Elastic scattering of ^{8}B from ^{12}C with internal three cluster structure of ^{8}B

K.Horii[1] ,T. Furumoto[2] ,M. Takashina[1] ,Y. Taniguchi[1],H. Toki[1] ,and Y. Sakuragi[2]
[1]*Research Center for Nuclear Physics (RCNP), Osaka University, Ibaraki, Osaka 567-0047, Japan*
[2]*Department of Physics , Osaka City University, Osaka city, Osaka 558-8585, Japan*

It is well-known that the proton drip-line nucleus ^{8}B has the last proton being very weakly bound by the core nucleus ^{7}Be, where the proton separation energy is only 0.137 MeV. Because of this property, one expects that ^{8}B breaks up into ^{7}Be+p easily in collision of process with target nuclei. Furthermore, the core nucleus ^{7}Be is described with α+^{3}He cluster model, and it is important to take into account the effect of deformation and the excitation of ^{7}Be into the α+^{3}He continuum in the ^{8}B collision process. In this paper, we study elastic scattering of ^{8}B from ^{12}C at E=95 MeV [1] to find the ^{7}Be+p breakup effect and the effect of the subsystem ^{7}Be (α+^{3}He).

It is generally difficult to solve scattering problem between a projectile such as ^{8}B that has a three cluster structure (p+α+^{3}He) and a target. We therefore calculate this scattering process by using the method of adiabatic recoil approximation [2]. In this approximation, the motion of the loosely bound proton is considered very slow (adiabatic) and keep its original motion, while the core nucleus ^{7}Be makes collision with the target nucleus and makes excitation into continuum and de-excites back to its ground state within short time. Hence, we consider the effect of excitation into continuum due to closeness to the continuum threshold during the course of collision process and the effect of deformation of ^{7}Be due to its cluster structure. We calculate ^{7}Be+^{12}C elastic scattering with coupled channel methods on the basis of microscopic optical model. We check goodness of this description by comparing the calculated results with experimental data. We then take into account the loosely bound proton using the momentum distribution of the loosely bound proton in the adiabatic recoil approximation [2].

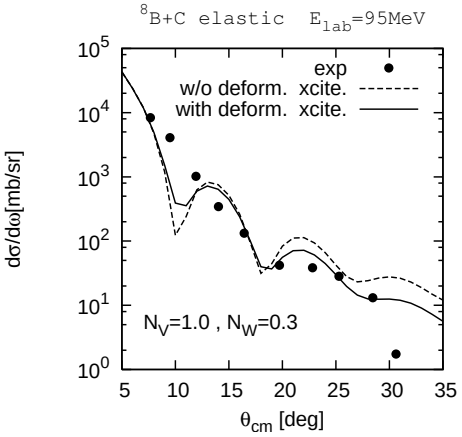

Figure 1: ^{8}B+^{12}C elastic scattering involving ^{8}B $\rightarrow$ ^{7}Be+p breakup effect and the internal cluster structure of ^{7}Be using the adiabatic recoil approximation of Johnson et al. [2]. Experimental data are taken from Tabacaru *et al* [1]. The dashed curve denotes calculated result without the effect of deformation and excitation of ^{7}Be, while the solid curve is the one with the effect of deformation and excitation of ^{7}Be. The G-matrix is used for the interaction with no normalization factor, $N_V = 1$ and the imaginary part is obtained by multiplying $N_W = 0.3$ to the real G-matrix interaction.[3]

We show calculated results and their comparison with experimental data in Fig. 1. We have obtained satisfactory results, where we have found the important effect being the exicitation and the deformation of the core nucleus ^{7}Be in the course of ^{8}B scattering with target nucleus. In our calculation we have used G-matrix (CDM3Y)[3]. We would like to replace effective interaction by CEG07 (complex G-matrix) [4]. We are encouraged to apply this method to other reactions involving unstable nuclei which have weakly bound system consisting of halo valence particle and core nucleus with internal structure.

References

[1] G. Tabacaru, *et al* Phys. Rev. C **73**, 025808 (2006)
[2] R. C. Johnson *et al.* Phys. Rev. Lett. **79**, 2771 (1997)
[3] Dao. T. Khoa *et al.* Phys. Rev. C. **56**, 954 (1996)
[4] T. Furumoto, Y. Sakuragi and Y. Yamamoto, Phys. Rev. **C79**, 011601(R) (2009)