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Double charge exchange reactions for neutrino physics: recent results and future perspectives

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The neutrinoless double beta ($0\nu\beta\beta$) decay, if observed, has important implications on particle physics, cosmology and fundamental physics. In particular it can give access to the effective neutrino mass. In order to extract such information from the $0\nu\beta\beta$-decay half-life measurement, the knowledge of the Nuclear Matrix Elements (NME) is of utmost importance. In this context the NUMEN and the NURE projects aim to extract information on the NME by measuring the Double Charge Exchange (DCE) reaction cross section in selected systems of interest for the $0\nu\beta\beta$-decay.
Early studies with heavy-ions DCE reactions performed in the 80's and 90's were not conclusive because of the experimental difficulties that have to be faced in such kind of measurements, like to obtain very forward-angle data, the very low cross section of the process to be measured, the requirement of a high energy resolution and, eventually, the unambiguous identification of the DCE reaction from other competing processes.
All these requirements can be met by the large-acceptance spectrometer MAGNEX, present at INFN-LNS, Catania. Its high energy and angular resolution and its large acceptance make MAGNEX a tool that can achieve the measurements of the DCE cross-sections in the zero-degree region.
An experimental campaign focused on DCE reactions involving the nuclei of interest for $0\nu\beta\beta$-decay has already begun. Recent results concerning the (20Ne, 20O) DCE reaction at 15 AMeV, on 116Cd and 130Te targets will be shown and discussed.

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