Reduced Stark effect in CsPbBr3 Perovskite Nanocrystals

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Lead halide perovskite nanocrystals (NCs), such as for instance CsPbBr3 NCs, have shown great potential as single photon sources "on-demand", exhibiting remarkable photon antibunching behaviour at room temperature but low single photon purity at low temperatures, contrary to what is typically observed in other semiconductor QD systems. Another particularity of these NCs is the absence of distinct biexciton lines in single dot spectroscopy experiments. This possibly suggests that the bi-exciton and exciton lines are close in energy, explaining the poor single photon purity at low temperatures. With increasing temperature, the hypothesis goes that some thermally-activated Auger process takes place, weakening the bi-excitonic emission and lowering drastically the g2(0) values at 300K. In order to clarify these hypotheses and deepen our understanding on the exciton transitions of these NCs [1-5], we present here a study on the emission properties of single CsPbBr3 NCs under the influence of an external electric field. Toward this end, substrates with special inter-digitated contacts, shown schematically in Fig.1, were fabricated by standard photo-lithography. A thin film of polystyrene, containing dilute numbers of CsPbBr3 NCs with 10nm edge length, was spin-cast over the electrodes. Micro-photoluminescence measurements on single CsPbBr3 NCs under external electric field, exhibited typically very tiny Stark shifts of the main exciton peak (Fig. 2), in contradistinction with earlier work on CsPbI3 NCs, where 20 times larger Stark shifts have been reported for similar fields [6]. In order to understand this result, further work focuses on the possible role of host-polymer in the observed Stark shifts and intends to extend the study to CsPbI3 NCs.

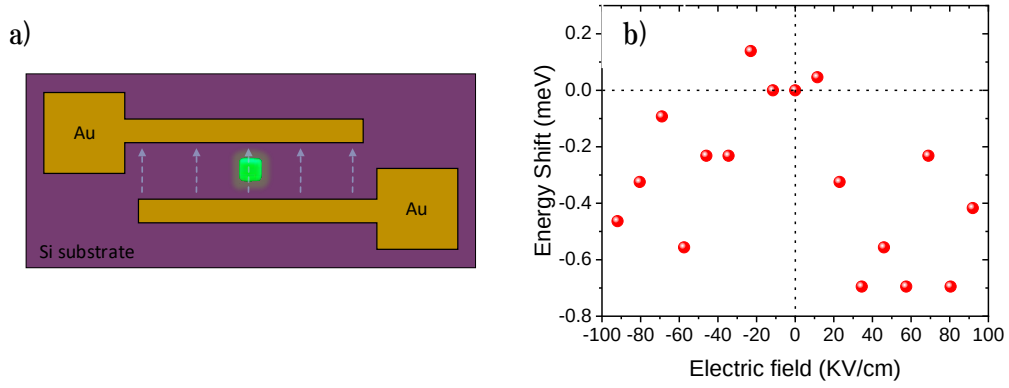

Figure 1: **a)** Schematic of the contact geometry used to apply electric field on CsPbBr3 NCs, **b)** Energy shift of exciton line from a single CsPbBr3 NC versus applied electric field

References

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