Energy dependence of Volume Integral and Mean Square Radii (MSR) for elastic scattering of neutrons from ^{40}Ca at 65 - 225MeV

S.Rafi[1]*[1],W.Haider [1], Manjari Sharma [1],Dipti Pachouri[1]
[1] *Department of Physics,Aligarh Muslim University, Aligarh ,India*
* *email:rafiindrabi@gmail.com*

We describe our results for the calculated neutron–nucleus optical potential in the energy region 65-200 MeV for the scattering of neutrons from ^{40}Ca, in first order Brueckner theory [1], using both the Urbana v -14 soft-core [2] and Hamada - Johnston (HJ) hard-core [3] interactions. The corresponding results are denoted by UB and HJ respectively. We have made a systematic study of energy dependence of Mean Square Radii and the volume integrals of the Optical model potentials.

We define the volume integrals Jv/A and Jw/A per nucleon of the real and imaginary central potential respectively as

$$J_V/A = 4\pi \int V(r) r^2 dr / A$$

and

$$J_W/A = 4\pi \int W(r) r^2 dr / A$$

We have shown the energy dependence of the volume integral per nucleon for the real and imaginary part of calculated central potential using Urbana v-14 [1] in fig 1. We have also used Hamada-Johnston realistic interaction for n-^{40}Ca in the energy region 65 to 225MeV.

We results show that:

1. Volume integral of the real central potential, resulting from HJ interaction & from v-14 interaction shows similar energy dependence. The real volume integral per nucleon decreases with increasing incident energy. However since the energy range is large the decrease is not linear.
2. We observe that for a given energy J_v /A obtained from HJ interaction is less than that Obtained from v-14 interaction. This is expected, as the HJ interaction compared with v14 interaction gives rise to a more attractive real central potential.
3. J_w/A obtained from HJ interaction and from v-14 interaction shows milder energy dependence.

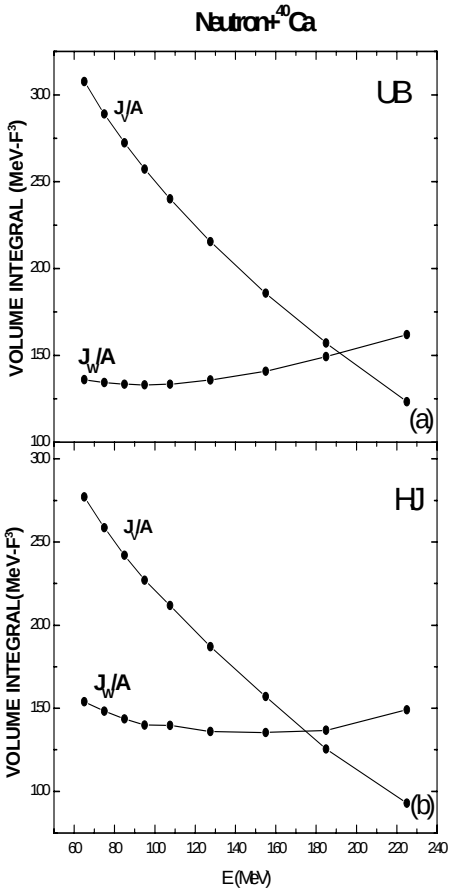

Figure 1

We also present our results for the energy dependence of root mean square radii of calculated real central optical potential, for neutron elastic scattering. The mean square radii of real central potential is defined as

$$< r^2 >_V = \frac{\int r^2 V(r) d^3 r}{\int V(r) d^3 r}$$

where V (r) is the real part of the optical model potential. Figure (2) shows our results $< r^2 >_v^{1/2}$ (MSR radii), for ^{12}C, ^{40}Ca and ^{208}Pb at all incident energies considered using v-14 and HJ interactions respectively.

We see that

1. The MSR for the real central-potential is mildly energy dependent.
2. The MSR for the real central potential calculated from HJ interaction is marginally greater than that obtained from Urbana v-14 interaction.
3. The MSR increases with the mass number of the target.

We find that the MSR for the neutron nucleus real central potential for all the targets considered in present work practically remains energy independent.

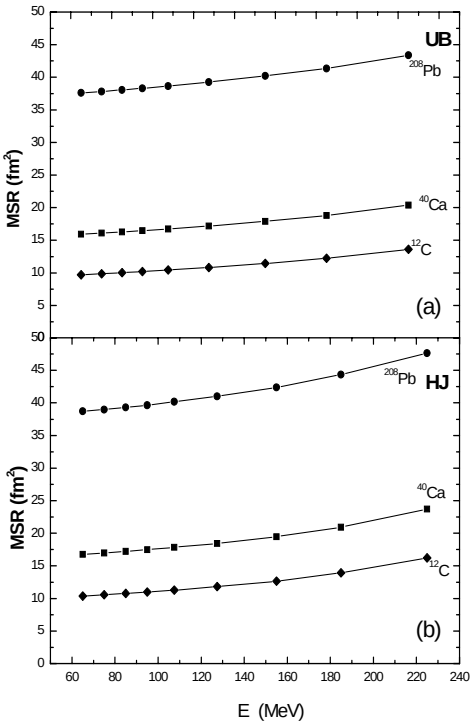

Figure 2

References

[1].K. A. Brueckner and J. L Gammel Phys. Rev .**109** (1958)1023.

[2]. I.E Lagris and V.R Pandharipande Nucl. Phys **A 359**(1981) 331

[3]. T.Hamada and I.D Johnston.Nucl.Phys.**34** (1962)382