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The multichannel approach within the NUMEN project

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Nowadays, the search for neutrino-less double beta (0νββ) decay continues with undiminished interest since it is a prominent tool for probing neutrino nature and its absolute mass scale. However, the latter task is hampered by the puzzling inconsistencies in the calculations of the nuclear matrix elements (NMEs) of 0νββ decay [1], despite the existing experimental constraints. In this respect, a challenging experimental campaign has been initiated at the Istituto Nazionale di Fisica Nucleare –Laboratori Nazionali del Sud (INFN-LNS) in Catania under the NUMEN and NURE projects [2,3], aiming to provide data-driven information on the NMEs for various 0νββ decay target candidates, through the study of heavy ion induced double charge exchange (DCE) reactions [4]. A key element for this campaign is the use of MAGNEX acceptance large-acceptance magnetic spectrometer which facilitates the measurement of various reaction channels under the same experimental conditions as the more suppressed DCE reactions. Such a multichannel approach allows for a global description of a plethora of reaction observables within a unique and coherent theoretical framework. This contribution will provide an overview of the pivotal experimental campaign which was performed within NUMEN over the past few years, emphasizing the main results and future perspectives.

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[3] M. Cavallaro et al., Proceedings of Science, BORMIO2017:015 (2017).
[4] F. Cappuzzello et al., Prog. Part. Nucl. Phys. 128, 103999 (2023).

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