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INTERMEDIATE ENERGY PROTON-^{12}C ELASTIC SCATTERING WITH A THEORETICAL OPTICAL POTENTIAL

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Recent experimental data on intermediate energy proton-^{12}C elastic scattering show an anomalous rise in the differential cross section at back angles [1]. This phenomenon is not explainable by a Woods-Saxon type optical potential, no matter how one adjusts the parameters [2]. Also a KMT optical potential, which uses an antisymmetrized on-shell NN t-matrix as input, fails to reproduce the back angle data [2].

Large angle behavior seems to be sensitive to a variety of mechanisms such as nucleon exchange, Pauli effect, nucleon-nucleon correlations, isobar excitation, and so on. On the other hand, when we examine the differential cross sections for p-^4He elastic scattering in the same energy region, we also find a similar rise at back angles. This indicates that the mechanisms mentioned above are also present in the large angle behavior of p-^4He scattering. Therefore, if we utilize the p-^4He amplitude as a basic input to calculate p-^{12}C scattering, it might be possible to explain the phenomenon of rising differential cross sections at large angles.

Based on the three-α-particle model of ^{12}C [3], we expand the multiple scattering series by using the α particles as the scatterers and construct a first-order optical potential. The p-^4He amplitudes are obtained directly from fitting data. Using this theoretical optical potential (no adjustable parameters), the differential cross sections for p-^{12}C elastic scattering at incident energy 200 MeV are calculated. As is expected, a rising behavior at back angles is obtained. The preliminary result is shown in Fig. 1. One can see that not only the large angle rise is obtained but also agreement with data over the whole angle region is better than that calculated using KMT potential.

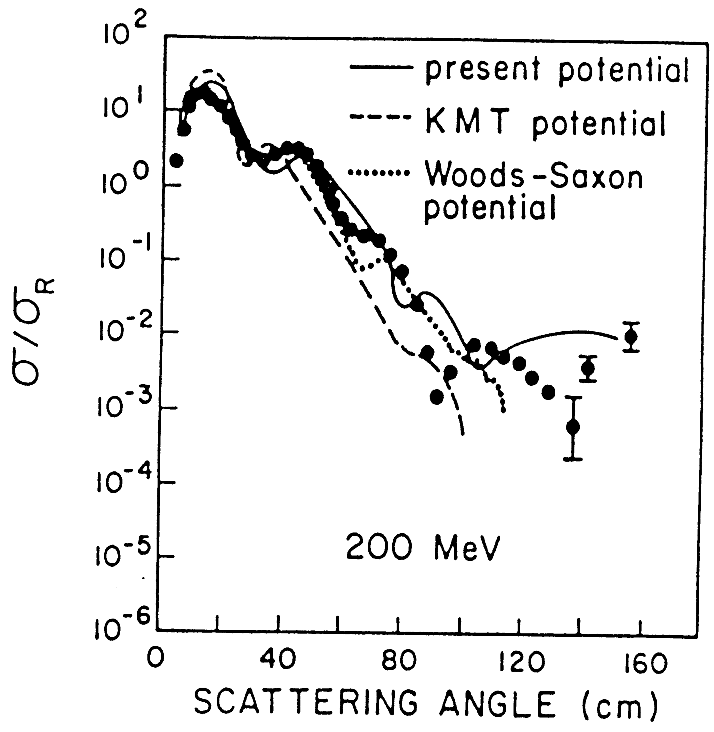

Fig. 1

[1] H.O. Meyer, P. Schwandt, W.W. Jacobs, and J.R. Hall, Phys. Rev C27, 459 (1983).

[2] H.O. Meyer, P. Schwandt, G.L. Moake, and P.P. Singh, Phys. Rev. C23, 616 (1981).

[3] Li Qing-run, Chen Sheng-zhong and Zhao En-guang, Physica Energiae Fortis et Physica Nuclearis 5 (1981) 531.