STATES IN ^{13}C ABOVE E_X = 11.5 MeV

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Many levels of ^{13}C up to 23 MeV in excitation were observed in our measurement[1] of the $^{13}C(p,p')$ reaction at 135 MeV incident energy. However our analyses[1] to date have focused mainly on states of ^{13}C below 11.5 MeV in excitation. Recently we have extracted peak areas for many of the states above 11.5 MeV. In Figs. 1 and 2 some of the differential cross sections obtained are presented.

The data in these figures were selected for presentation here because DWA calculations gave a reasonable indication of the structure of these states. The calculations were performed using the code DWBA84[2] in which the density-dependent Paris force[3] was used. The nuclear structure is the $1h\omega$ spectroscopy of Lee and Kurath[4] (LK).

A number of states were unresolved near 12 MeV in excitation, but peak fitting using lineshapes deduced from the information listed by Ajzenberg-Selove[5] revealed the contributions from the individual states. Analyses of the $^{13}C(p,p')$ reaction[6] at 800 MeV and the

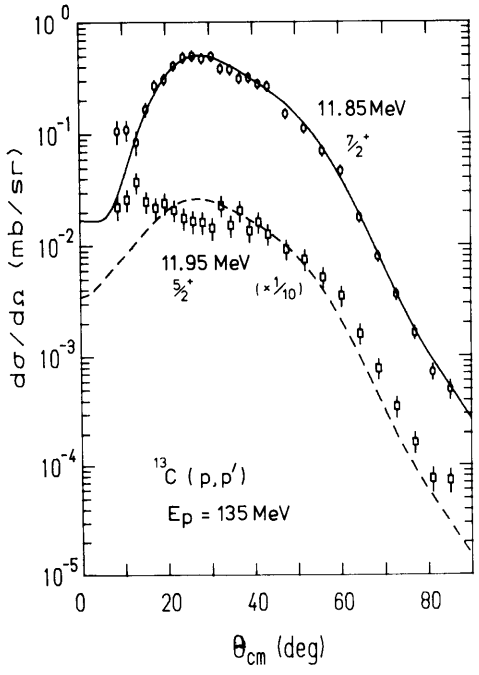

Figure 1. Differential Cross sections obtained for the excitation of the 11.85 and 11.95 MeV states of ^{13}C by 135 MeV protons. The data are compared with DWA calculations assuming that the 11.85 MeV state is the second $7/2^+$ state and the 11.95 MeV state is the fourth $5/2^+$ state of the LK model.

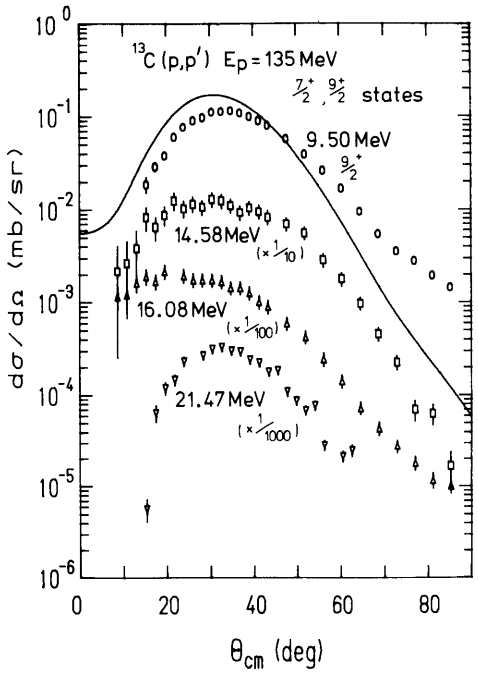

Figure 2. Differential cross sections measured for the excitation of the 9.50 ($9/2^+$), 14.58, 16.08 and 21.47 MeV states of ^{13}C by 135 MeV protons. The result of the DWA calculation for the lowest $9/2^+$ state of the LK model is shown.

^{13}C (π,π') reaction[7] at 162 MeV suggested that a $5/2^+$ and a $7/2^+$ state were unresolved near 12 MeV. The data and calculations shown in Fig. 1 confirm this suggestion. Without any rescaling the LK structure of the second $7/2^+$ state gives an excellent fit to the data for the 11.85 MeV state, while a less convincing fit is obtained for the data for the 11.95 MeV state, assuming its structure is that of the fourth $5/2^+$ state of the LK model.

In Fig. 2 the data are shown for the known $9/2^+$ state at 9.50 MeV and for three other states with similar angular distributions. The solid curve is $\Delta J=4$ only, and is for the lowest $9/2^+$ state of the LK model. Thus it appears that the 14.58, 16.08 and 21.47 MeV states are largely $\Delta J=4$ excitations and hence either $7/2^+$ or $9/2^+$ states. The latter two states were observed in the $^{13}C(e,e')$ reaction[8] and the $^{13}C(\pi,\pi')$ reaction[7] at 162 MeV also, in which similar conclusions were reached. More extensive shell model calculations are obviously required to gain a better understanding of these and other levels of ^{13}C.

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