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LETTER OF INTEREST

SIN-ISOLDE

INVESTIGATION OF THE BETA MINUS STRENGTH FUNCTION OF VERY NEUTRON-RICH NUCLEI

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Investigation of the beta minus strength function of very neutron-rich nuclei

From our collaborative studies during the last years, it has been shown that structures in the β^--strength function (S_β-(E)) well beyond that implied by the Gamow-Teller giant resonance (GTGR) hypothesis [1] are decisive in determining the β-decay properties of neutron-rich nuclei [2-1o]. In this sense, the distribution of the GT-strength is intimately connected to the long-standing problem of the hindrance of β-transition rates from the single particle limits. The real form of S_β-(E) for neutron-rich nuclei is of particular importance for any estimation of the β-decay behaviour of nuclei important to calculations of astrophysical processes like the r- or n-process [2,9,11] as well as for the study of fission barriers by β-delayed fission [12]. Up to the present time, rather simplified assumptions on the nature of S_β-(E) are used in these fields which are inconsistent with our present knowledge of the nucleus.

With this perspective, we therefore propose to measure at ISOLDE-3, following our current experimental program, the detailed structure of S_β-(E) mainly for medium-heavy and heavy nuclei ($A \gtrsim 6o$) (i.e., beyond the mass region covered by present ISOLDE activities) in addition to 'gross' decay properties like $T_{1/2}$, P_n, P_{xn} and Q_β. By combining the most developed techniques for high-resolution d.n.- [6,7,13,14] and γ-ray spectroscopy with Compton-shielded Ge(Li)-detectors [15] and for coincidence measurements, it will be possible to obtain complete high-resolution β^--strength functions of nuclides further away from stability than obtainable today and to extend our knowledge on β-decay properties of nuclei to regions close to the neutron-drip line. Since the investigation of S_β-(E) of such exotic nuclei depends on a number of different complex and rather time consuming experiments, the high beam intensities expected at SIN-ISOLDE will be essential.

With respect to the specific nuclear physics information that can be extracted, particular attention will be devoted to systematic trends in S_β-(E) as a function of N and Z, to the influence of deformation and shell closures on the shape of S_β-(E), the

amount of sum-rule strength concentrated in the low-lying resonances in S_β-(E) and the degree of equilibration of 'doorway states' populated in β-decay [7,1o]. Furthermore, more detailed analyses of the β-delayed neutron- and γ-ray spectra will permit the determination of nuclear level densities, neutron strength functions and nγ-competition [4,7,16], and to investigate the extent of pre-equilibrium neutron emission in the special decay mode of β-delayed neutron emission [3,7,14].

Finally, we would like to point out that our proposed experiments will be a natural continuation and extension of activities now underway with smaller installations at our home laboratories. These facilities will continue to be essential resources as they will enable developing and testing experimental methods and procedures prior to starting specific experiments at SIN-ISOLDE.

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