High Resolution Measurement of the ^{123}Sb($\vec{p}$,α)^{120}Sn Reaction: Low Lying States

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In order to investigate the spectator role of the $1g_{7/2}$ proton in Z=50 region and to test the validity of the concept of homology also in this mass region, the reaction ^{122}Sn($\vec{p}$,α)^{119}In was measured [1] and ^{123}Sb($\vec{p}$,α)^{120}Sn reaction is now studied. This last reaction has been measured using the 24 MeV proton beam from the Munich MP Tandem accelerator and the Stern-Gerlach source for intense and bright beams of negative polarized Hydrogen ions [2]. The beam current intensity was up to 1.5 μA and the beam polarization $\sim$ 60 %. A 50 $\mu g/cm^2$ thick ^{123}Sb isotopic enriched target (98.28 %) has been evaporated on a 8 $\mu g/cm^2$ carbon backing. The reaction products were analyzed with the Q3D spectrograph, from 6^o up to 52.5^o in two different magnetic fields settings in order to reach an excitation energy of the residual nucleus of $\sim$ 5900 keV. Outgoing α particles were identified in the focal plane of the Q3D magnetic spectrometer by the new detector with cathode-strip readout described in [3]. Absolute cross sections were calculated taking into account effective target thickness, solid angle and collected charge and were estimated with an uncertainty of $\pm$ 15 %. The high resolution and the very low background allowed study of 53 transitions to the final states of ^{120}Sn nucleus.

In the α particle energy spectra [4] two different contributions can be observed. At higher excitation energies multiplets of states are populated, whose configurations result from the coupling of the spectator proton with the one-proton-hole-two-neutron-hole excited in the core, while at low excitation energy some weakly excited states are populated by the pickup of the spectator proton together with a neutron pair of the core. The weak population of the low-lying levels of ^{120}Sn residual nucleus is strictly related to the energy gap in the nucleon state spacing at the filling of the magic shell. Angular distributions of cross sections and asymmetries for the transitions to some observed levels at low excitation energy involving the pickup of the spectator proton are shown in Fig.1. The transitions to the 0^+ G.S. and 1.875 MeV level involving a unique L transfer (L=4) are analyzed in the framework of a semimicroscopic pickup theory using the TWOFNR code [5].

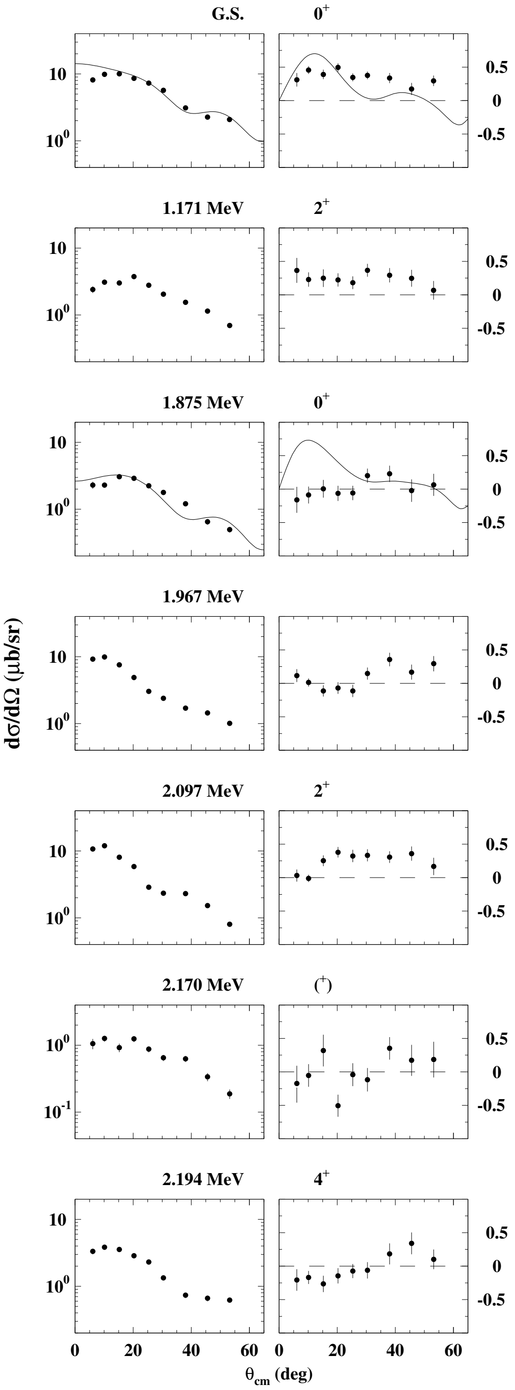

Fig. 1: Angular distributions of $\sigma(\theta)$ and $A_y(\theta)$ for some of the observed low lying levels of ^{120}Sn.

References

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[5] M. Igarashi, computer code TWOFNR (1977), unpublished