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Status and perspectives of the NUMEN project at INFN-LNS

Monday, 3 September 2018 14:30 (25 minutes)

The presentation aims at describing the main achievements of the NUMEN project [1], together with an updated and detailed overview of the related R&D activities and theoretical developments. NUMEN proposes an innovative technique to access the nuclear matrix elements entering the expression of the lifetime of the double beta decay by cross section measurements of heavy-ion induced Double Charge Exchange (DCE) reactions. Despite the fact that the two processes, namely neutrinoless double beta decay and DCE reactions, are triggered by the weak and strong interaction respectively, important analogies are suggested. The basic point is the coincidence of the initial and final state many-body wave functions in the two types of processes and the formal similarity of the transition operators. First experimental results obtained at the INFN-LNS laboratory for the 40Ca(18O,18Ne)40Ar reaction at 270 MeV give an encouraging indication on the capability of the proposed technique to access relevant quantitative information [2]. The main experimental tools for this project are the K800 Superconducting Cyclotron and MAGNEX spectrometer [3]. The former is used for the acceleration of the required high resolution and low emittance heavy-ion beams and the latter is the large acceptance magnetic spectrometer for the detection of the ejectiles. The use of the high-order trajectory reconstruction technique, implemented in MAGNEX, allows to reach the experimental resolution and sensitivity required for the accurate measurement of the DCE cross sections at forward angles. However, the tiny values of such cross sections and the resolution requirements demand beam intensities much larger than those manageable with the present facility. The on-going upgrade of the INFN-LNS facilities in this perspective is part of the NUMEN project and will be discussed at the Conference.

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