High Resolution Investigation of the ^{120}Sn(p,t)^{118}Sn and ^{121}Sb(p,t)^{119}Sb Reactions

P. Guazzoni [a], L. Zetta [a], G. Graw, R. Hertenberger, H.-F. Wirth, M. Jaskola [b], and V.Yu. Ponomarev [c]

[a] Dipartimento di Fisica dell'Università and I.N.F.N, I-20133 Milano, Italy

[b] Soltan Institute for Nuclear Studies, Warsaw, Poland

[c] Bogoliubov Laboratory of Theoretical Physics, JINR - Dubna, Russia

In spectroscopic studies of odd-A nuclei [1,2] the weak coupling model has been used to try to understand ther spectra. In this model, in its simplest form, a class of states in odd-A nuclei arises from the coupling of the odd spectator particle with an excited state of the (A-1) even-even nucleus. Therefore a multiplet of homologous states with spin J and excitation probability proportional to (2J+1) is generated. J ranges from $\mid J_p - J_C \mid$ to J_p+J_C, where J_p (J_C) is the spin of the particle (core).

The aim of the present experiment is to compare the cross sections of (p,t) reactions induced on adjacent ^{120}Sn and ^{121}Sb target nuclei in order to characterize the properties of ^{119}Sb whose configurations may be described by the coupling of the $1g_{7/2}$ proton with the even-even ^{118}Sn core. The ^{120}Sn target nucleus has a magic proton shell, while the additional proton in ^{121}Sb occupies a higher proton shell. Information on the role of the unpaired proton can be supplied by means of the comparison of cross sections of the two reactions, measured in the same experimental conditions.

Microscopic calculations of the ^{121}Sb(p,t)^{119}Sb reaction cross sections using the quasiparticle-phonon model [3] to describe the fragmentation of the (p,t) cross sections are in progress. The experimental results from the ^{120}Sn(p,t)^{118}Sn reaction will be used to discuss the role of the unpaired quasiparticle in ^{121}Sb in determining the properties of its levels. In fact the single particle spectrum and phonon basis are determined from the calculation on the neighboring even-even nuclear core.

We measured ^{120}Sn(p,t)^{118}Sn and ^{121}Sb(p,t)^{119}Sb at the Q3D magnetic spectrograph at eleven angles from 10^o to 65^o with 21 MeV protons, up to an excitation energy of about 3 MeV. The proton beam was produced by the Stern-Gerlach ion source with an intensity of up to 500 nA on the target. The targets consisted of 102 μg/cm^2 enriched (99.53%) ^{121}Sb evaporated on a 7.5 μg/cm^2 carbon backing and 114 μg/cm^2 enriched (99.6%) ^{120}Sn evaporated on a 6 μg/cm^2 carbon backing. The outgoing tritons were detected and identified in the cathode strip detector [4] in the Q3D focal plane, using two different magnetic field settings for each reaction. To our knowledge the ^{121}Sb(p,t)^{119}Sb reaction was not studied so far: this fact enhances the importance of this measurement.

Figure 1 shows typical angular distributions for both reactions.

References

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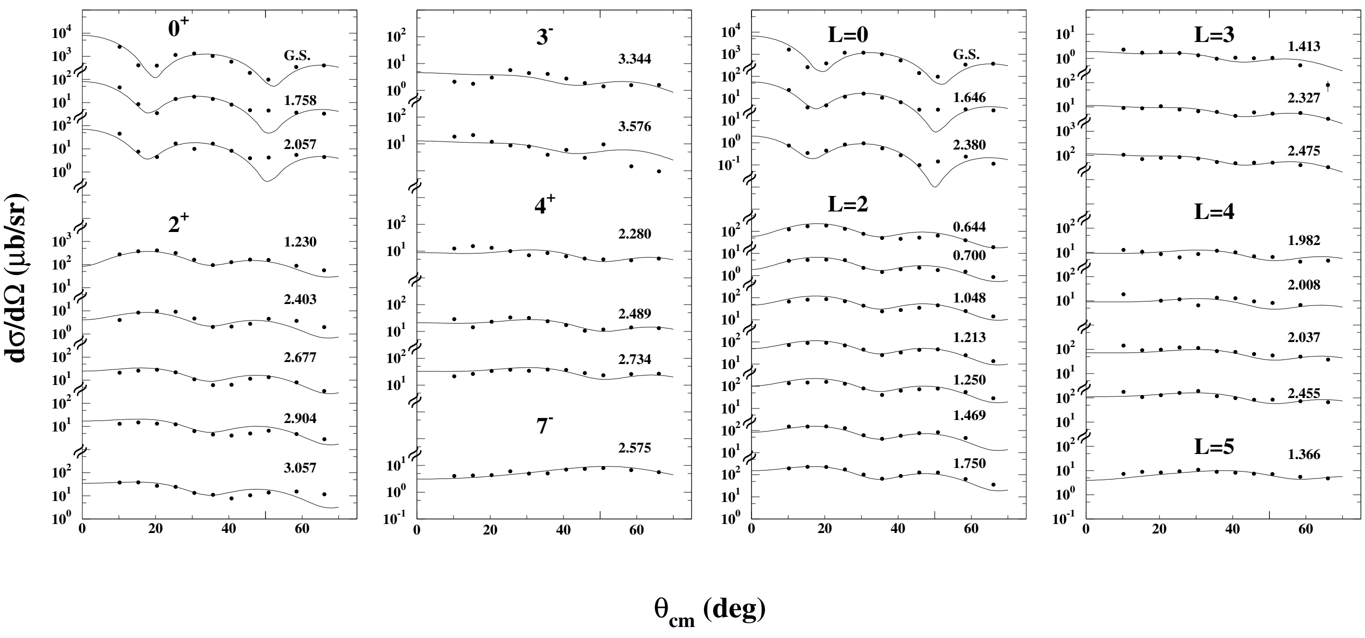

Fig. 1: Typical angular distributions for ^{120}Sn(p,t)^{118}Sn (left) and ^{121}Sb(p,t)^{119}Sb (right) reactions