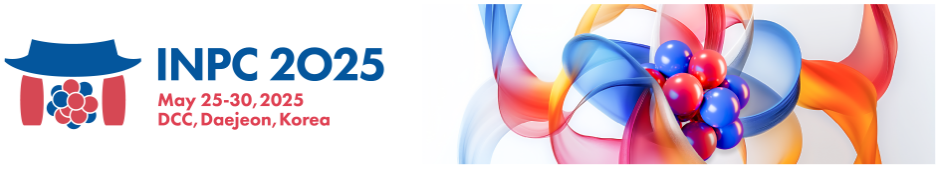


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# Heavy-ion induced single and double charge exchange reactions in a multi-channel approach: new results from the NUMEN project

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In order to get quantitative information on neutrino absolute mass scale from the possible measurement of the 0νββ decay rates, the Nuclear Matrix Elements (NME) involved in such transitions are required. Recently, heavy-ion induced double charge exchange (DCE) reactions have been proposed in Italy [1-2] and Japan [3,4] as tools to get information about 0νββ NMEs. The basic point is that there are important similarities between the two processes, mainly that the initial and final states are the same and the transition operators have a similar structure, including in both cases a superposition of Fermi, Gamow-Teller and rank-two tensor components [5].
The NUMEN project at INFN-LNS laboratory in Italy proposes to explore the whole network of direct nuclear reactions connecting the initial and final nuclear states of the ββ-decay. This includes DCE, Single Charge Exchange (SCE), multinucleon transfer reactions, elastic and inelastic scattering. A key aspect is the consistent investigation of all the above reaction channels. This multi-channel approach demands that: i) the cross sections for all the relevant reaction channels are measured under the same experimental conditions; ii) the data analysis is performed in the framework of the microscopic quantum reaction theory in a model space large enough to include all the reaction channels and adopting consistent nuclear structure inputs.
Experimental campaigns have been performed at INFN-LNS in order to explore heavy ion induced reactions on target of interest for 0νββ decay. These studies are complemented by a strong activity on the theoretical side, especially tailored to give a detailed description of the challenging DCE reaction mechanisms [6-7]. An overview of recent activity performed in Catania in this field will be presented at the INPC2025 Conference.

**References**

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