

Ba-ion extraction from high pressure Xe gas for double-beta decay studies with nEXO

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An RF-only ion funnel has been developed to efficiently extract single Ba ions from a high-pressure (10 bar) xenon gas into vacuum. Gas is injected into the funnel where ions are radially confined by an RF field while the neutral gas escapes. Residual gas flow alone transports the ions longitudinally through the funnel. In the downstream chamber the ions are detected while the Xe is captured for reuse.

With the current test setup ions were extracted from xenon gas of up to 10 bar. A mass spectrometer is being developed for spectroscopic identification of the extracted ions.

This approach of ion extraction is intended for application in a future large-scale Xe-136 neutrinoless double-beta decay experiment like nEXO. The technique aims to extract the $\beta\beta$ -decay product, Ba-136, from liquid to gaseous xenon to vacuum and identify it. This identification enables a higher level of sensitivity to the $0\nu\beta\beta$ decay half-life and allows an unambiguous verification of a possible $0\nu\beta\beta$ signal.

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