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## Scientists Design Lead-free Rare-earth-based Double Perovskite Nanocrystals with Near-infrared Emission

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Lead-free halide perovskite nanocrystals (NCs) with unique optical properties are promising in light-emitting diodes (LEDs), photodetectors, and solar cells.

Previous studies mainly focused on the photoluminescence (PL) in the visible region, and those on the near-infrared (NIR) PL of lead-free perovskite NCs are rare.

Recently, a research group led by Prof. HAN Keli from the Dalian Institute of Chemical Physics ([DICP](#)) of the Chinese Academy of Sciences ([CAS](#)), in collaboration with Prof. MIAO Xiangyang's group from Shanxi Normal University, designed colloidal synthesis of all-inorganic rare-earth-based double perovskite NCs with NIR emission, and revealed their exciton dynamics.

This study was published in [Laser & Photonics Reviews](#) on August 27.



NIR PL emission spectra and HRTEM images of  $\text{Cs}_2\text{NaEr}_{0.5}\text{B}_{0.5}\text{Cl}_6$  NCs.

The researchers synthesized all-inorganic rare-earth-based  $\text{Cs}_2\text{NaEr}_{1-x}\text{B}_x\text{Cl}_6$  (B: In, Sb, Bi;  $x = 0, 0.13, 0.5$ ) double perovskite NCs by hot injection with variable temperature.

They found that all these NCs exhibited a NIR PL emission from  $4\text{I}_{13/2} \rightarrow 4\text{I}_{15/2}$  transition of  $\text{Er}^{3+}$ , and on account of the incorporated  $\text{Sb}^{3+}$ ,  $\text{Cs}_2\text{NaEr}_{0.5}\text{Sb}_{0.5}\text{Cl}_6$  NCs showed a 23-fold NIR PL enhancement with the average lifetime of 119.1  $\mu\text{s}$ .

"The origin of NIR PL enhancement was attributed to the increase of exciton absorption, the

longer PL lifetime, the suitable phonon-assisted process caused by the indirect band structure, and the process of long-lived dark trap state assisted NIR PL emission," said Prof. HAN.

Read the [original article](#) on Chinese Academy of Sciences (CAS).