FERMI AND GAMOW-TELLER TRANSITIONS OBSERVED IN $^{12,13,14}C(^3He,t)^{12,13,14}N$ CHARGE EXCHANGE AT $E(^3He) = 200$ MeV

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The techniques established for performing measurements at $\theta = 0°$ with the K600 magnetic spectrometer have been used to determine (^{3}He,t) cross sections for several low-excited states in ^{12}N,^{13}N,^{14}N. Fig. 1 displays a spectrum for $^{14}C(^3He,t)^{14}N$. The transitions to the 0^+, T=1 (2.313 MeV) and 1^+, T=0 (3.948 MeV) states represent pure Fermi and Gamow-Teller transitions, respectively.

Cross sections at $\theta = 0°$ are used extensively in (p,n) charge exchange to extract the ratio of spinflip to non-spinflip strength.[1] Using this procedure and our earlier data,[2] taken at $E(^3He) = 200$ MeV for the transitions to the $1/2^-$ (g.s.) and $3/2^-$ (3.511 MeV) states in ^{13}N, led to a ratio of spinflip to non-spinflip strength of about unity. Furthermore, it was shown from data for isobaric analog states from A=30 to 208 that the non-spinflip strength V_τ decreases for bombarding energies from 75 MeV to 200 MeV by a factor 0.6 in agreement with (p,n) data.

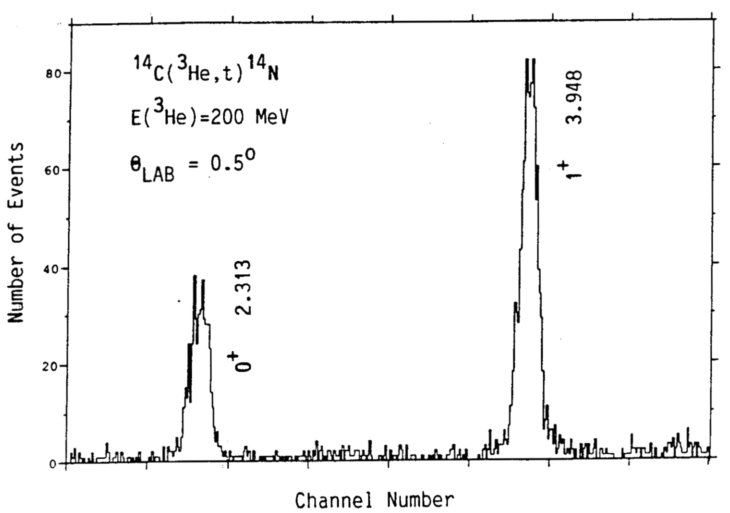

Figure 1. Triton energy spectrum from $^{14}C(^3He,t)^{14}N$ for the angular range = 0° to 1° for transitions to the low-excited 0^+ and 1^+ states in ^{14}N.

However, it is known[3] from results obtained at lower ^{3}He bombarding energies that 0° cross sections are not sufficient to determine spinflip strength because of the presence of the tensor interaction $V_{T\tau}$ in addition to the spinflip interaction $V_{\sigma\tau}$. It was, therefore, decided to measure complete angular distributions for several low-excited states with targets of ^{12,13,14}C. Some of the preliminary results are displayed in Fig. 2. The non-spinflip Fermi transitions to the $1/2^-$ (g.s.) state in ^{13}N and the 0^+ (2.313 MeV) state in ^{14}N show a more diffractive behavior at small angles compared to the spinflip Gamow-Teller transitions to the 1^+ (g.s.) state in ^{12}N, the $3/2^-$ (3.511 MeV) state in ^{13}N, and the 1^+ (3.948 MeV) state in ^{14}N. It should be noted, though, that the transition to the $1/2^-$ (g.s.) state in ^{13}N contains weak spinflip admixtures.

The theoretical interpretation of the data has not been completed. It will follow the earlier one-step DWBA analysis[3] performed for 65/90 MeV data. Microscopic wave functions will again be used, and the effective ^{3}He-nucleon interaction will be parameterized with potentials of Yukawa shape and strengths V_τ, $V_{\sigma\tau}$ and $V_{T\tau}$. It is expected that the tensor interaction will play a major role, and a comparison with the (p,n) charge-exchange reaction will become possible.

1. E. Sugarbaker, *et al.*, Phys. Rev. Lett. **65**, 551 (1990).
2. J. Jänecke, *et al.*, Nucl. Phys. **A526**, 1 (1991).
3. S. van der Werf, *et al.*, Nucl. Phys. **A496**, 305 (1989).

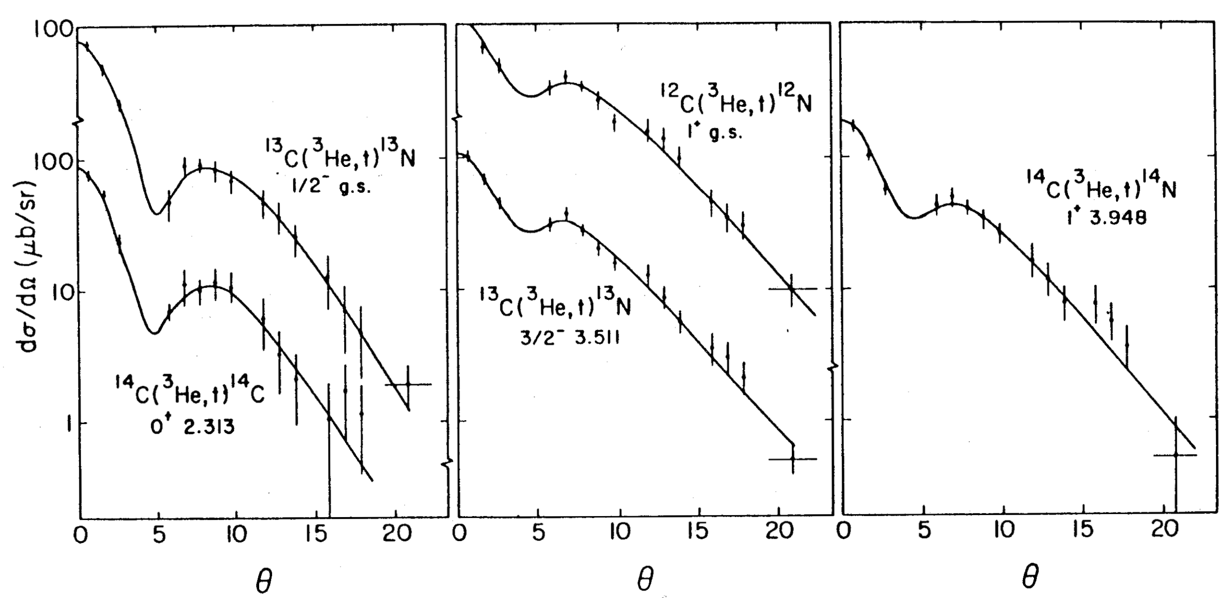

Figure 2. Angular distributions for Fermi (left) and Gamow-Teller (middle and right) transitions to low-excited states in ^{12,13,14}N. The lines are drawn to guide the eye.