Proton Skin in ^{9}C

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Introduction

The discovery of Halo structure in ^{11}Li has triggered interest in activities concerning the production of new variety of exotic nuclei having large neutron or proton excess. The progress in the study of these unstable nuclei has led to a renewed interest in the investigations concerning proton and neutron distributions. Proton elastic scattering from these nuclei has been one of the important tools in extracting information about the distribution of nucleons.

In view of the above, Matsuda *et. al* [1] have recently measured the elastic scattering of ^{9}C from protons at 290MeV/Nucleon and analysed the data using the modified version of the Murdock and Horowitz model [2].This model involves density dependence in the effective interaction in terms of four parameters. The parameters are extracted by calculating observables for the scattering of protons from N=Z nucleus ^{12}C for which the nucleon density distribution is known with a much greater level of confidence. The parameters thus calibrated are then used for calculating the elastic cross section of protons from ^{9}C.The major deficiency of the method is that the proton and neutron density distribution in ^{9}C is expressed as two parameter Fermi distribution thus introducing additional parameters. These parameters are determined by obtaining χ^2 minimization of the elastic scattering data. Hence the agreement with the differential cross section data is unable to provide an independent test of the proton skin ^{9}C.

Here we analyze the above data using the folding the g-matrices over the density distribution of ^{9}C. The effective interaction (g-matix) has been calculated using the realistic interaction
Argonne V18 (AV18).The nucleon distribution in ^{9}C has been calculated using Relativistic Mean Field (RMF) approach [3].This method has been used for predicting the cross section of protons from ^{22}C [4] and proton scattering observables from Pb and Sn isotopes [5] previously. In order to further test the reliability of our method we have used the microscopic optical potential for analyzing the proton scattering from ^{12}C at 300MeV/Nucleon calculated using RMF density distribution.

Figure 1 shows that the method is able to achieve a reasonably satisfactory agreement with the experimental data.

Figure 2 shows our results for the differential cross section of protons from ^{9}C using two types of densities for ^{9}C (a) two parameter Fermi density distribution obtained by Matusuda *et.al*. [1] and (b) RMF density distribution. We observe that the agreement between the calculated results and the experiment is reasonable at small angles for both densities. Further the results obtained by using RMF density distribution are much superior at larger angles.

The root mean square (RMS) matter, proton, neutron radii and Binding energy (B.E) per Nucleon for ^{9}C calculated using RMF approach are listed in Table 1 along with those reported by Matsuda *et.al* [1] for comparison. Our calculated value of B.E per nucleon for ^{9}C is close to its experimental value which is 4.337 MeV.

We conclude that additional experimental measurements are required to obtain more reliable information about the proton skin in ^{9}C.

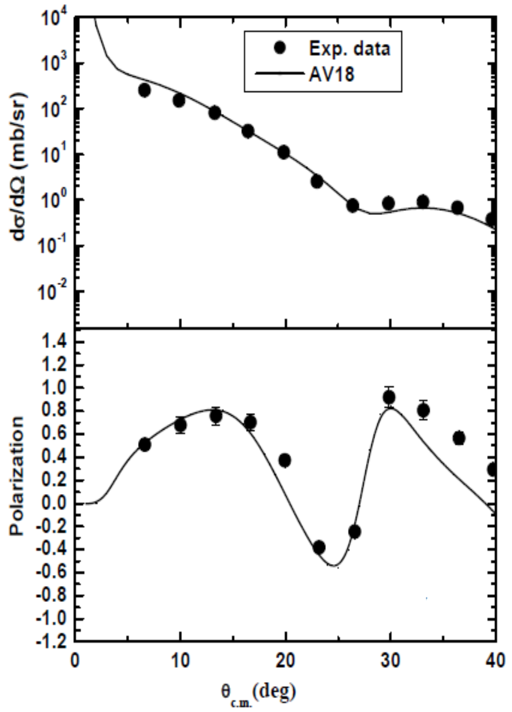

Fig. 1 BHF results compared with the experimental data for differential crossection and analyzing power for ^{12}C at 300MeV/Nucleon.

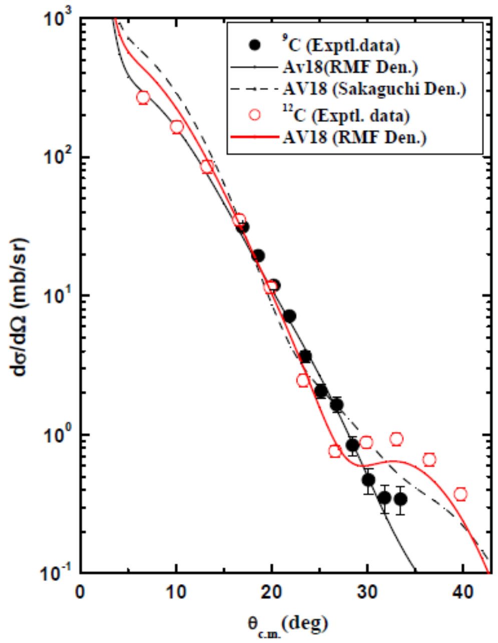

Fig. 2 BHF results compared with the experimental data for differential crossection of ^{9}C and ^{12}C at 290MeV/Nucleon using AV18 potential.

	Rp	Rn	Skin thickness	B.E/Nuc. (MeV)
RMF	2.684	2.164	0.52	4.82
Ref.[1]	3.345	1.647	1.698	

Acknowledgement

W. Haider gratefully acknowledges the financial grant from the Department of Atomic Energy (DAE), Board of Research in Nuclear Sciences (BRNS), Government of India under BRNS Project No. 2011/37P/16/BRNS.

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