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Recent Advancements in Lead Halide Perovskite Nanocrystals and Nanocomposites for Radiation Detection.

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The urgency for affordable and reliable detectors for ionizing radiation in medical diagnostics, nuclear control and particle physics is generating growing demand for innovative scintillator devices combining efficient scintillation, fast emission lifetime, high interaction probability with ionizing radiation, as well as mitigated reabsorption to suppress losses in large volume/high-density detectors. Prized for their solution processability, strong light-matter interaction, large electron-hole diffusion length and tunable, intense luminescence at visible wavelengths, lead halide perovskite nanocrystals (LHP-NCs) are attracting growing attention as highly efficient emitters in artificial light sources and as high-Z materials for next generation scintillators and photoconductors for ionizing radiation detection. Nonetheless, several key aspects, such as the trapping and detrapping mechanisms to/from shallow and deep trap states involved in the scintillation process and the radiation hardness of LHP NCs and LHP NC-based plastic nanocomposites under high doses of ionizing radiation are still not fully understood, leaving scientists without clear indications of the suitability of LHP-NCs in real world radiation detectors or design strategies for materials optimization. In this talk, I will present on our recent strategies for high performance radiation detection schemes and will report recent spectroscopic results of the scintillation process and its competitive phenomena, ultimately offering a possible path to the realization of highly efficient and extremely radiation hard LHP-NCs. This work is the joint result of numerous scientific teams worldwide and part of the AIDAInnova project.

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