Single $CsPbX_3$ Perovskite QDs at Room Temperature

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Lead-halide perovskite $APbX_3$ (A=Cs or organic cation; X=Cl, Br, I) quantum dots (QDs) are subject of intense research due to their exceptional properties as both classical[1] and quantum light sources.[2-4] As the luminescence properties are determined by the excitonic states, a detailed understanding of the band-edge exciton states are of prime importance to explain the outstanding optical properties as well as to further optimize their performances. Here, we report a comprehensive investigation of single $CsPbX_3$ QDs optical properties at room temperature, overcoming limitations of ensemble measurements by eliminating inhomogeneous contribution from size, shape or composition of QDs. Furthermore, benefited from our implemented encapsulation method, spectrally stable PL (no dynamic blue shifting as reported previously[5, 6]) allows investigation into intrinsic properties. The results reveal the origin of the QD homogeneous PL linewidths, and the peculiar size-dependent exciton photoluminescence line broadening and the exciton and multi-excitons recombination dynamics. Experimental results are corroborated by ab-initio molecular dynamics. Such findings guide the further design of robust single photon sources operating at room temperature.

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