

## **Exploration of Ultra-Fast and Bright Scintillator Materials**

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The demanding requirements of radiation detection for subcritical experiments and the broader NNSA mission necessitate scintillator materials exhibiting ultrafast response and significantly high light output. Traditional scintillator technologies are fundamentally limited in their ability to meet these rigorous performance benchmarks, posing a challenge to achieving optimal detection capabilities. This ongoing research by an NNS team directly addresses this critical gap through the development of next-generation scintillator solutions. Leveraging recent advancements in nanomaterial engineering and additive manufacturing, our efforts are focused on creating novel scintillator materials characterized by highly efficient emission, substantially improved light yield, and an ultra-fast response with virtually no afterglow.

Our effort encompasses two primary, yet complementary, development avenues. The first investigates the potential of perovskite quantum dot materials, specifically tailored for high-performance fast neutron imaging applications. The second explores the fabrication of 3D-printed nanocrystalline-loaded plastic scintillators, which offer flexibility in form factor and material composition. This presentation will comprehensively detail the methodologies employed, present the experimental results obtained from both development thrusts, articulate the valuable lessons learned throughout the research and development phases, and outline strategic future plans for the continued development of these scintillator technologies.

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