Reaching ultimate perovskite quantum dot optical properties with a new synthetic approach

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A new synthetic method for colloidal perovskite nanocrystals has been designed, which offers slow thermodynamic control [1] instead of conventional kinetic growth [2]. The reaction time is increased up to 30 minutes while a wide size range of nanoparticles, some even reaching the strong confinement regime, is obtained with high level control of size and shape [1]. The synthesized quantum dots (QDs) turn out to have a spheroidal shape on average with remarkably well-separated higher absorption peaks. For the first time, this allows for a direct comparison between theory and experimental data related to the transitions beyond the lowest absorption line. Using empirical modelling with second-order many body perturbation theory, we are able to predict the energy positions as well as the oscillator strength of not only the lowest 1s-1s exciton but also of the higher excitonic transitions [3]. The calculated values are in fair agreement with the experimental data. Besides, by taking into consideration the spherical and cuboidal confining potentials, our theory offers an explanation for the well-defined higher transitions in the spheroidal QDs compared to cuboidal ones obtaining from more standard synthetic approaches [4]. The accuracy of the theoretical methods will be also critically discussed.

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