FRAGMENTATION OF GAMOW-TELLER STRENGTH OBSERVED IN CHARGE EXCHANGE ON TARGETS OF $^{112-124}$Sn

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Triton energy spectra have been measured for the (^{3}He,t) charge-exchange reaction at E(^{3}He)=200 MeV and $\theta \approx 0°$ on essentially all stable Sn targets. This is an extension of earlier work[1] which concentrated on the reactions on ^{117}Sn and ^{120}Sn.

The experiment was carried out with the K600 high-resolution magnetic spectrometer at $\theta \approx 0°$. The ray-tracing capability proved to be very important as it permits the simultaneous measurement of triton spectra centered at 0° and at 2°. This provides a powerful signature for both non-spinflip and spinflip L=0 transitions because of the sharp decrease in cross section for angles >0°. Particularly the difference spectra 0°−2° are very sensitive to such contributions, whereas other resonances as well as non-resonant background are strongly suppressed. Fig. 1 displays the difference spectra obtained for all the Sn targets. In addition to the isobaric analog state (IAS), the main component of the Gamow-Teller (GT) resonances is clearly seen at higher excitation energies even without the decomposition of the spectra into their resonance components. As expected, the energy difference between the GT resonance and the IAS decreases with increasing neutron excess from about 4 MeV to 1 MeV. The low values of the cross section differences at even higher excitation energies result from the electric giant dipole resonance (E1) which has a weak minimum at 0°. Below the IAS, additional GT components and sharp 1^+ states are observed, particularly for the lightest Sn isotopes. This fragmentation of the giant Gamow-Teller resonance into separate components of the particle-hole type[1] has been predicted many years ago.[2] The components are connected with what is usually referred to in the literature as direct, core-polarization, and back spinflip. A detailed comparison between the data for ^{117}Sn and ^{120}Sn (based on earlier IUCF data) and theoretical predictions has been carried out recently.[1] Fig. 2 displays results for ^{120}Sn. Here, a corrected 0°-spectrum is shown where the contributions from other resonances and the non-resonant background are removed. The lower part shows a theoretical GT strength function. As discussed in detail in Ref. 1, the measured and predicted excitation energies agree quite well. The experimentally observed widths exceed the calculated widths because of admixtures of two-particle/two-hole configurations. The observed 0°-cross sections are not proportional

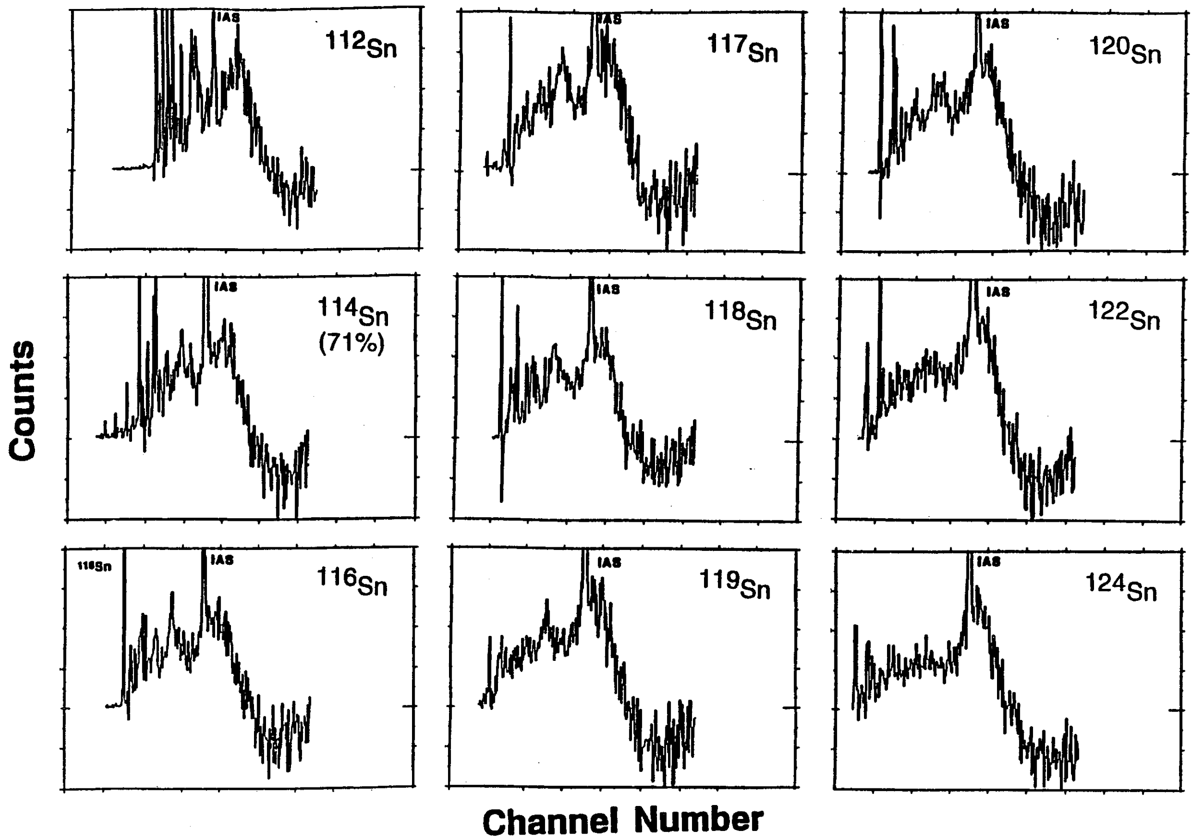

Figure 1. Triton-energy difference spectra (θ =0°−2°) obtained for the (^{3}He,t) charge-exchange reaction of Sn targets from ^{112}Sn to ^{124}Sn at E(^{3}He)=200 MeV.

to B(GT) because of interference with L=2 tensor contributions. This leads to an enhancement of the cross sections which makes the observation of fragmentation possible. A further configuration splitting of the main GT component which is predicted theoretically[3] could not be observed. However, the data are compatible with such a splitting as shown by the dotted lines in Fig. 2.

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2. Yu.V. Gapanov and Yu.S. Lyutostanskii, Yad. Fiz. **19**, 62 (1974); Fiz. Elem. Chastits Yadra **12**, 1324 (1981).
3. V.G. Guba, M.A. Nikolaev, and M.G. Urin, Phys. Lett. **218**, 283 (1989).

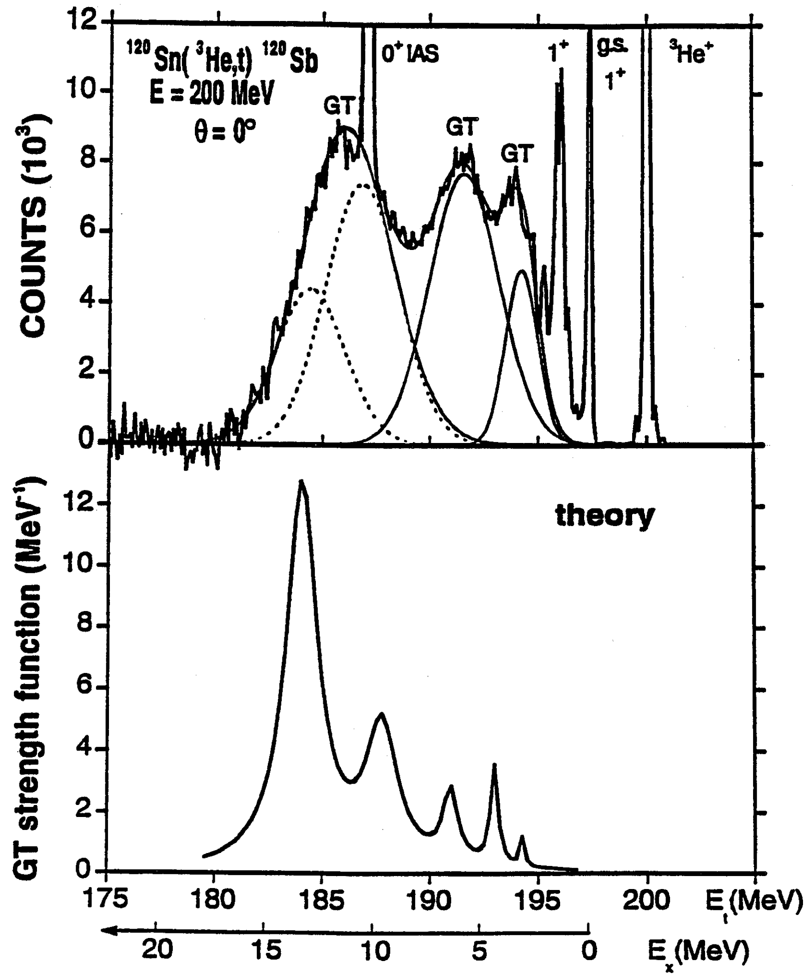

Figure 2. Experimental triton energy spectrum from Ref. 1 for the giant Gamow-Teller resonances observed in ^{120}Sn(^{3}He,t)^{120}Sb at E(^{3}He)=200 MeV and $\theta \approx 0°$. Non-resonant background and the electric giant dipole resonances at higher excitation energy have been subtracted from both the experimental data and the fitted spectra. A theoretical Gamow-Teller strength function[1] is shown at the bottom. Excitation energies are for the final nucleus ^{120}Sb.