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(G*) Ba-ion mobility simulations in LXe for Ba-tagging at TRIUMF

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The proposed nEXO experiment is a tonne-scale liquid xenon (LXe) time projection chamber that aims to uncover properties of neutrinos via the neutrinoless double beta decays ($0\nu\beta\beta$) in the isotope Xe-136. The observation of $0\nu\beta\beta$ would point to new physics beyond the Standard Model and imply lepton number violation, indicating that neutrinos are their own antiparticle. The nEXO detector is expected to be constructed at SNOLAB in Sudbury, Canada, with a projected half-life sensitivity of 1.35×10^{28} years.

The collaboration has been pursuing the development of new technologies to further improve upon the detection sensitivity of nEXO, such as Barium (Ba)-tagging. This extremely challenging technique aims to extract single Ba ions from a LXe volume. Ba-tagging would allow for an unambiguous identification of true $\beta\beta$ decay events, and if successful would result in an impactful improvement to the detection sensitivity.

Innovative Ba-tagging studies aimed at determining the ion-extraction efficiency of Ba-ions from LXe will be performed at TRIUMF in the near future. Due to the slow rate of the $2\nu\beta\beta$ decay of Xe-136, short-lived isotopes will be implanted into the LXe. These isotopes will subsequently decay to isotopes of Ba, which are then extracted from LXe and identified. In this contribution, I will introduce the Ba-tagging setup at TRIUMF and elaborate on ongoing simulations for future ion-mobility studies in LXe under the influence of an external field.

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