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SUPPORTING INFORMATION

Infrared-photostimulable and long-persistent ultraviolet-emitting phosphor $LiLuGeO_4:Bi^{3+},Yb^{3+}$ for biophotonic applications

Hao Cai, Zhen Song*, Quanlin Liu*

The Beijing Municipal Key Laboratory of New Energy Materials and Technologies, School of Materials Science & Engineering, University of Science and Technology Beijing, Beijing 100083, China.

* Corresponding Author: E-mail address: qlliu@ustb.edu.cn (Quanlin Liu)

* Corresponding Author: E-mail address: zsong@ustb.edu.cn (Zhen Song)

Table S1. The refined structural parameters of $LiLuGeO_4$ host.

Space group		Pnma	**Symmetry**		orthorhombic
Cell parameters		a = 11.02262 Å, b = 6.23147 Å, c = 5.04259 Å, V = 346.361 Å^3			
Reliability factors		R_p = 9.06%, R_{wp} = 12.7%, R_{exp} = 7.81%, χ^2 = 2.65			
Atom	**Site**	**x**	**y**	**z**	**Occ.**
Li	4a	0.000(0)	0.000(0)	0.000(0)	1.000
Lu	4c	0.226(5)	0.250(0)	0.508(1)	1.000
Ge	4c	0.086(3)	0.750(0)	0.569(2)	1.000
O1	8d	0.166(9)	0.531(0)	0.719(2)	1.000
O2	4c	0.050(8)	0.250(0)	0.289(5)	1.000
O3	4c	0.091(2)	0.750(0)	0.222(7)	1.000

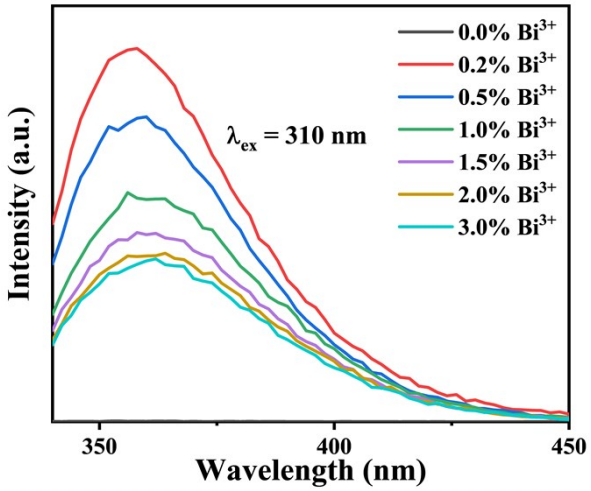

Fig. S1. PL spectra with different Bi^{3+} doping concentration under 310 nm excitation.

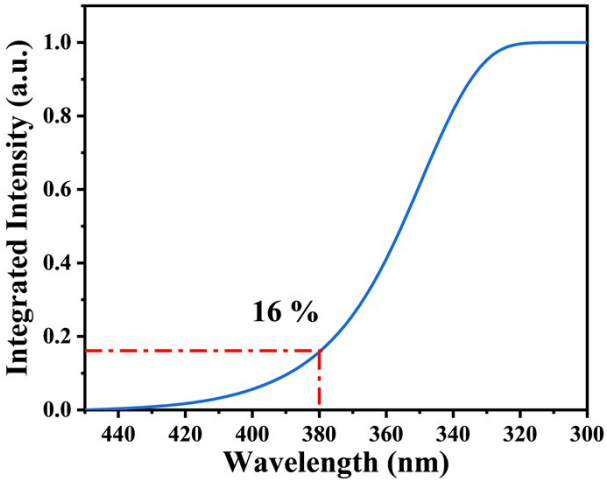

Fig. S2. Integrated intensity of the $LiLuGeO_4:Bi^{3+},Yb^{3+}$ accumulates with the wavelength.

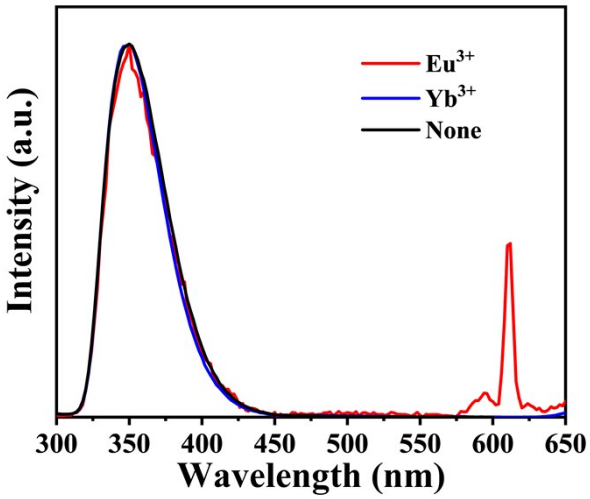

Fig. S3. Normalized PerL spectra of $LiLuGeO_4:Bi^{3+},Yb^{3+}$ and $LiLuGeO_4:Bi^{3+},Eu^{3+}$ compared with non-rare earth doped sample.

Table S2. The lowest state of $4f^{n+1}$ configuration for divalent lanthanide ions in $LiLuGeO_4$.

n	0	1	2	3	4	5	6	7	8	9	10	11	12	13
E(eV)	10.38	8.9	7.64	7.2	7.11	6.02	4.77	9.33	7.98	7.04	7.17	7.35	6.49	5.203

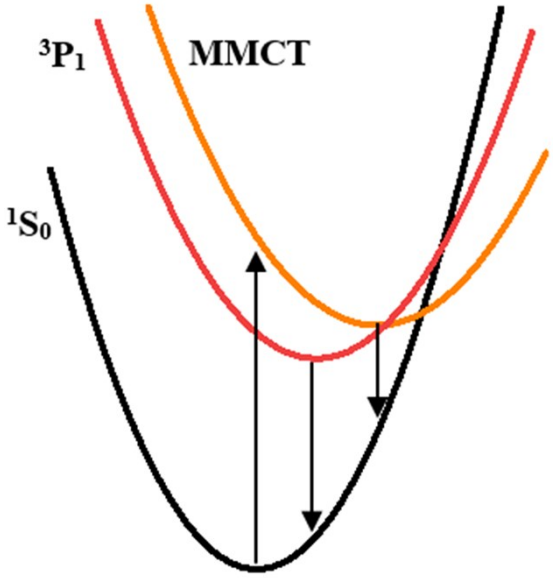

Fig. S4. The schematic coordinate energy level diagram of $LiLuGeO_4:Bi^{3+},Yb^{3+}$.

The schematic coordinate energy level diagram of this material is shown in **Fig. S4**. We should notice that intensity of the 400 nm peak is weaker than the 350 nm peak, although electrons are directly excited to the MMCT state. This phenomenon indicates that a large number of electrons are relaxed to the $^3P_1$ state under continuous 254 nm excitation, accompanied by a very small part of electrons returning from the MMCT state to the ground state, either by MMCT emission or relaxation. During the persistent luminescence process, because the bottom of the MMCT state is very close to the $^3P_1$ state, the released electrons from traps are all relaxed to the $^3P_1$ state, thus the PerL spectra show different profile compared to the PL spectrum.