Microscopic optical model potential for $p$-$C$ scattering at 40A MeV

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Introduction

The structure of carbon isotopes has recently attracted much attention. New measurements [1] of reaction cross section ($\sigma_R$) for $^{19,20,22}C$ on proton target at 40A MeV shows a large enhancement in $\sigma_R$ for $^{22}C$ compared to those for the neighboring isotopes. Also large increase in reaction cross section for $^{12}C$ scattering from $^{16}C$ target at 83A MeV has been observed experimentally [2]. Both these experiments suggest the formation of neutron halo in these nuclei.

Here we report the preliminary study of $\sigma_R$ for chain of carbon isotopes with $A = 10 – 24$ on proton target for 40A MeV. We adopt the same prescription as our previous work as reported in Ref. [3]. The densities are employed in the semi-microscopic optical model (MOM) to determine the proton optical potentials for the different carbon isotopes. For this purpose, the densities are folded with the extended Jeukenne, Lejeune, and Mahaux (JLM) energy and density dependent nucleon-nucleon interaction using the code MOM. This yields both the real and imaginary parts of the respective optical potentials. In the final step, this optical potential is used to compute the reaction and the differential cross sections for 40A MeV even isotopes of C, with $A = 8 – 24$, incident on proton target are shown in Fig. 2. The experimental data, where available, for the same are plotted in Fig. 2. We find that the calculations in case of $^{12}C$ does not agree with that of the data. We expect that better agreement would be obtained for $\sigma_R$ for $^{12}C$ by introduction of normalisation for the real and imaginary part of the MOM potential. Moreover it is observed that calculated $\sigma_R$ for $^{20}C$ agrees well with the corresponding data while the experimentally

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obtained large value of $\sigma_R$ for $^{22}$C is not reproduced by our calculations. Further calculations to reproduce this enhancement in $\sigma_R$ for $^{10}$C and $^{22}$C is being carried out.

Fig. 1 Differential cross section for $p-^{10,12,14,16,18,20,22,24}$C calculated using MOM potentials. Data are taken from Ref. [1,7].

Fig. 2 The total reaction cross section obtained from our analysis of elastic scattering by $^{8,10,12,14,16,18,20,22,24}$C isotopes. The solid line is guide to the eye.

References