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Heterostructured fast scintillators for HEP and medical applications.

Perovskite nanocrystals and semiconducting quantum dots are low-dimensional materials that possess unique optoelectronic properties due to their strong direct band gap absorption and excellent charge transport capabilities. These materials exhibit fast light emission and adjustable optical properties, making them highly promising for the development of advanced scintillators with improved time resolution.

A recent proposal introduces an innovative approach to create ultrafast detectors by combining scintillating materials with complementary properties. In this contribution we present the R&D programme for the construction and test of a heterostructured scintillator that combines standard LYSO crystals with perovskites. While LYSO crystals exhibit high stopping power and good energy resolution, the perovskites are expected to contribute to the ultrafast response component through their photoluminescent emission, resulting in an efficient and rapid scintillating heterostructure. Various deposition techniques are being considered like thin layer deposition on bulk scintillators and 3D dispersion of the nanocrystals in polymeric matrices. The detector composition and geometry will optimize the detector performance.

This proposed blue sky research program aims to explore the application of such fast heterostructured scintillators in the fields of high-energy physics (HEP) and medical physics. The light response and time resolution of the heterostructured scintillators are the key parameters to be measured in order to characterize the detector.

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