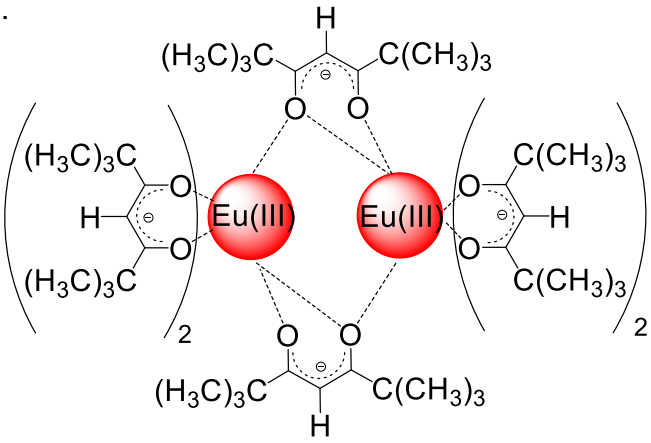


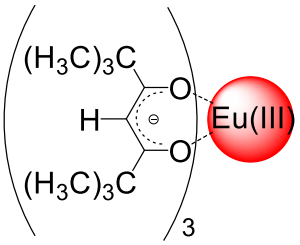
$\Phi_{\pi\pi}$ = 0.2 %[14]
(Ref. 14, 28)



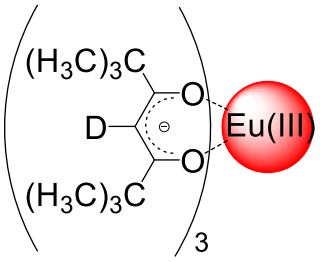
(300K) Φ_{ff} = 46 %, τ = 0.651 ms
(77K) Φ_{ff} = 57 %, τ = 0.728 ms
(Ref. 15)



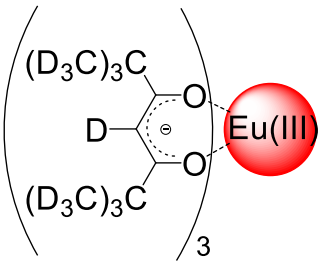
(300K) Φ_{ff} = 8 %, τ = 0.049 ms
(77K) Φ_{ff} = 79 %, τ = 0.470 ms
(Ref. 15)



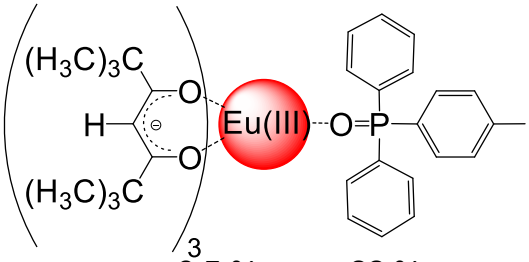
(150K) τ = 0.442 ms[18]
(Ref. 17, 18, 24, 28)



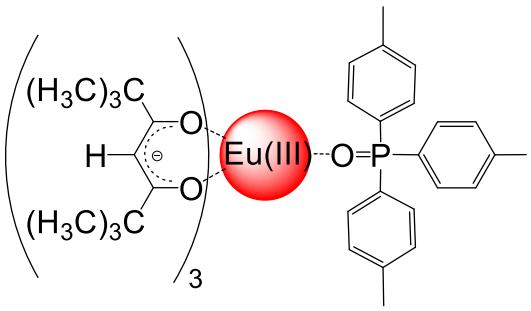
(150K) τ = 0.467 ms
(Ref. 18)



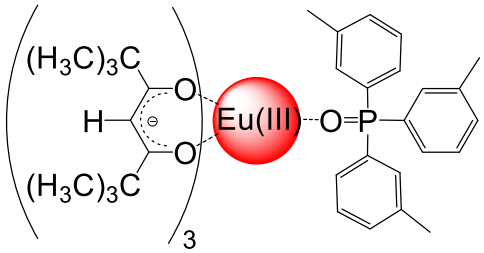
(150K) τ = 0.509 ms
(Ref. 18)



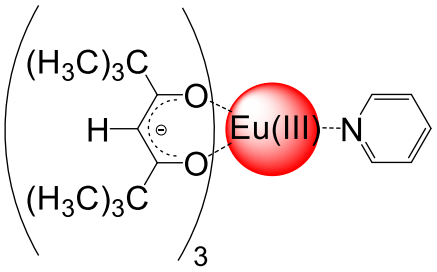
$\Phi_{\pi\pi}$ = 0.5 %, Φ_{ff} = 82 %,
τ = 0.50 ms (Ref. 19)



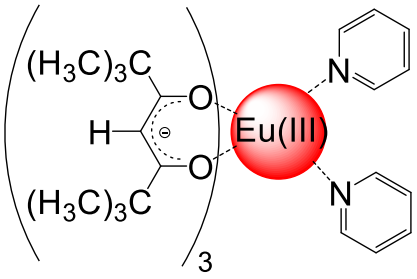
$\Phi_{\pi\pi}$ = 0.6 %, Φ_{ff} = 85 %,
τ = 0.73 ms (Ref. 19)



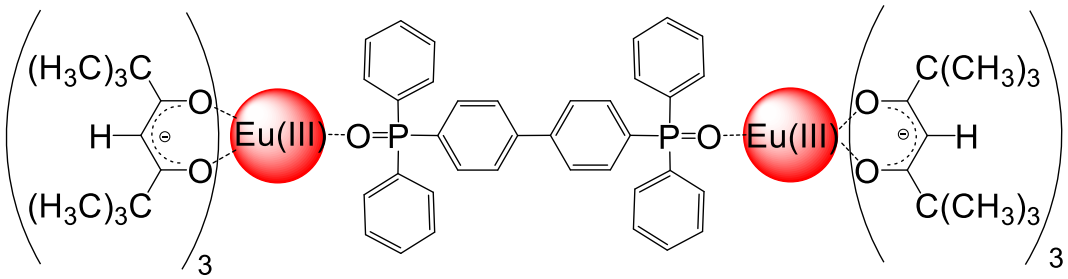
$\Phi_{\pi\pi}$ = 0.6 %, Φ_{ff} = 86 %,
τ = 0.61 ms (Ref. 19)



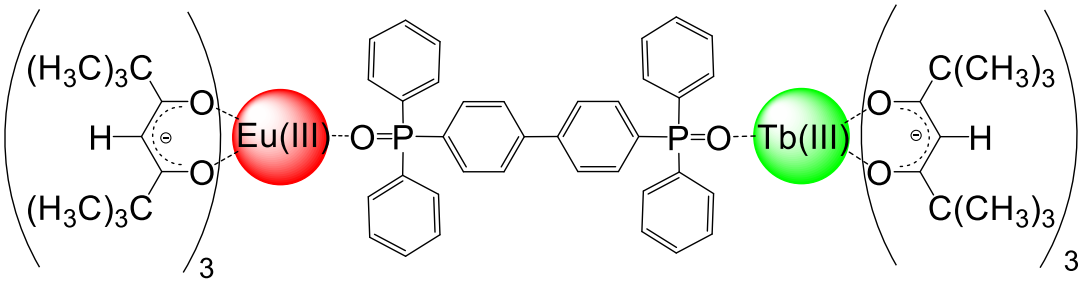
$\Phi_{\pi\pi}$ = 0.26 %, Φ_{ff} = 60 %,
τ = 0.45 ms (Ref. 20)



$\Phi_{\pi\pi}$ = 2.1 %, Φ_{ff} = 63 %,
τ = 0.51 ms (Ref. 20)

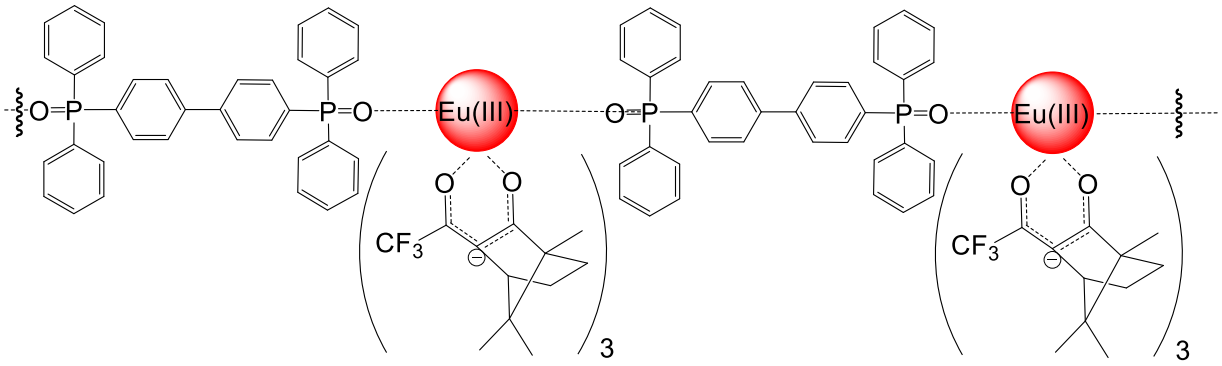


$\Phi_{\pi\pi}$ = 0.5 %, Φ_{ff} = 66 %,
τ = 0.62 ms (Ref. 21)

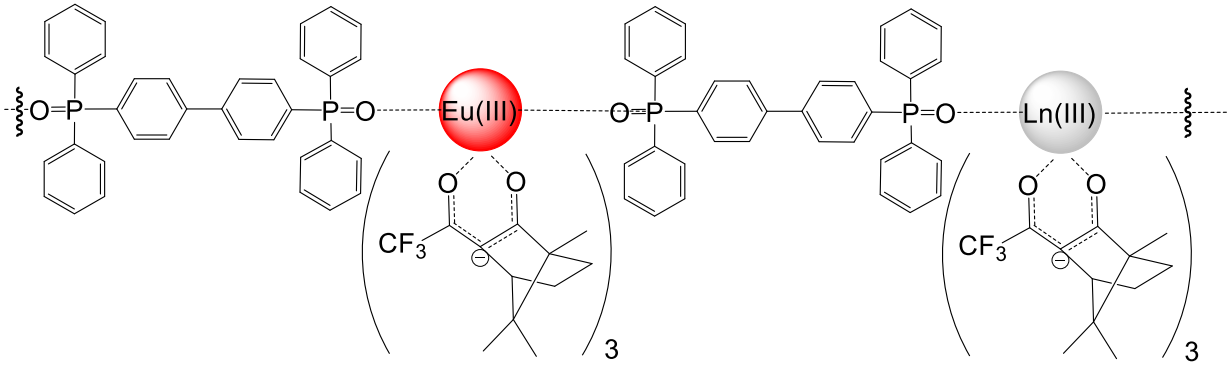


τ = 0.76 ms (Ref. 21)

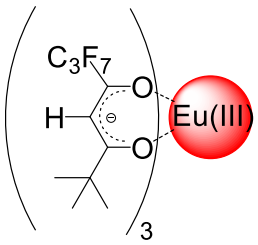
Figure S1. Chemical structures of the Eu(III) complexes with β-diketonate-based LMCT



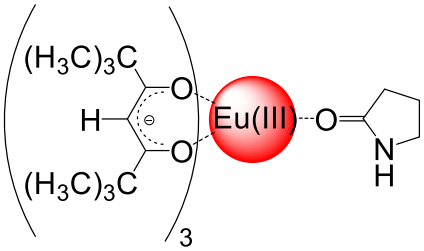
$\Phi_{\pi\pi}$ = 36 %, Φ_{ff} = 61 %, τ = 0.61 ms (Ref. 22)



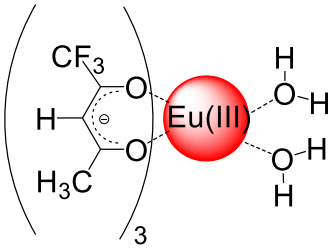
(Ln = Gd) $\Phi_{\pi\pi}$ = 34 %, Φ_{ff} = 63 %, τ = 0.63 ms (Ref. 22)
(Ln = Sm) $\Phi_{\pi\pi}$ = 52 %, Φ_{ff} = 60 %, τ = 0.60 ms (Ref. 22)



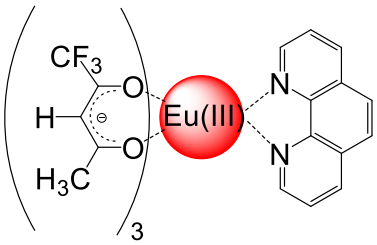
(Ref. 23)



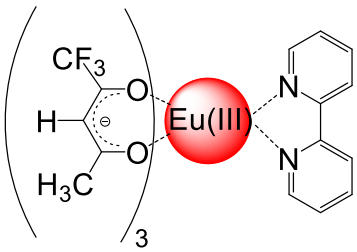
(300K) Φ_{ff} = 19.9 %, τ = 0.6578 ms
(82K) Φ_{ff} = 58.4 %, τ = 0.2190 ms
(Ref. 24)



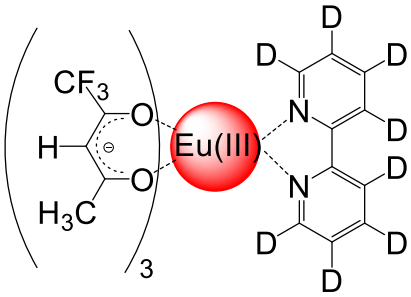
(295K) τ = 0.41 ms
(77K) τ = 0.41 ms
(Ref. 25)



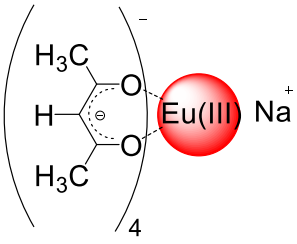
(295K) τ = 0.84 ms
(77K) τ = 0.86 ms
(Ref. 25)



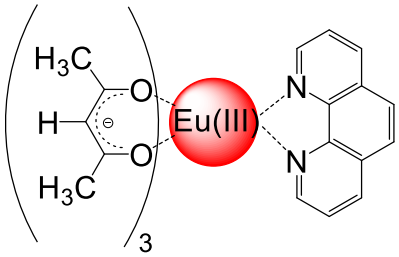
(295K) τ = 0.84 ms
(77K) τ = 0.87 ms
(Ref. 25)



(295K) τ = 0.90 ms
(77K) τ = 0.94 ms
(Ref. 25)

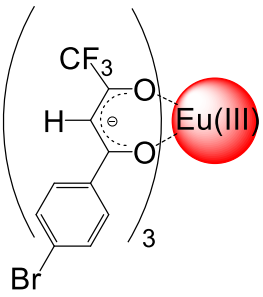


(295K) τ = 0.81 ms
(77K) τ = 0.83 ms
(Ref. 25)

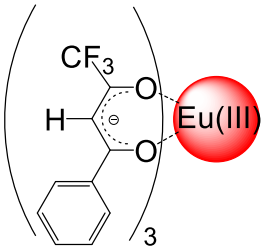


(295K) τ = 0.68 ms
(77K) τ = 0.70 ms (Ref. 25)

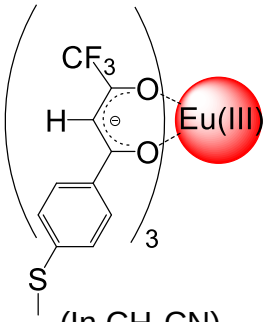
Figure S2. Chemical structures of the Eu(III) complexes with β-diketonate-based LMCT



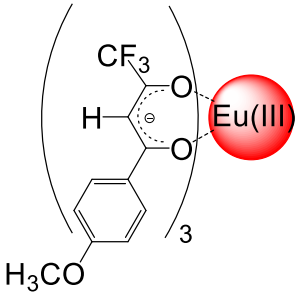
(In CH_3CN)
τ = 0.63 ms
(Ref. 26)



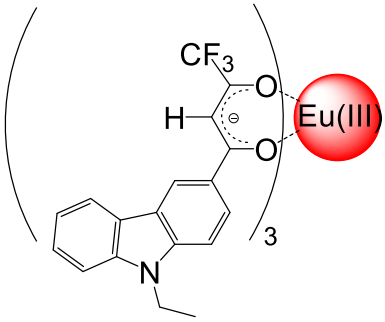
(In CH_3CN)
τ = 0.67 ms
(Ref. 26)



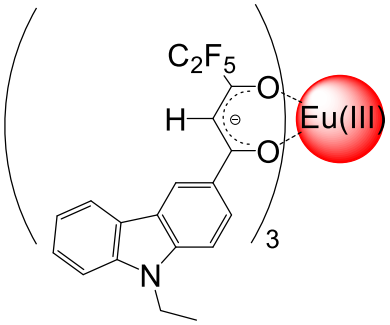
(In CH_3CN)
τ = 0.62 ms
(Ref. 26)



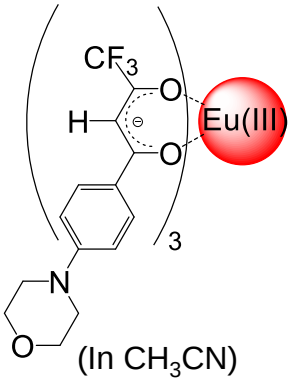
(In CH_3CN)
τ = 0.67 ms
(Ref. 26)



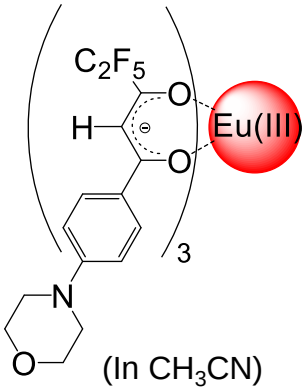
(In CH_3CN)
τ = 0.63 ms
(Ref. 26)



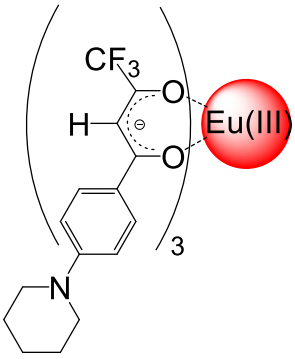
(In CH_3CN)
τ = 0.58 ms
(Ref. 26)



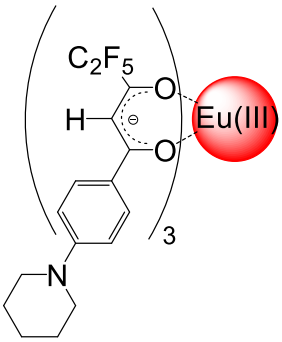
(In CH_3CN)
τ = 0.31 ms
(Ref. 26)



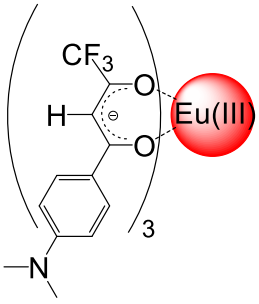
(In CH_3CN)
τ = 0.33 ms
(Ref. 26)



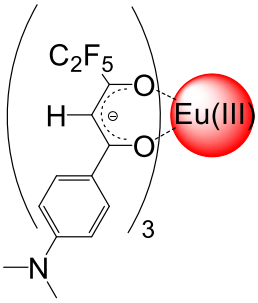
(In CH_3CN)
τ = 0.50 ms
(Ref. 26)



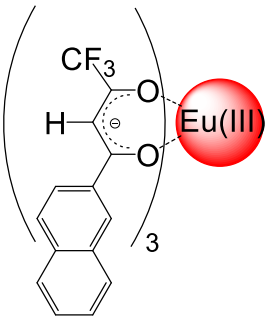
(In CH_3CN)
τ = 0.54 ms
(Ref. 26)



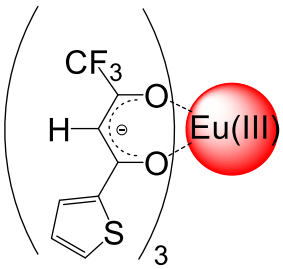
(In CH_3CN)
τ = 0.42 ms
(Ref. 26)



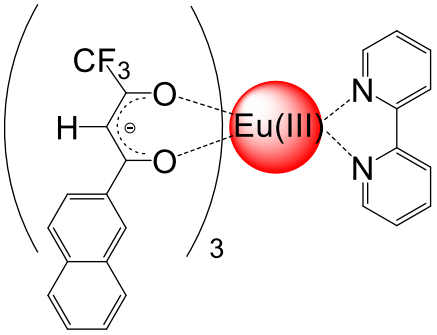
(In CH_3CN)
τ = 0.44 ms
(Ref. 26)



(In CH_3CN)
τ = 0.58 ms
(Ref. 26)

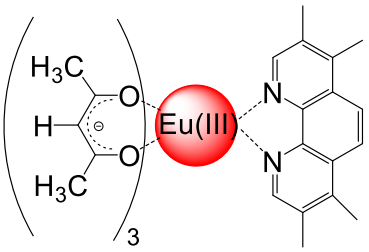


(In CH_3CN)
τ = 0.70 ms
(Ref. 26)

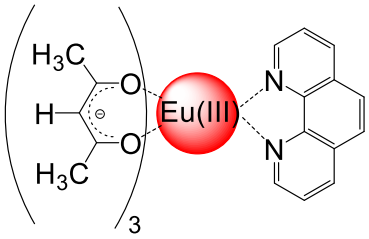


(300K) τ = 0.447 ms
(77K) τ = 0.432 ms
(Ref. 27)

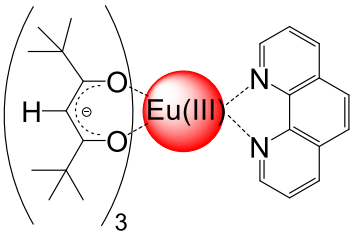
Figure S3. Chemical structures of the Eu(III) complexes with β-diketonate-based LMCT



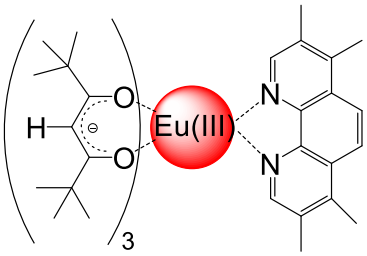
Ref. 28



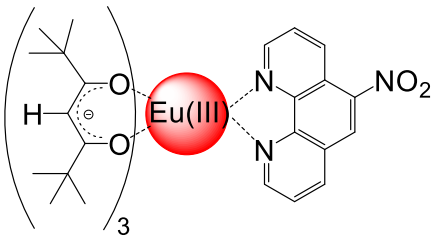
Ref. 28



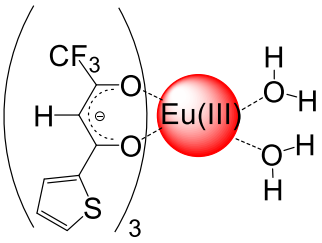
Ref. 28



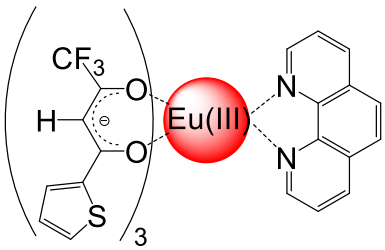
Ref. 28



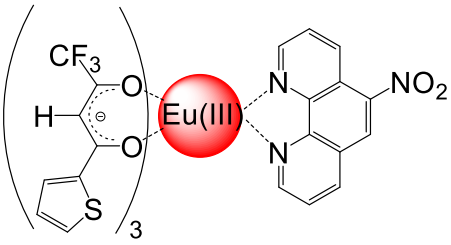
Ref. 28



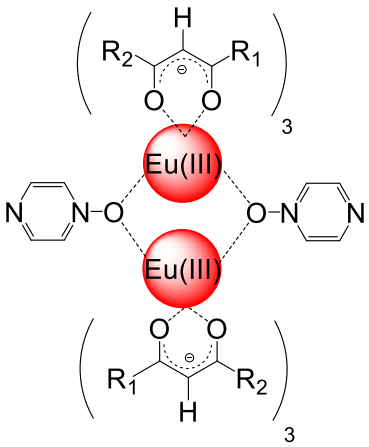
Ref. 28



Ref. 28



Ref. 28



Ref. 29

*4-4'-bipyridine-N-oxide

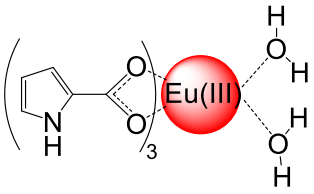
tta ligand: $R_1 = CF_3$, R_2 =  $\Phi_{\pi\pi} = 35\ \%$, $\Phi_{ff} = 59\ \%$, $\tau = 0.59$ ms

dbm ligand: R_1 =  ,R_2 =  $\Phi_{\pi\pi} = 48\ \%$, $\Phi_{ff} = 50\ \%$, $\tau = 0.58$ ms

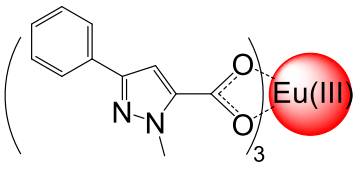
bta ligand: $R_1 = CF_3$, R_2 =  $\Phi_{\pi\pi} = 22\ \%$, $\Phi_{ff} = 67\ \%$, $\tau = 0.67$ ms

hfa ligand: $R_1 = CF_3$, $R_2 = CF_3$ $\Phi_{\pi\pi} = 10\ \%$, $\Phi_{ff} = 67\ \%$, $\tau = 0.70$ ms

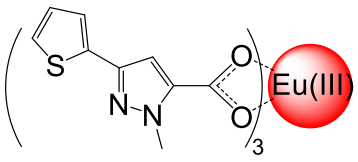
Figure S4. Chemical structures of the Eu(III) complexes with β-diketonate-based LMCT



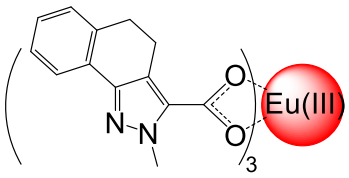
(295K) τ = 0.25 ms
(77K) τ = 0.45 ms
(Ref. 30)



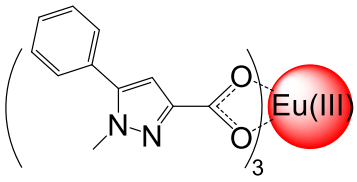
$\Phi_{\pi\pi}$ = 3 %, Φ_{ff} = 17%,
(Ref. 31)



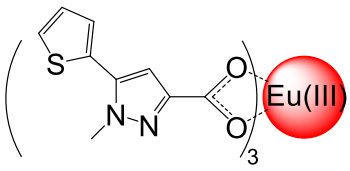
$\Phi_{\pi\pi}$ < 1 %
(Ref. 31)



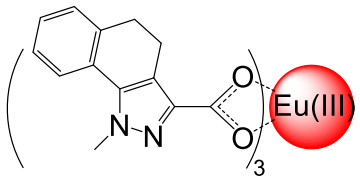
$\Phi_{\pi\pi}$ = 1 %, Φ_{ff} = 12%,
(Ref. 31)



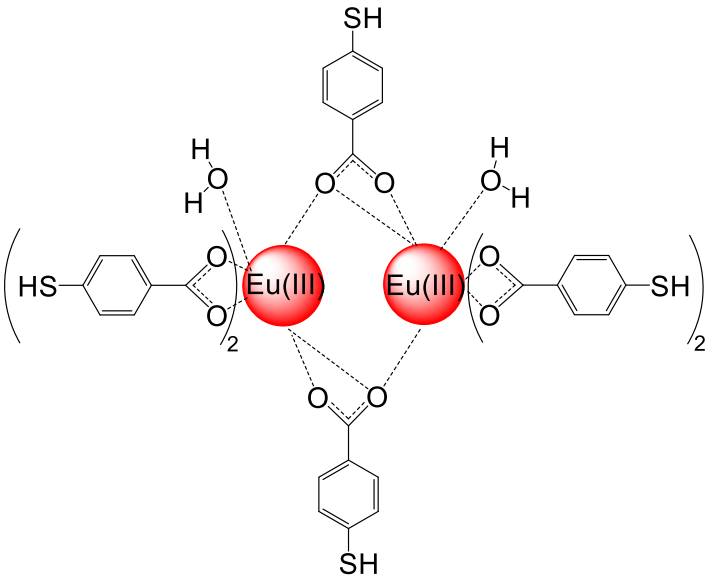
$\Phi_{\pi\pi}$ = 14 %, Φ_{ff} = 14%,
(Ref. 31)



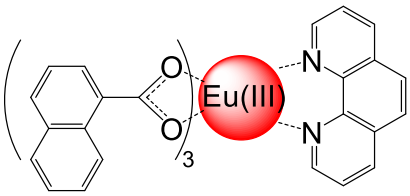
$\Phi_{\pi\pi}$ = 16 %, Φ_{ff} = 20 %,
(Ref. 31)



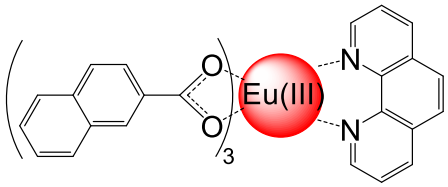
$\Phi_{\pi\pi}$ = 10 %, Φ_{ff} = 20 %,
(Ref. 31)



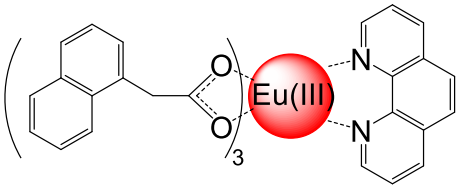
(77 K) τ = 0.56 ms
(295 K) $\Phi_{\pi\pi}$ = 10.44 %, τ = 0.29 ms
(Ref. 32)



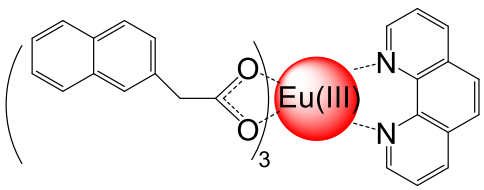
(Ref. 33)



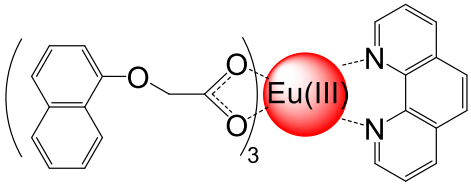
(Ref. 33)



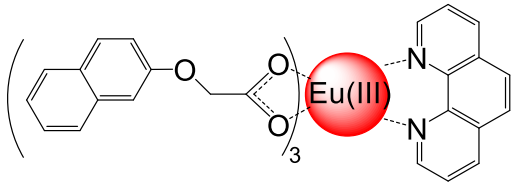
(Ref. 33)



(Ref. 33)



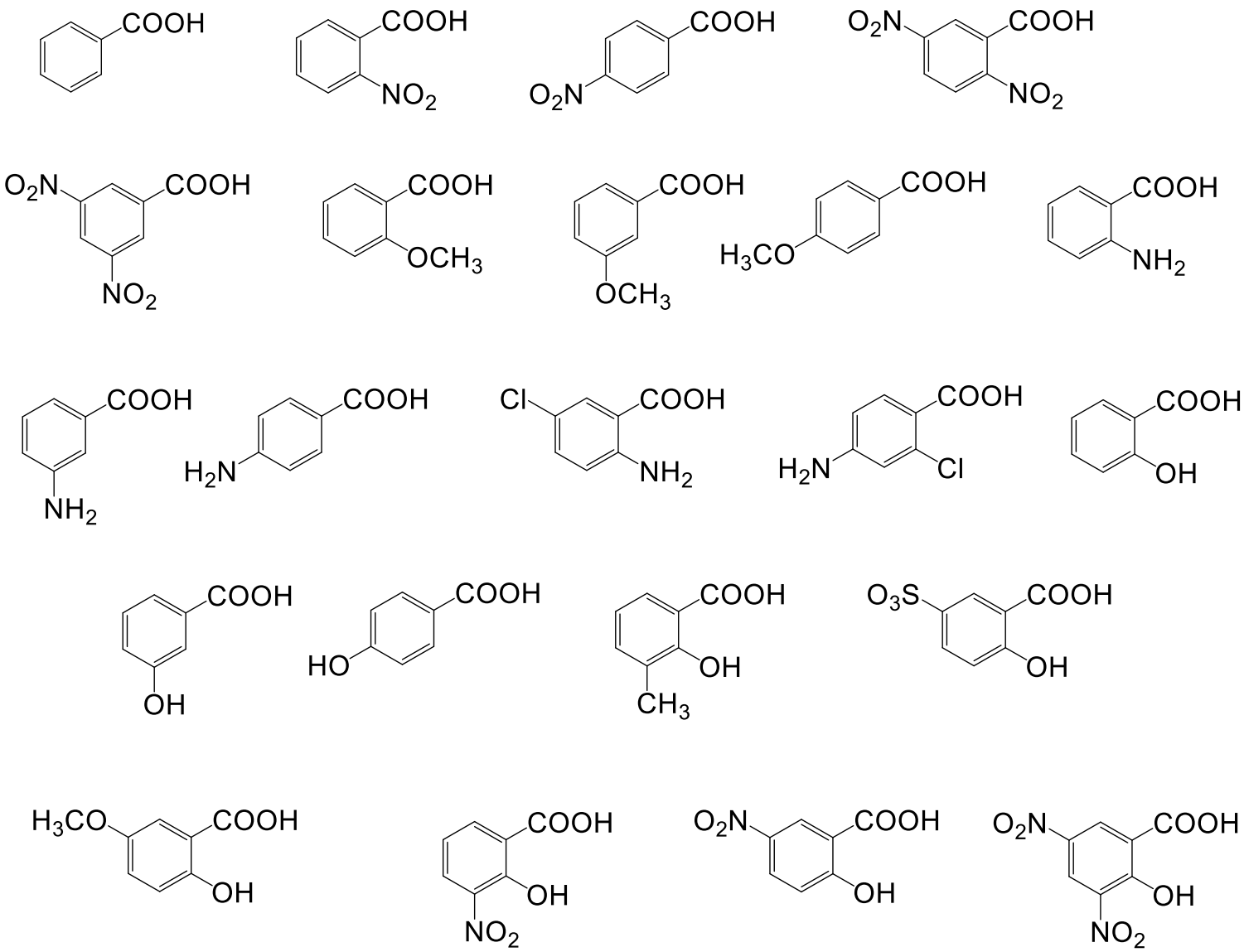
(Ref. 33)

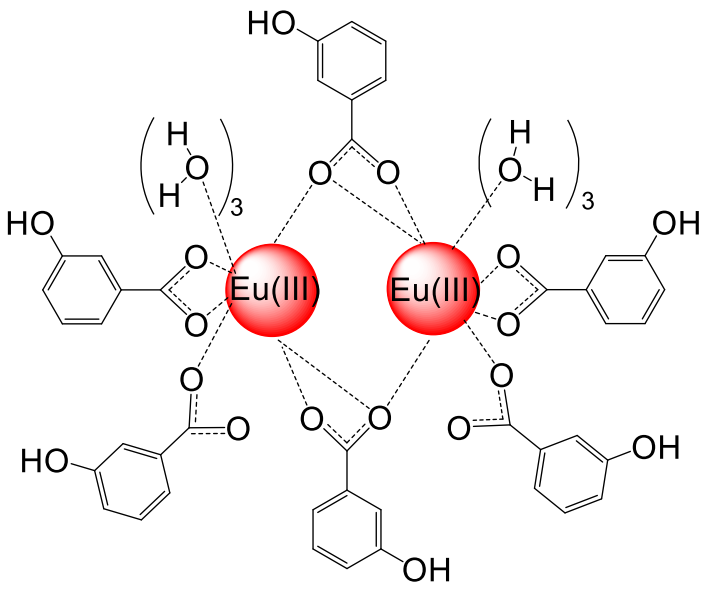


(Ref. 33)

Figure S5. Chemical structures of the Eu(III) complexes with carboxylate ligand-based LMCT

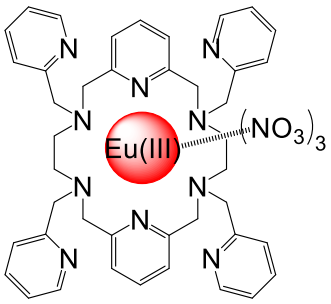
Review of Eu(III) complexes with benzoate typed ligands (Ref. 34)



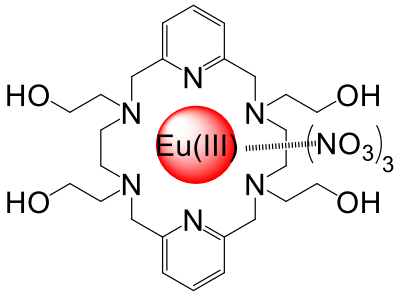


(77 K) τ = 0.28 ms
(295 K) τ = 0.27 ms
(Ref. 35)

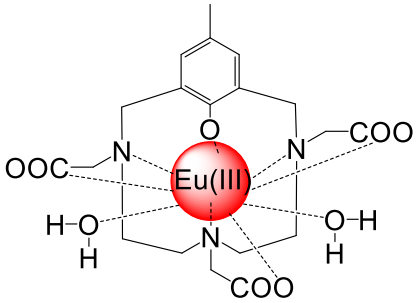
Figure S6. Chemical structures of the Eu(III) complexes with carboxylate ligand-based LMCT



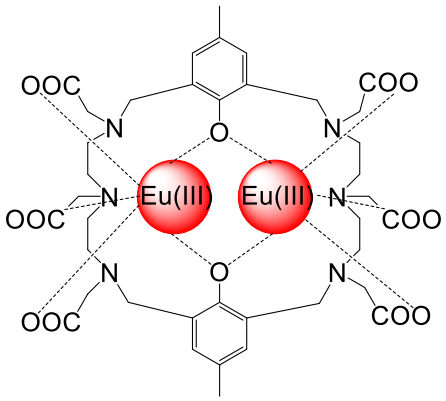
(in H_2O) $\Phi_{\pi\pi}$ = 0.1 %, τ = 1.4 ms, 0.47 ms
(in D_2O) $\Phi_{\pi\pi}$ = 0.24 %, τ = 2.11 ms, 1.30 ms
(Ref. 36)



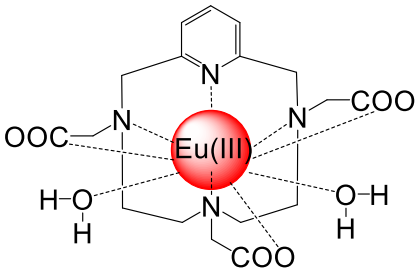
(in H_2O) $\Phi_{\pi\pi}$ = 1.6 %, τ = 0.49 ms
(in D_2O) $\Phi_{\pi\pi}$ = 5.3 %, τ = 1.36 ms
(Ref. 36)



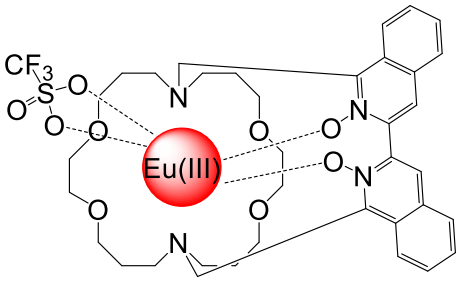
τ = 0.31 ms
(Ref. 37)



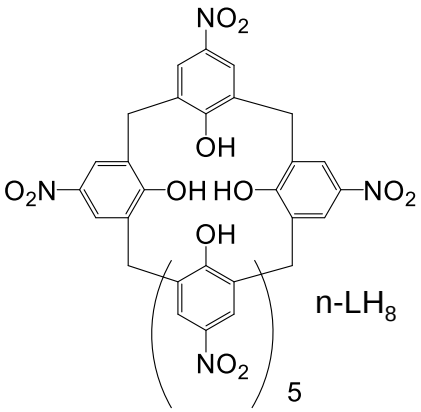
τ = 0.55 ms
(Ref. 37)



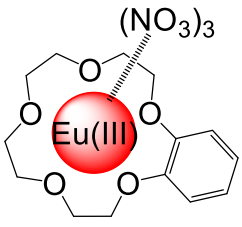
τ = 0.37 ms
(Ref. 37)



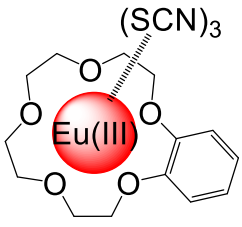
(in D_2O) $\Phi_{\pi\pi}$ = 21.5 % (77K),
$\Phi_{\pi\pi}$ = 5.9 % (293K), τ = 0.804 ms
(Ref. 38)



$[Eu_2(n\text{-}LH_2)(DMF)_x]$ $(DMF)_y(EtOH)_z$
(x + y = 9, z =0) τ = 0.305 ms
(x + y = 7, z =1) τ = 0.301 ms
(Ref. 39)

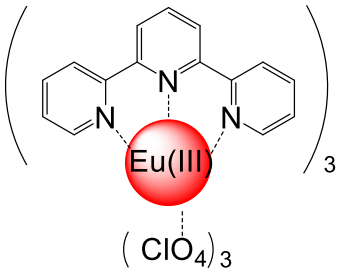


Ref. 40

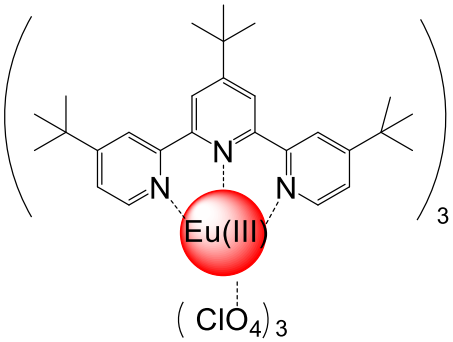


Ref. 40

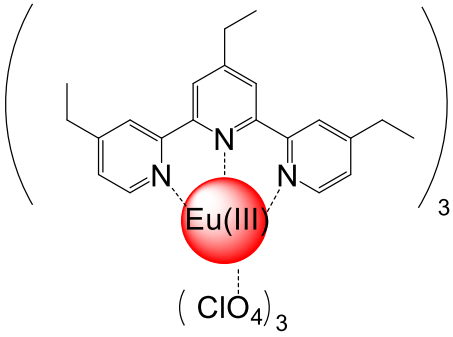
Figure S7. Chemical structures of the Eu(III) complexes with macrocycle ligand-based LMCT



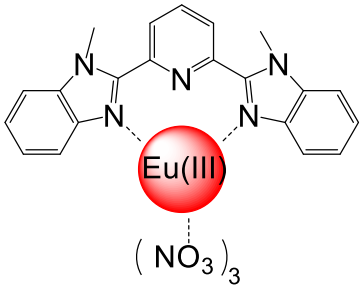
(in CH_3CN) $\Phi_{\pi\pi}$ = 1.3 % (Ref. 41)



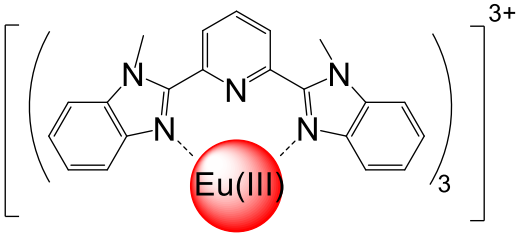
(in CH_3CN) $\Phi_{\pi\pi}$ = 10 % (Ref. 41)



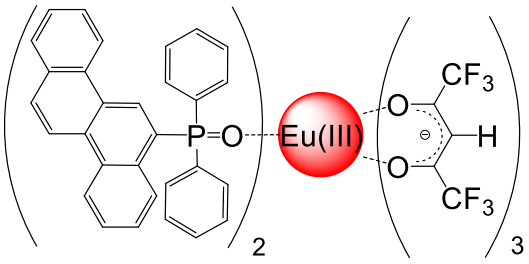
(in CH_3CN) $\Phi_{\pi\pi}$ = 11 % (Ref. 41)



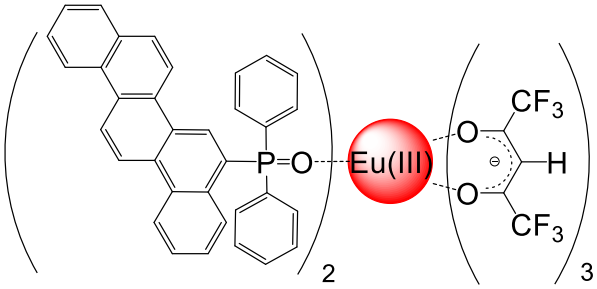
(Ref. 42,43)



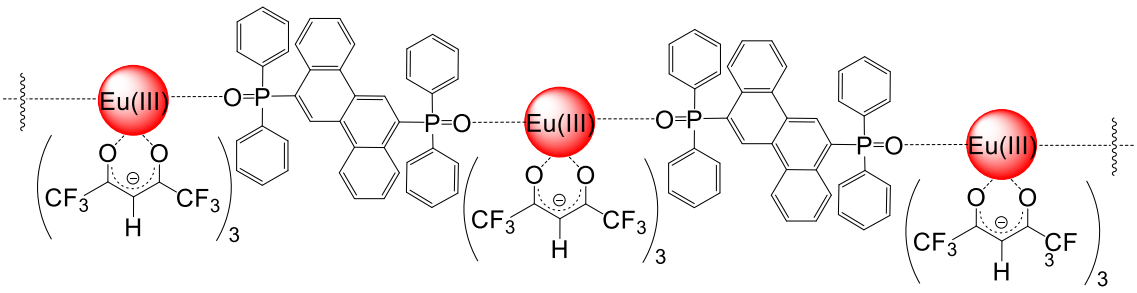
(Ref. 42,43)



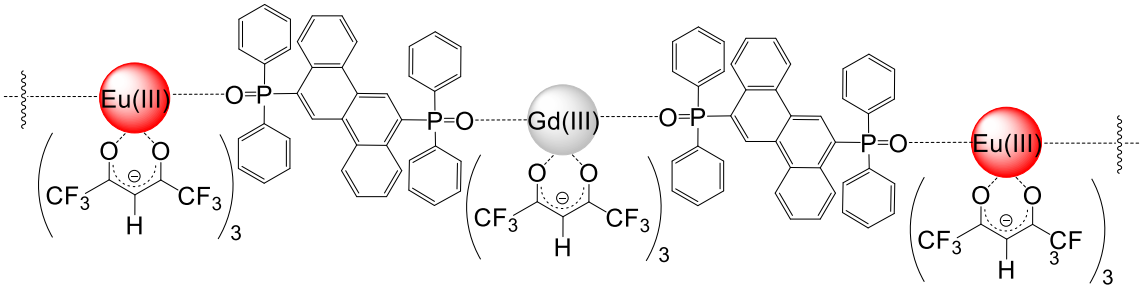
ε = 490,000 $cm^{-1}M^{-1}$, $\Phi_{\pi\pi}$ = 22 %
Φ_{ff} = 73%, T_d = 281 °C (Ref. 44)



Φ_{ff} = 51 %,
T_d = 285 °C (Ref. 46)

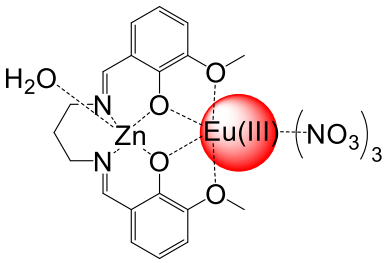


ε = 490,000 $cm^{-1}M^{-1}$
$\Phi_{\pi\pi}$ = 36 %
Φ_{ff} = 69 %
T_d = 358 °C
(Ref. 45)

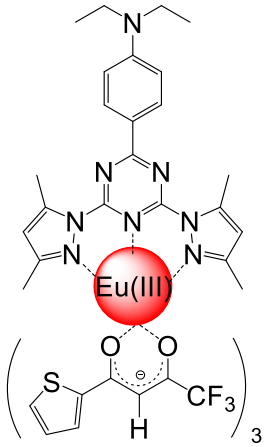


$\Phi_{\pi\pi}$ = 52 %
Φ_{ff} = 74 %
T_d = 358 °C
(Ref. 45)

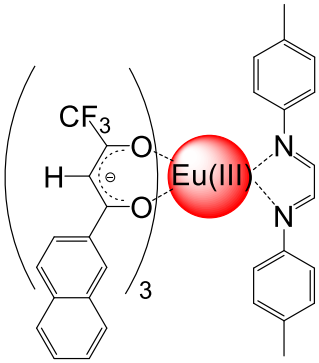
Figure S8. Chemical structures of the Eu(III) complexes with terpyridine or phosphine oxide ligand-based LMCT



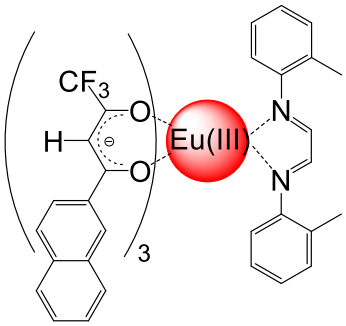
$\Phi_{4f\text{-}4f}$ = 8.0 %, τ = 0.190 ms
(Ref. 47)



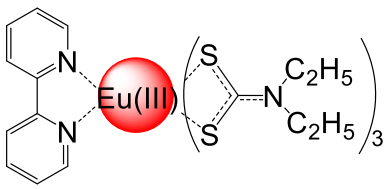
$\Phi_{\pi\pi}$ = 52 %,
(Ref. 48)



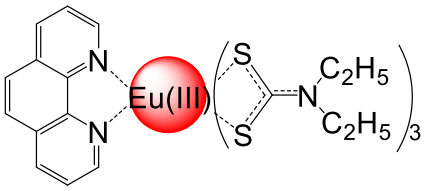
Φ_{ff}= 3.1 %,
τ = 0.038 ms
(Ref. 50)



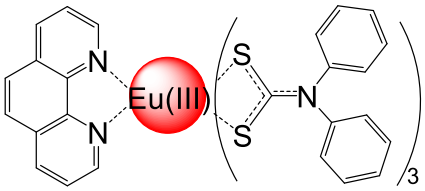
Φ_{ff}= 2.2 %,
τ = 0.030 ms
(Ref. 50)



(300K) τ < 0.05 ms
(77K) $\Phi_{\pi\pi}$ = 1.7 %, τ = 0.05 ms
(Ref. 49)



(300K) $\Phi_{\pi\pi}$ = 4.2 %, τ = 0.09 ms
(77K) $\Phi_{\pi\pi}$ = 10.5 %, τ = 0.224 ms
(Ref. 49)



(300K) $\Phi_{\pi\pi}$ = 3.4 %, τ = 0.075 ms
(77K) $\Phi_{\pi\pi}$ = 12.0 %, τ = 0.261 ms
(Ref. 49)

Figure S9. Chemical structures of the Eu(III) complexes with the other (Figure S1-S8) typed ligand-based LMCT