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Two-nucleon transfer studies relevant for 136Xe neutrinoless double beta decay

There is significant worldwide interest to establish the Majorana nature of neutrinos, by observing lepton-number-violating neutrinoless double beta decays ($0\nu\beta\beta$). In this regard, $^{136}\mathrm{Xe}$ is one of the most promising candidates to search for $0\nu\beta\beta$. Recently, the KamLAND-Zen experiment used this isotope to place the most stringent limits on the effective Majorana neutrino mass, and demonstrated for the first time, a sensitivity within the inverted neutrino mass ordering region. Future experiments aim to build on this work, both at the tonne-scale and beyond.

A critical aspect in $0\nu\beta\beta$ studies is the nuclear matrix element (NME) for the decay, which is highly model-dependent, and evaluated using a variety of many-body techniques. This theoretical limitation translates into a spread in the upper-limit placed on the Majorana neutrino mass.

In light of the above, we performed high-resolution transfer reaction studies in the $A = 136$ region to guide $^{136}\mathrm{Xe}$ $0\nu\beta\beta$ NME calculations. This presentation will discuss recent results from a part of this work that focuses on $^{138,136}\mathrm{Ba}(p,t)$ and $^{138}\mathrm{Ba}(d,\alpha)$ studies. Implications related to $^{136}\mathrm{Xe}$ $0\nu\beta\beta$ decay and other rare physics searches with xenon detectors will be briefly discussed.

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