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Spontaneous emission enhancement of colloidal perovskite nanocrystals. ZHILI YANG, EDO WAKS, Univ of Maryland-College Park — Halide perovskite semiconductors have emerged as prominent photovoltaic materials since their high conversion efficiency and promising light emitting materials in optoelectronics. In particular, easy-to-fabricated colloidal perovskite nanocrystals based on CsPbX3 quantum dots has been intensively investigated recently. Their luminescent wavelength could be tuned precisely by their chemical composition and size of growth. This opens new applications including light-emitting diodes, optical amplifiers and lasing since their promising performance as emitters. However, this potentially high-efficient emitter and gain material has not been fully investigated and realized in integrated photonic structures. Here we demonstrate Purcell enhancement effect of CsPbBr3 perovskite nanocrystals by coupling to an optimized photonic crystal nanobeam cavity as a first crucial step towards realization of integrated on-chip coherent light source with low energy consumption. We show clearly highly-enhanced photoluminescent spectrum and an averaged Purcell enhancement factor of 2.9 is achieved when they are coupled to nanobeam photonic crystal cavities compared to the ones on unpatterned surface in our lifetime measurement. Our success in enhancement of emission from CsPbX3 perovskite nanocrystals paves the way towards the realization of efficient light sources for integrated optoelectronic devices with low energy consumption.

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