Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.
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Supporting Information

Ambient light stimulation enabling intense and long-lasting ultraviolet-C persistent luminescence from Pr^{3+}-doped YBO_3 in bright environments

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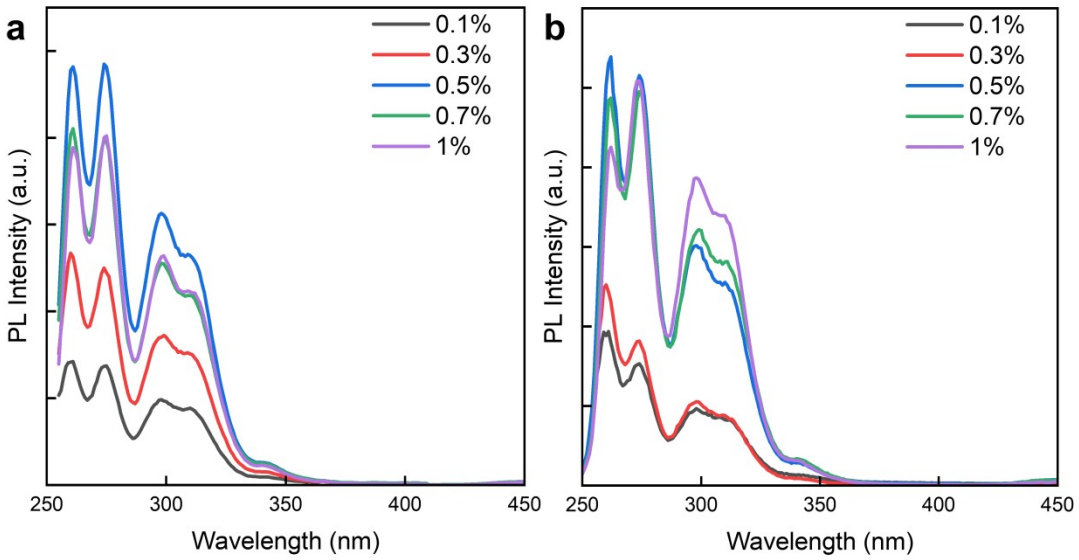

Fig. S1 Photoluminescence emission spectra of the $Y_{1-x}BO_3:xPr^{3+}(0 < x \leq 0.01)$ phosphors at room temperature. The emission spectra were obtained under the excitation of (a) 249 nm light and (b) X-ray, respectively.

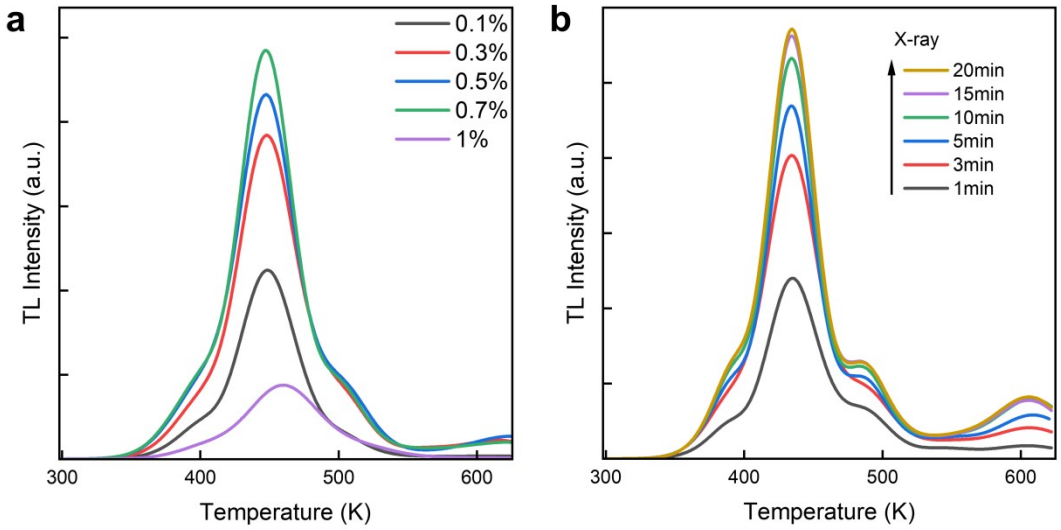

Fig. S2 TL curves of the $YBO_3:Pr^{3+}$ phosphors with (a) different excitation durations and (b) different Pr^{3+} doping concentrations. The TL curves were acquired at 60 s decay after ceasing X-ray irradiation.

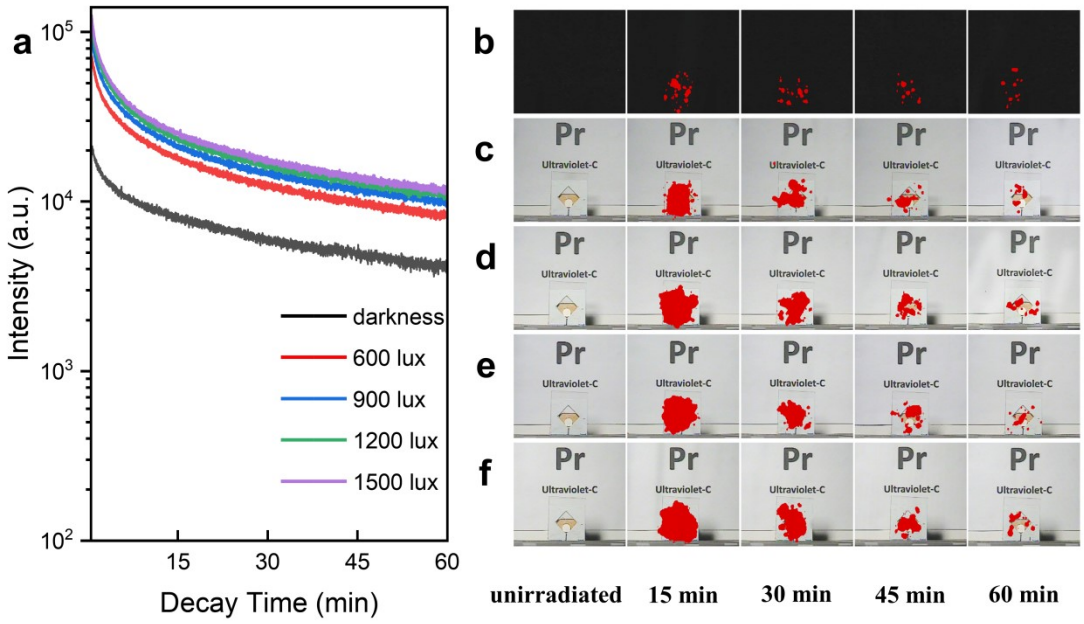

Fig. S3 (a) UVC persistent luminescence decay curves of the $YBO_3:Pr^{3+}$ phosphor recorded upon white LED light illumination with different illuminance values (0, 600, 900, 1200, and 1500 lux). Before each measurement, the phosphor has been charged by X-ray for 15 min. The related UVC persistent luminescence images of the phosphor disc captured by an OFIL corona camera upon indoor white LED light: (b) darkness (0 lux); (c) 600 lux; (d) 900 lux; (e) 1200 lux and (f) 1500 lux after ceasing the X-ray excitation.

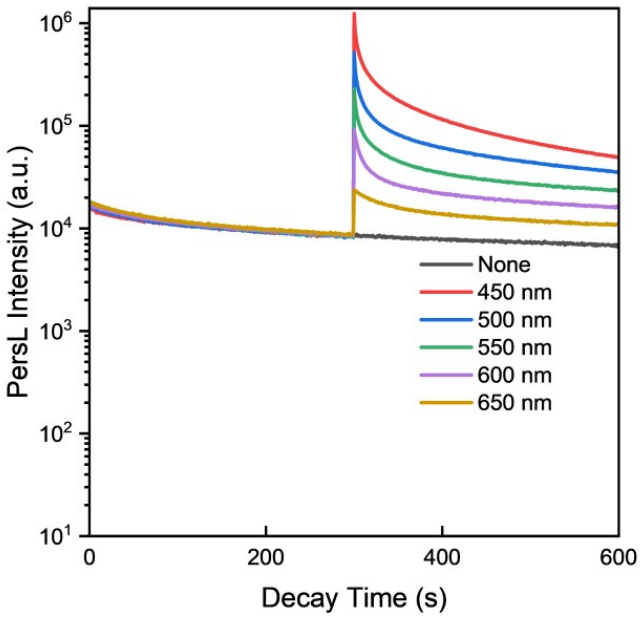

Fig. S4 UVC persistent luminescence decay curves of the $YBO_3:Pr^{3+}$ phosphor monitored at 274 nm after irradiation by X-ray for 15 min. The photo-stimulated decay curves were measured under the stimulation of different monochromatic lights over 450–650 nm in a step of 50 nm.

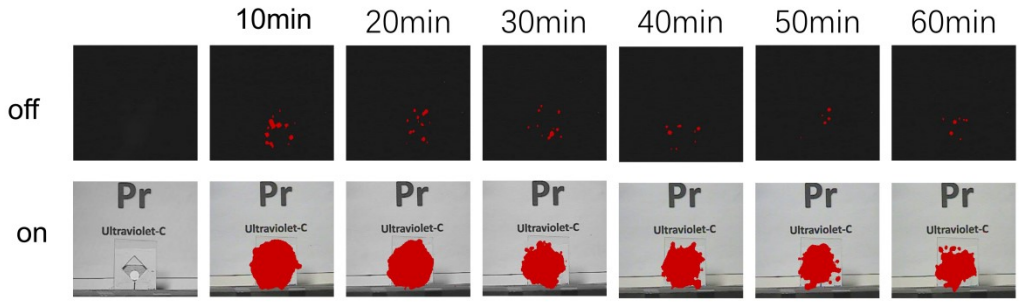

Fig. S5 UVC persistent luminescence images of the $YBO_3:Pr^{3+}$ phosphor in darkness and under the illumination of white LED. The phosphor was stored in the dark after irradiation by X-ray. Every 10 minutes, the UVC signals were recorded firstly in the dark, and then were recorded again when the white LED was turned on for 10 s. After that, the white LED was switched off again.

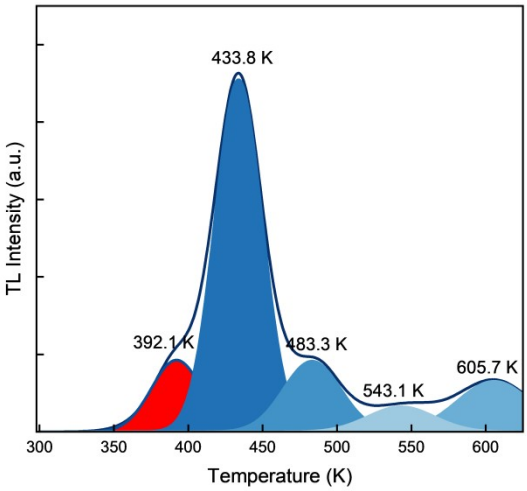

Fig. S6 The Gaussian fitting of the thermoluminescence spectrum of the $YBO_3:Pr^{3+}$ phosphor. The sample was pre-irradiated with an X-ray for 15 min.

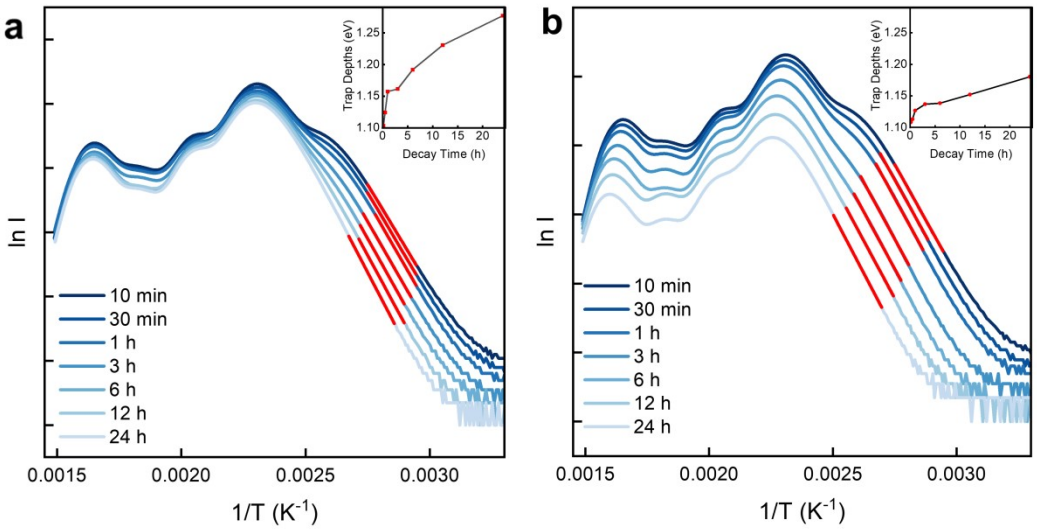

Fig. S7 Thermoluminescence curves and fittings of the $YBO_3:Pr^{3+}$ phosphor plotted in ln(I) versus 1/T coordinate: (a) in darkness (0 lux illuminance), (b) 900 lux illuminance. The insets show trap depths of the $YBO_3:Pr^{3+}$ phosphor at different decay instants.

This initial rise method assumes that the initial low-temperature side of the TL peak will follow the Arrhenius equation:

$I = Cexp(-\Delta E/kT)$

where I represents the thermoluminescence intensity, C is a fitting constant that includes a frequency factor, ΔE represents the trap depth, T represents the temperature, and k is the Boltzmann constant. According to Equation, the initial rise part of the glow curve is represented by a straight line with a slope of -ΔE if ln(I) is plotted as a function of $1/kT$. The fittings of the selected glow curves are shown by the red solid lines.

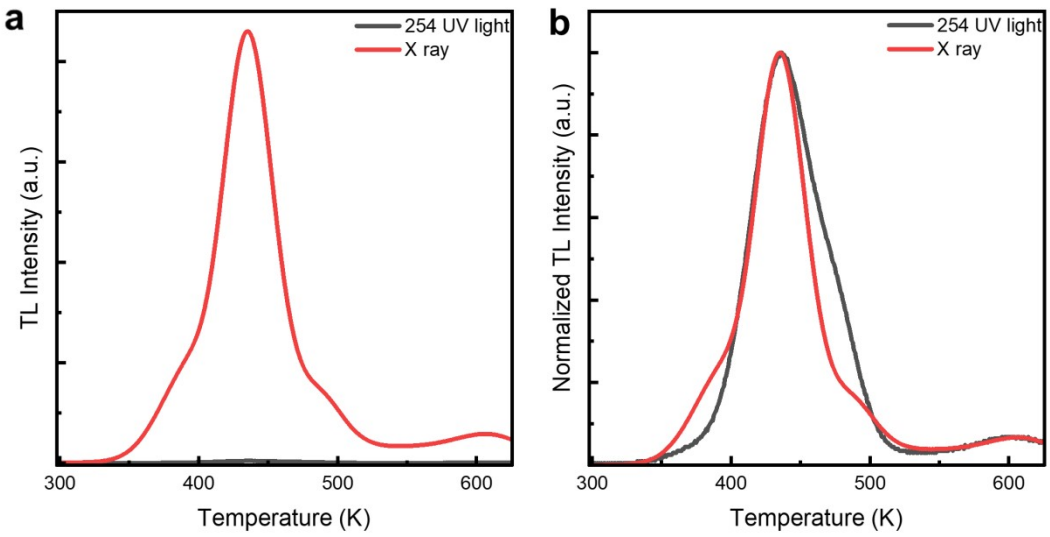

Fig. S8 Thermoluminescence spectra after irradiation by a 254 nm UV lamp and X-ray, respectively. Thermoluminescence curves were acquired at 60 s decay after the cessation of external excitation.

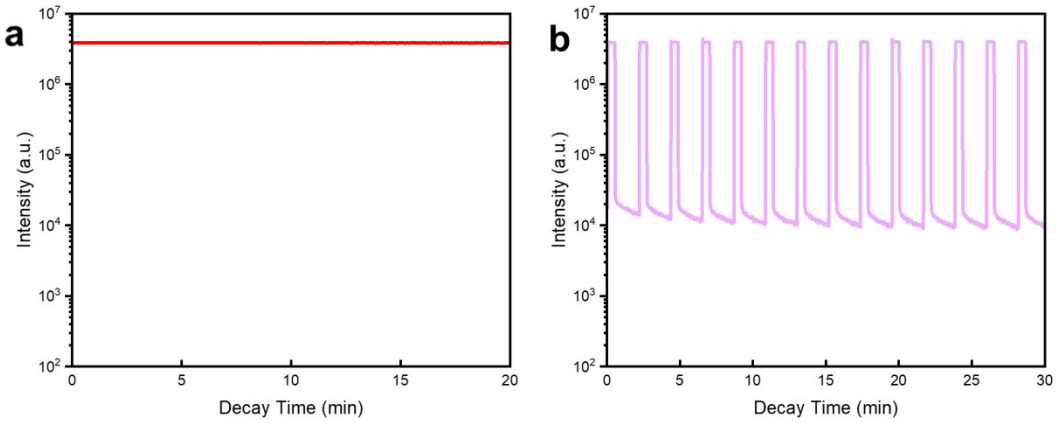

Fig. S9 Radiation stability of the charged $YBO_3:Pr^{3+}$ phosphor under (a) continuous X-ray irradiation for 20 min and (b) repeated cycles of X-ray irradiation (on 30 s; off 100 s).

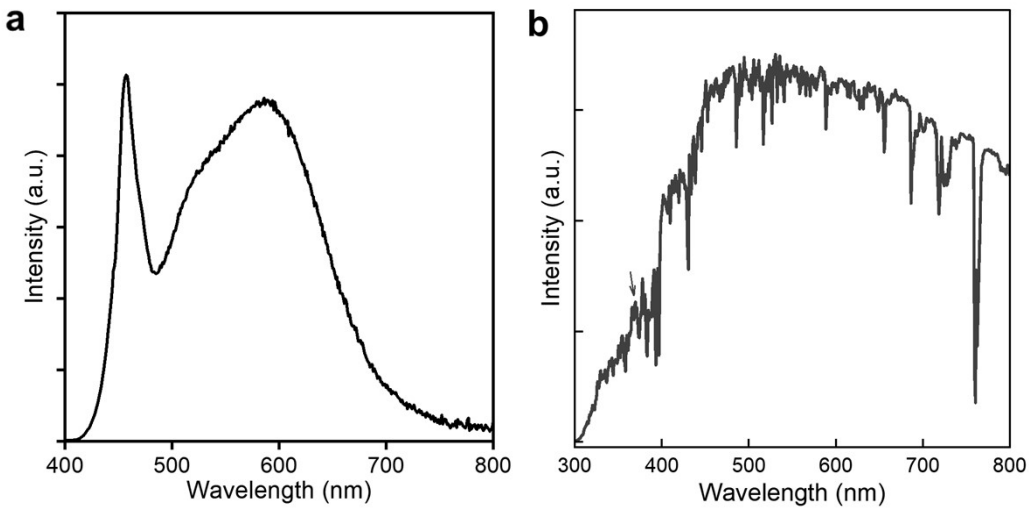

Fig. S10 Emission spectra of (a) the white LED light source and (b) natural sunlight.

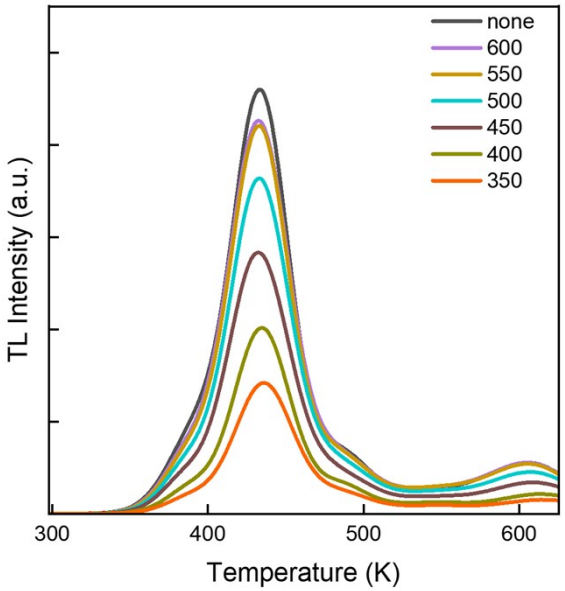

Fig. S11 Thermoluminescence curves of the fully charged $YBO_3:Pr^{3+}$ phosphor after irradiation by different monochromatic lights for 15 min over 350–600 nm in a step of 50 nm.

Table S1 Rietveld refinement parameters of the YBO_3 and YBO_3:0.7%Pr^{3+} phosphor.

Sample	YBO_3	YBO_3:0.7%Pr^{3+}
Space group	C2/c	C2/c
a (Å)	11.3138(3)	11.36196(32)
b (Å)	6.5403(2)	6.56318(8)
c (Å)	9.5499(2)	9.57757(22)
V(Å^3)	650.995	658.012(27)
α=γ (º)	90	90
β (º)	112.902(1)	112.8799(19)
Density (g/cm^3)	/	4.144
Rp and Rwp	/	6.15 % and 9.44 %