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Enhancing Scintillation Efficiency of Scintillator Nanocomposites

The European Pathfinder project Unicorn aims to advance radiation detection techniques through the development of novel nanoparticle-based scintillating materials. This work explores the scintillation properties of inorganic scintillator nanocrystals embedded in polymer or glass matrices, aiming at applications in gamma and beta decay detection. This research employs a numerical simulation framework of GEANT4 to examine the effects of key optical parameters such as the absorption and overall scattering on the light transport within the composite and the overall scintillation performance of nanocomposites. This work is complemented by experimental studies which aim to assess the absorption and overall light scattering of produced nanocomposite samples and decouple the two main components of scattering: Rayleigh and Mie. The decoupling is done using a combination of experimental measurements of transmittance with a plug-in integrating sphere and additional numerical simulations of light transport. Ultimately, this work contributes to the development of efficient scintillator nanocomposites, paving the way for enhanced radiation detection capabilities in various applications, including high-energy physics, medical imaging and search for rare events, in particular for neutrinoless double beta decay.

Primary experiment

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Track Classification: Photon Detectors