Photoluminescence and radioluminescence spectra and temporal dynamics of γ-rays scintillators

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For the registration of ultrafast γ-pulses, efficient detectors with subnanosecond response time are needed. So, the development of efficient, fast, and robust scintillators for ionizing radiation detection is an important problem in modern high-energy particle physics. Typically, it is difficult to achieve optimal performance and high-speed operation of the scintillator at the same time. A new class of scintillator based on quantum shells opens a way to solve this problem.

In this work, we performed a comparative analysis of photoluminescence and radioluminescence properties of traditional plastic, inorganic, and colloidal quantum shells scintillators. Photoluminescence data were collected using a pump generated by a femtosecond Ti:sapphire laser, with emission collected by fiber and directed onto a visible-range spectrometer. Time-resolved emission was registered by a streak camera with 5 ps resolution. Radioluminescence spectra and temporal dynamics of scintillators were investigated under excitation by γ-ray pulses with picosecond duration.