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New results from the NUMEN experiment

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The physics of neutrinoless double beta (0νββ) decay has important implications on particle physics, cosmology and fundamental physics. In particular, it is the most promising process to access the average neutrino mass. To determine quantitative information from the possible measurement of the 0νββ decay half-lives, the knowledge of the Nuclear Matrix Elements (NME) involved in the transition is mandatory. The possibility of using heavy-ion induced double charge exchange (DCE) reactions as tools toward the determination of the NME is at the basis of the NUMEN [1] and the NURE (funded by ERC-Starting Grant) projects. The basic points are that the initial and final state wave functions in the two processes are the same and the transition operators are similar, including in both cases a superposition of Fermi, Gamow-Teller and rank-two tensor components.
The availability of the MAGNEX spectrometer [2] for high resolution measurements of the very suppressed DCE reactions is essential to obtain high resolution energy spectra and accurate cross sections at very forward angles. The concurrent measurement of the other relevant reaction channels allows to isolate the direct DCE mechanism from the competing multinucleon transfer processes.
In this context, an experimental campaign has started at the INFN-Laboratori Nazionali del Sud in Catania, using the MAGNEX spectrometer, focused on DCE reactions involving the nuclei of interest for 0νββ decay. Recent results obtained by the exploration of the (20Ne,20O) DCE reaction, measured for the first time using a 20Ne10+ cyclotron beam at 15 AMeV, on 116Cd and 130Te targets will be discussed.

References

[1] F.Cappuzzello et al., J. Phys.: Conf. Ser. 420 (2013) 012061.
[2] F.Cappuzzello et al., Eur. Phys. J. A 52 (2016) 167.

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