

Pixelated colour convertor plays an immensely important role in next-generation display technologies. However, the inherent randomness of light propagation within the convertor presents a formidable challenge to reconcile the huge contradiction between excitation and outcoupling. Here, we demonstrate a bioinspired photonic waveguide pixelated colour convertor (BPW-PCC) to realize the directional excitation and outcoupling, which is inspired from an insect visual system. The lens array of BPW-PCC enables a focusing photonic waveguide that guides the excitation light and converge it on colloidal quantum dots; the directional channel provides a splitting photonic waveguide to enhance the outcoupling of photoluminescence light. Consequently, the excitation and outcoupling efficiency can be simultaneously improved at this judiciously designed pixelated colour convertor with a thickness of 50  $\mu\text{m}$ . By this strategy, ultrathin BPW-PCCs with 4.4-fold enhanced photoluminescence intensity have been demonstrated in micro-light-emitting diode devices and achieved a record-high luminous efficacy of 1600  $\text{lm W}^{-1}\text{mm}^{-1}$ , opening a new avenue for efficient miniaturized displays.