

Heavy-ion double charge exchange reactions as a tool for double beta decay nuclear matrix elements

The presentation aims at describing an overview of the activities related with the NUMEN project at INFN – LNS. NUMEN is an international collaboration which proposes an innovative technique to give information on the nuclear matrix elements entering the expression of the decay rate of double beta decay by cross section measurements of heavy-ion induced Double Charge Exchange (HI-DCE) reactions. The exploration of HI-DCE reactions is of interest not only for double beta-decay investigations, but also for studies of nuclear reaction and nuclear structure. From the experimental side, the characteristically tiny cross sections for HI-DCE processes and the high background generated by other more probable competing reactions is the main challenge, which has hindered HI-DCE spectroscopy until recent years. Modern magnetic spectrometers, such as the MAGNEX spectrometer, have proven to have the requisites to overcome past limitations. From the theory side, the description of the measured HI-DCE cross sections poses manifold challenges. Dealing with processes involving composite nuclei, HI-DCE reactions can, in principle, proceed through several alternative paths. These, in turn, correspond to different reaction mechanisms probing competing aspects of nuclear structure, from mean field to various classes of nucleon-nucleon interactions and correlations. A powerful way to scrutinize the nuclear response to HI-DCE is to consistently link it to the information extracted from the competing quasi-elastic reactions. Indeed, these complementary studies are mandatory in order to minimize the systematic errors in the data analyses and build a many-facets and parameter-free representation of the systems under study.

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