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A linear quadrupole ion trap for barium tagging in nEXO

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Barium tagging is a future upgrade for nEXO (next-generation Enriched Xenon Observatory), a planned experiment that will search for neutrinoless double beta decay ($0\nu\beta\beta$) in ^{136}Xe. If detected, $0\nu\beta\beta$ would confirm that neutrinos are their own anti-particles and reveal their absolute masses. Due to the long half-life (>10^{26} years) of $0\nu\beta\beta$, a low background is critical to achieve the necessary detection sensitivity. Barium tagging is the ultimate method for rejecting $0\nu\beta\beta$-like background events by confirming the production of ^{136}Ba as the daughter isotope of this decay. This can be done by extracting ions from the xenon detector, then identify barium through laser spectroscopy in a Linear Quadrupole Ion Trap (LQIT). The ions will then be sent to a Multi-reflection Time of Flight (MR-TOF) mass spectrometer, to distinguish ^{136}Ba from other naturally occurring barium isotopes as well as to identify other contaminants. The LQIT has been simulated and optimized to achieve high efficiencies in ion trapping and transmission. The development of the LQIT, from simulations to most recent experimental results of a prototype, will be presented.

Primary author: LAN, Yang (TRIUMF)

Co-authors: BRUNNER, Thomas (McGill University); DILLING, Jens (triumf/UBC); FARINE, Jacques (Laurentian University); GORNEA, Razvan (Carleton University); GRATTA, Giorgio (Stanford University); KWIATKOWSKI, Anna (TRIUMF); KOFFAS, Thomas (Carleton University (CA)); MURRAY, Kevin (McGill University); ORRELL, John (Pacific Northwest National Laboratory); REITER, Moritz Pascal (TITAN); SHANG, Xiao (McGill University)

Presenter: LAN, Yang (TRIUMF)

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