ANALYSES OF THE $^{12}C(p,p')$ AND $^{16}O(p,p')$ REACTIONS AT 135 MeV USING LARGE-BASIS NUCLEAR STRUCTURE MODELS AND DENSITY-DEPENDENT INTERACTION

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It is now well known from DWA analyses of intermediate energy (p,p') reaction data to isoscalar natural parity states that calculations in which a density-dependent force rather than a free force is used give improved fits to differential cross section data. However such calculations have usually used a limited-basis model of nuclear structure, such as that of Cohen and Kurath[1] or Millener and Kurath,[2] and in such cases the results require scaling in order to give cross section magnitudes correctly. It has been shown[3,4] however, that where large-basis models of nuclear structure are used for states of ^{12}C, the 2^+, T=0 state in particular, the magnitude of data could be calculated correctly.

Recently, we have reported[5,6] on the use of such large-basis wave functions in DWA analyses of 135 MeV data for the $^{12}C(p,p')$ and $^{16}O(p,p')$ reactions, in which the Paris density-dependent force[7] was used.

In Fig. 1, the differential cross sections for the lowest 2^+, T=0 and 4^+, T=0 states of ^{12}C are compared with DWA calculations in which the large-basis projected Hartree-Fock[3] (PHFBA) and the particle-hole model[4] wave functions were used. Without the need for any rescaling, the agreement in the 2^+ case is

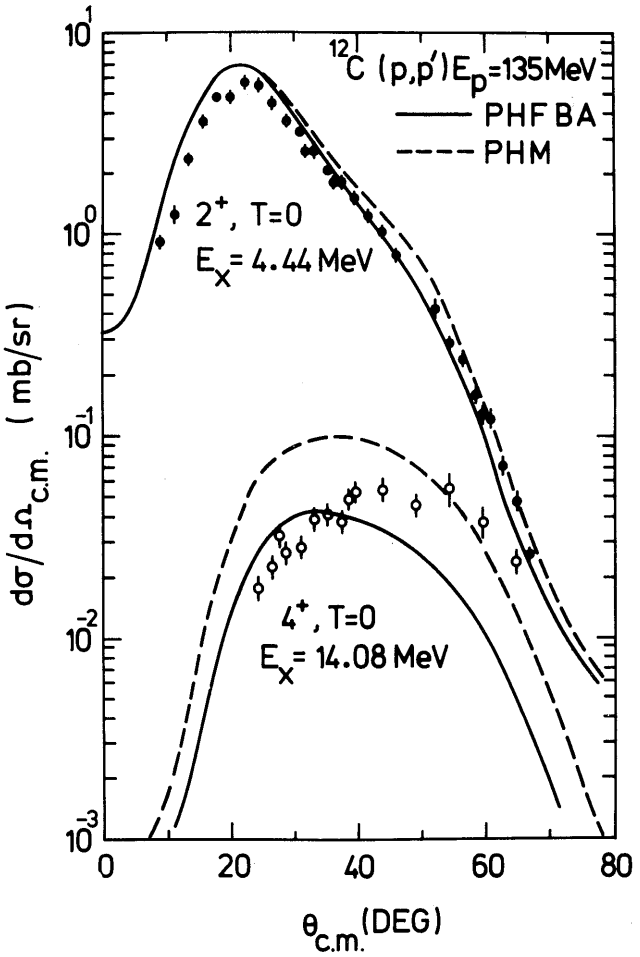

Figure 1. Comparison of DWA calculations and the measured differential cross sections for the excitation of the lowest 2^+ and 4^+ states in the $^{12}C(p,p')$ reaction at 135 MeV. Two models of nuclear structure, PHFBA and PHM, were used.

impressive as is the agreement for the forward-angle 4^+ data when the PHFBA is used.

For ^{16}O, wave functions derived from $2\hbar\omega$ shell model calculations based on the interaction of Millener and Kurath[2] were used in DWA calculations. Two such results are shown in Fig. 2 for the 2^+ and 4^+ states near 11 MeV, and are compared with the differential cross section data. The 2^+ data are accounted for quite well.

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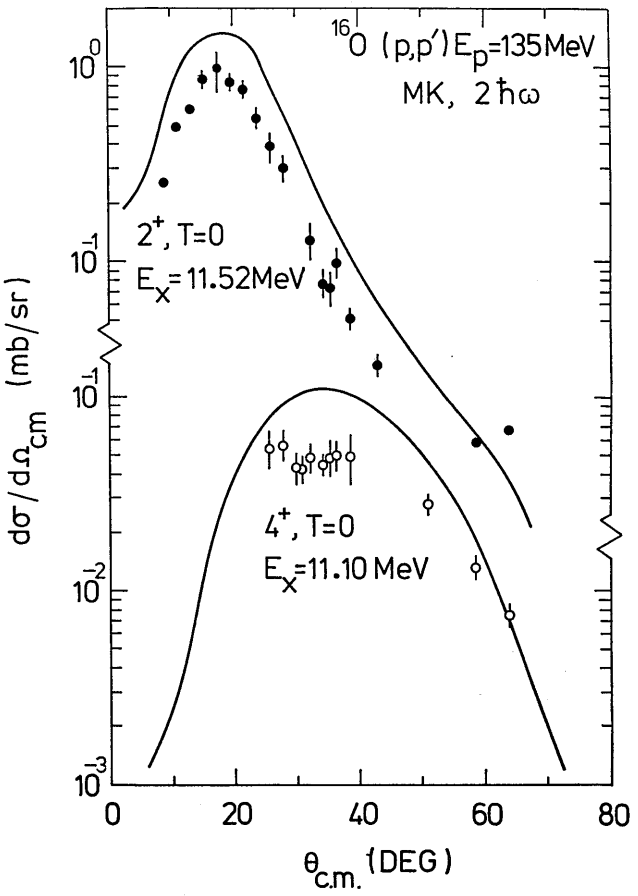

Figure 2. Differential cross section data for the 2^+ and 4^+ states of ^{16}O near 11 MeV as excited in the (p,p') reaction at 135 MeV compared with DWA predictions in which large-basis wave functions were used.