Electronic Supplementary Information (ESI) for

Modulation of Auger recombination via facet engineering in $CsPbBr_3$ perovskite nanocrystals

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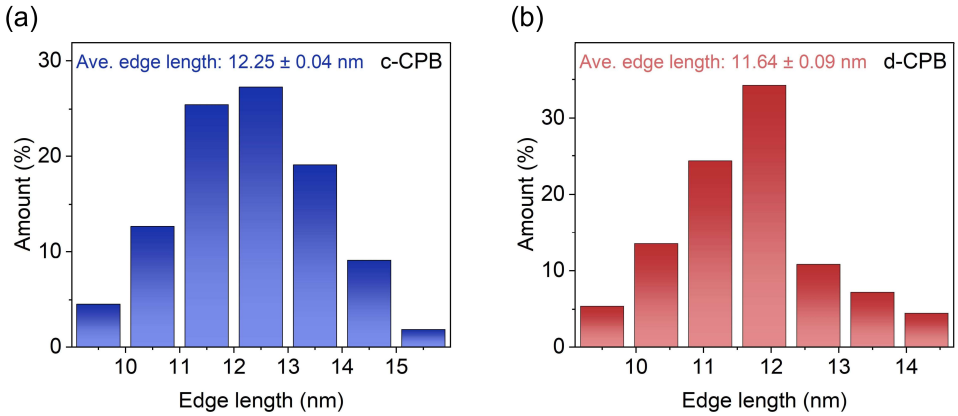

Fig. S1 Size distribution histograms for (a) c-CPB and (b) d-CPB NCs from TEM images.

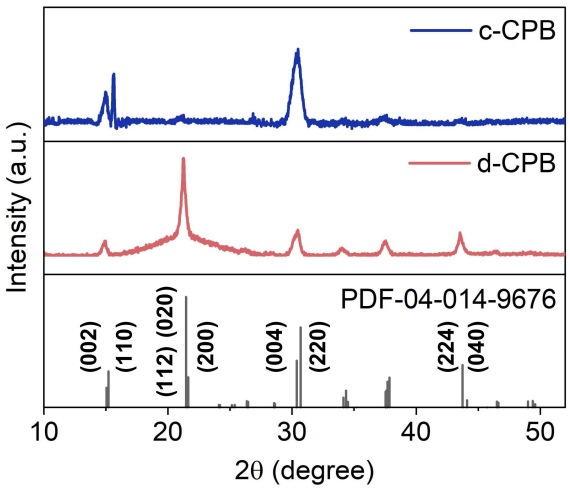

Fig. S2 XRD patterns for c-CPB and d-CPB NCs. Compared to c-CPB NCs, d-CPB NCs exhibited much stronger signals at the diffraction angles corresponding to the (020), (112) and (200) facets, while much weaker signals at the diffraction angles corresponding to the (110) and (002) facets.

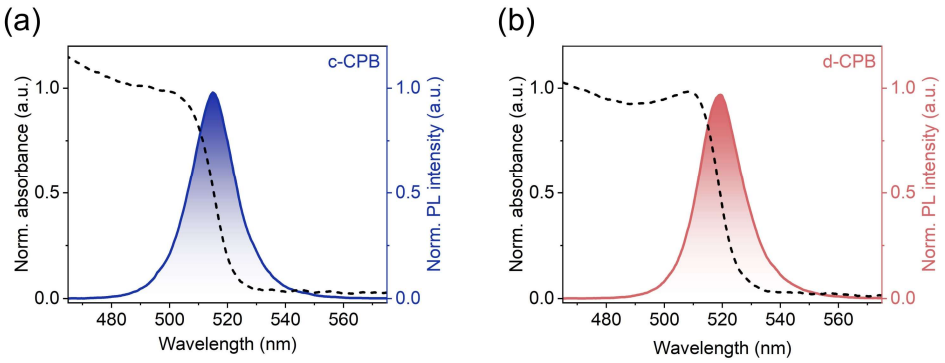

Fig. S3 Normalized steady-state absorption and PL spectra (excited at 400 nm) for (a) c-CPB and (b) d-CPB NCs.

Table S1 The fitting results (based on eqn 2 in the main text) for c-CPB and c-CPB NCs under investigation. The parameter *B* was fixed as the reciprocal of the PL quantum yield. The PL quantum yields were measured to be about 78% and 82% for c-CPB and d-CPB, respectively.

	I_0	A	E_a (meV)	B	E_b (meV)
c-CPB	1	109.7 ± 40.8	13.4 ± 1.5	1.28	85.2 ± 8.6
d-CPB	1	19.0 ± 7.6	16.4 ± 2.2	1.22	60.4 ± 7.0

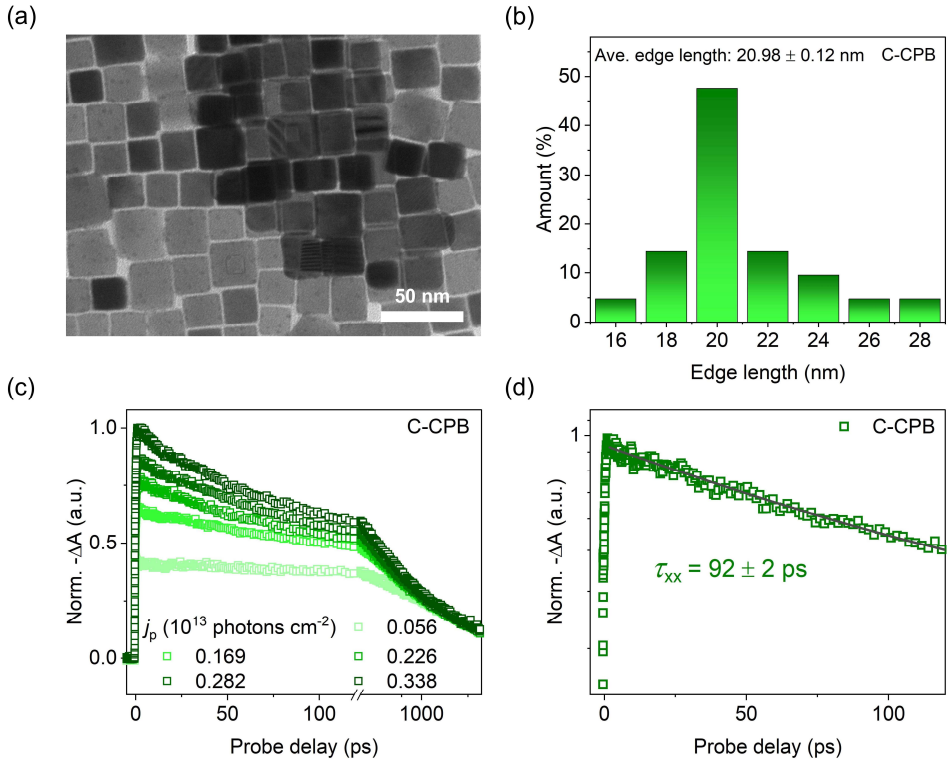

Fig. S4 (a) Representative TEM image for C-CPB NCs. (b) Size distribution histogram for C-CPB NCs from TEM image. (c) Representative j_p-dependent fs-TA kinetic traces (late-time tail normalized) for C-CPB NCs. (d) Retrieval of biexciton lifetime (τ_{xx}) for C-CPB NCs based on the kinetics data shown in (c).

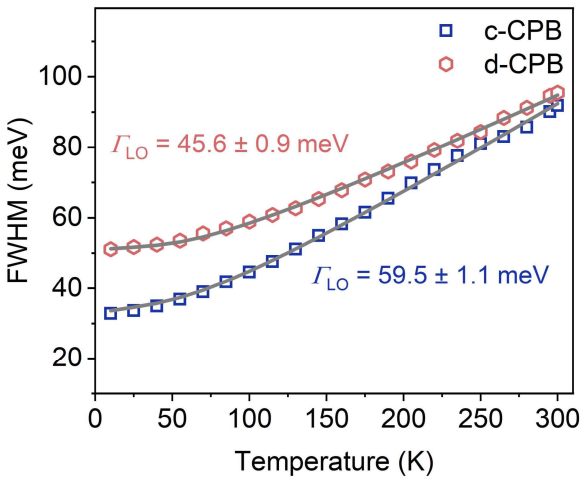

Fig. S5 Temperature-dependent PL FWHM analysis for c-CPB and d-CPB NCs. The information about the charge carrier–LO-phonon coupling strength can be obtained with the aid of an analysis on the temperature-dependent FWHM, $\Gamma(T)$, according to $\Gamma(T) = \Gamma_{\mathrm{inh}} + \Gamma_{\mathrm{LO}}[\exp(E_{\mathrm{LO}}/k_{\mathrm{B}}T) - 1]^{-1}$,[S1–S3] where the first term Γ_{inh} denotes temperature-independent inhomogeneous broadening due to the imperfections and/or disorder, Γ_{LO} denotes the charge carrier–LO-phonon scattering, E_{LO} denotes the LO-phonon energy (~20 meV)[S4] and k_{B} is the Boltzmann constant. The best-fit results are as follows: Γ_{LO} = 59.5 ± 1.1 meV and Γ_{inh} = 37.7 ± 1.0 meV for c-CPB; Γ_{LO} = 45.6 ± 0.9 meV and Γ_{inh} = 52.8 ± 0.5 meV for d-CPB.

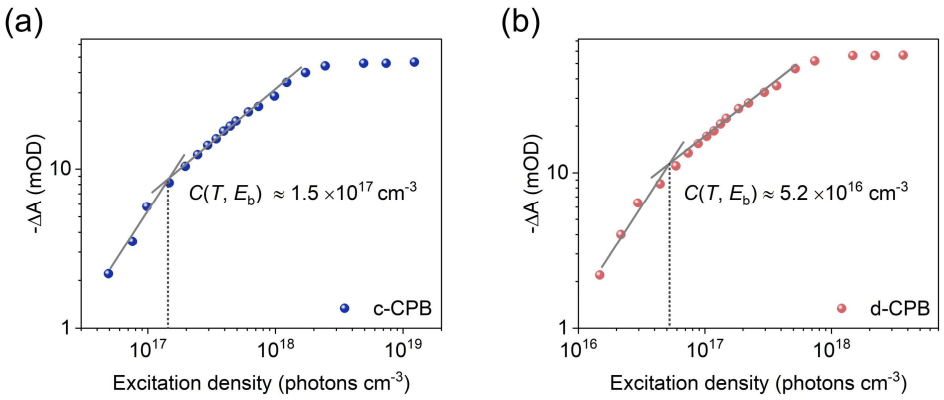

Fig. S6 The fs-TA photobleaching signal (taken at 2–5 ps) as a function of excitation density for (a) c-CPB and (b) d-CPB NCs. The values of excitation density, n, can be determined according to $n = j_p\sigma/V$, where j_p denotes the pump fluence, σ denotes the absorption cross section and *V* denotes the NC volume. Following the treatment described in the literature,[S5] we can readily retrieve the excited-state E_b values of interest according to $C(T, E_b) = (2\pi\mu k_B T/h^2)^{3/2}\exp(-E_b/k_B T)$, where μ denotes the reduced mass according to $\mu = (1/m_e^* + 1/m_h^*)^{-1}$, k_B is the Boltzmann constant, h is the Planck constant and T = 300 K. The $C(T, E_b)$ positions can be determined simply by intersecting the quadratic and linear fitting lines as indicated in the plots. The obtained excited-state E_b values are ~30.2 meV for c-CPB and ~57.5 meV for d-CPB.

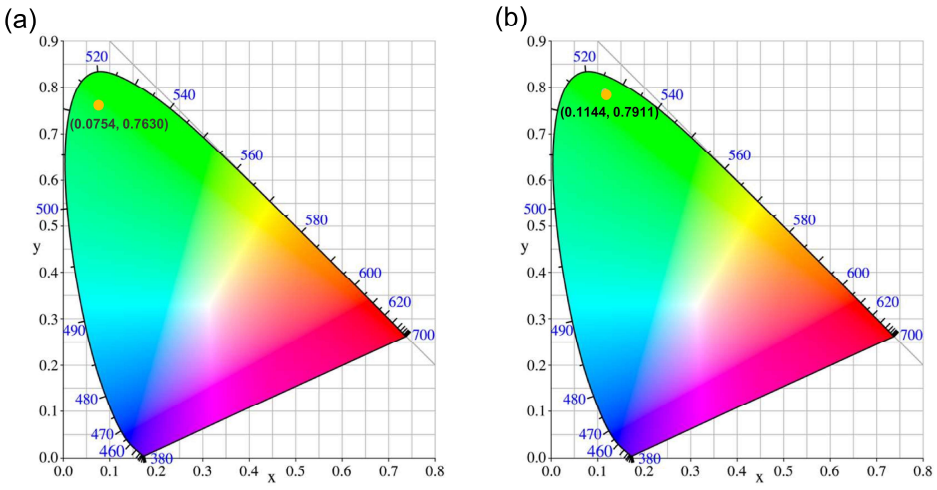

Fig. S7 Commission Internationale de l'Eclairage (CIE) colour coordinates for (a) c-CPB and (b) d-CPB NCs-based LEDs at a driving voltage of 4.0 V.

References

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