**Weakly-Confined perovskite quantum dots as high purity room-temperature single-photon sources**

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Colloidal perovskite quantum dots (PQDs) emerge as highly promising single photon emitters for quantum information applications. Presently, most strategies have focused on leveraging quantum confinement to increase the nonradiative Auger recombination (AR) rate to enhance SP purity in all-inorganic CsPbBr3 QDs. However, this also increases fluorescence intermittency. Achieving high SP purity and blinking mitigation simultaneously remains a significant challenge. Here, we transcend this limitation with room-temperature synthesized weakly-confined hybrid organic–inorganic perovskite (HOIP) QDs. Superior single photon purity with low g(2)(0)<0.07± 0.03 and nearly blinking-free behaviour (ON-state fraction >95%) in 11 nm FAPbBr3 QDs is obtained at room temperature; attributed to their long exciton lifetimes and short biexciton lifetimes. The significance of the organic A-cation is further validated using mixed-cation FAxCs1-xPbBr3. Theoretical calculations utilizing a combination of the Bethe-Salpeter (BSE) and ***k⋅p*** approaches point towards the modulation of the dielectric constants by the organic cations. Importantly, our findings provide valuable insights into an additional lever for engineering facile-synthesized room-temperature PQD single photon sources.

A person wearing glasses and smiling

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**Bo Wang** received his PhD degree in condensed matter physics from Beijing Institute of Technology, China. Currently, he works as a Research Fellow in Prof. Sum Tze Chien’s group at Nanyang Technological University, Singapore. His research interests are quantum dots and optical microcavities.