Contribution ID: **39** Type: **not specified**

Beta-delayed (multi-)proton emission at DESIR

The study of the beta-delayed two-proton (β–2p) emission is an important tool to obtain direct information about the structure of proton-rich nuclei. This exotic decay can be either a sequential emission via an intermediate state or a simultaneous emission of the two protons. Up to now, the 2p direct branch has never been evidenced. Recently, a silicon cube, a high-efficiency charged-particle detector, has been developed to search for such correlated 2p emission.

With a detection set-up such as SEASON or the Silicon Cube previously developed, the study of several or other β–2p candidates like ^{22}Al, ^{23}Si, ^{26}P, ^{27}S, ^{31}Ar, ^{35}Ca, ^{43}Cr,⋯will be possible at the DESIR facility with beams from SPIRAL1 or S3-LEB.

The one-proton emission also allows to address many questions for nuclei close to the drip-line: first estimates of atomic masses and Coulomb displacement energy, structure and deformation from the B(GT) distribution over a large Q_{EC} window, etc. In addition, with gamma detection (such as foreseen for BESTIOL or EXOGAM), the competition between gamma and proton de-excitation can be addressed for astrophysical interests (resonances close to emission threshold) and to test the isospin mixing in populated states.

The achievable topics and precisions highly depend on the production rate (at detection point). Typically, a minimum of the order of 1 Hz is expected. From the isotopes mentioned above, most will not be available when the DESIR facility will start receiving beams. Only ^{22}Al, ^{31}Ar and possibly ^{26}P may be accessible. ^{31}Ar has already been studied in detail in previous works, and could be considered for testing the detection setup and related analysis. For ^{22}Al and ^{26}P, no detailed decay scheme is known and they are good candidates for the proposed measurements.

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