

## The Key to a Background-Free $0\nu\beta\beta$ Search in Liquid Xenon: Ba-Tagging - Status and Prospects

*Tuesday, 19 May 2026 18:50 (1 hour)*

Barium tagging (“Ba-tagging”) has the potential to become a defining technology for next-generation liquid and gas xenon time projection chambers searching for neutrinoless double-beta decay ( $0\nu\beta\beta$ ) in  $^{136}\text{Xe}$ . The successful identification of the  $\beta\beta$ -decay daughter  $^{136}\text{Ba}$  at the reconstructed decay site would provide an event-by-event confirmation of the parent decay isotope  $^{136}\text{Xe}$  and enable unprecedented background rejection. This capability could allow experiments such as nEXO to operate in a near background-free regime at the multi-tonne scale.

We review ongoing efforts in barium ion localization, extraction, isolation and trapping strategies aimed at single-ion identification. We present the current status, highlighting the recent progress made by the Ba-tagging research and development program for nEXO. Finally, we outline the near-term milestones and the pathway toward demonstrating a complete Ba-tagging system to benchmark the maximum deliverable tagging-efficiency.

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