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Colloidal quantum dots design for scintillation applications

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The synthesis of colloidal nanocrystals has greatly improved over the past 25 years. Semiconductor nanocrystals –the so-called quantum dots–can currently be synthesized in a wide range of sizes, shapes, crystal structure and compositions, allowing tuning their emission properties from the UV to the deep infrared. Furthermore, nanocrystal heterostructures of numerous geometries such as core/shell nanoparticles, dot-in-rod structures or core/crown nanoplatelets open up still new possibilities to tune the optical properties of these semiconductor nanoparticles.
For scintillation applications, conversion yield as well as decay times are of particular importance. In the case of quantum dots scintillation, these parameters are strongly related to structural parameters such as the use of a core/shell structure, the band alignment between the core and the shell, and the size of both components.
In this presentation I will first present the usual strategies used in colloidal quantum dot syntheses to control the wavelength, fluorescence lifetime and quantum efficiency.
I will then discuss multi-charges phenomena arising in quantum dots: Auger assisted recombination and multiexciton generation. These effects are related to physical behaviors such as blinking and have been widely studied over the years in an attempt to suppress or control them.
Finally, different strategies to create quantum-dots in matrix systems will be analyzed, highlighting the potential uses of such composite materials, their advantages and drawbacks for scintillation applications.

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