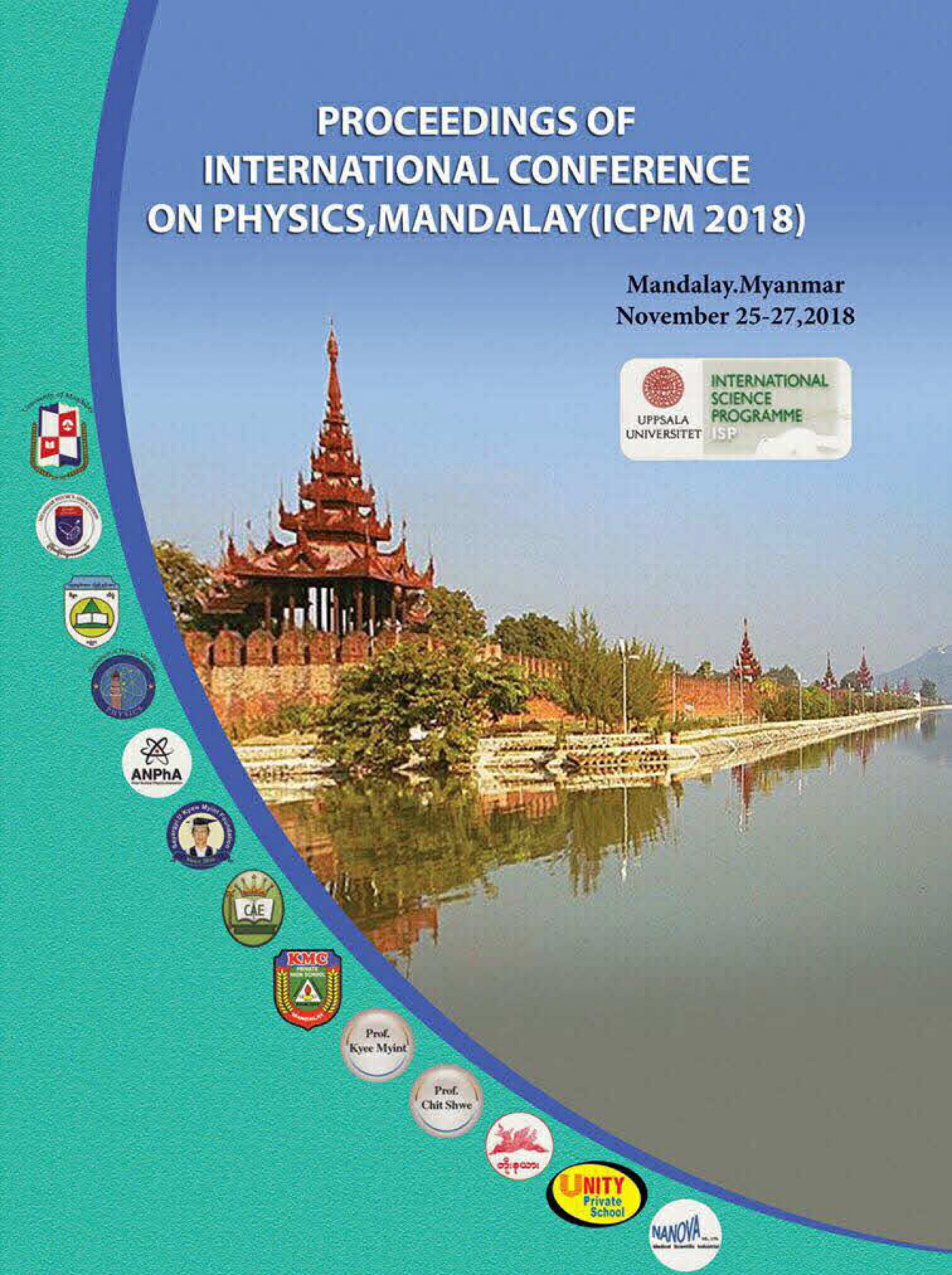
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON PHYSICS,MANDALAY(ICPM 2018)

Mandalay.Myanmar
November 25-27,2018



POCEEDINGS OF

INTERNATIONAL CONFERENCE ON PHYSICS, MANDALAY (ICPM 2018)

Mandalay, Myanmar
November 25-27, 2018

DEPARTMENT OF PHYSICS
UNIVERSITY OF MANDALAY

Conference Patrons

Tin Oo Hlaing [Rector (Retd.), Univ. of Yangon]
Tin Aung [HOD of Physics (Retd.), Univ. of Yangon]
Myo Tint [HOD of Physics (Retd.), Univ. of Yangon]
Hla Pe [Rector (Retd.), Mawlamyine Univ.]
Kyee Myint [Rector (Retd.), Mandalay Univ. of Foreign Languages]
Tin Hlaing [Deputy Director (Retd.), Ministry of Science and Technology]
Thida Win (Rector, Univ. of Mandalay)

Local Organizing Committee (Central)

Lei Lei Win (Chair)
Kalyar Thwe (Vice-Chair)
Than Zaw Oo (Secretary)
Thida Wint (Joint Secretary)
Thanda Swe (Treasurer)
Khin Thitsa Shin (Audit)

Sub-Committee Chairs

Kalyar Thwe (Publication/Proceedings)
Khin Thitsa Shin (Decoration)
Moe Sandar Maung (Ushering and Transportation)
Theingi (Registration and Conference Kit)
Mya Thet Naing (Hospitality)
Win Zaw (Media and Information)
Thida Wint (Opening and Closing Ceremony)

Theoretical Investigation on $^{12}C\left(K^-,p\right)^{11}_{K^-}Be$ Reaction

Thinn Kyu[1,*], Mar Mar Htay[2] and Khin Swe Myint[3]

[1] Physics Department, Kalay University, Kalay, Myanmar

[2] Physics Department, Monywa University, Monywa, Myanmar

[3] Physics Department, Mandalay University, Mandalay, Myanmar

* E-mail address: thinnkyu2016@gmail.com

Abstract

The purpose of our research is to conduct theoretical study on production reaction $^{12}C\left(K^-,p\right)^{11}_{K^-}Be$ which populates kaonic nuclei $^{11}_{K^-}Be$. The KEK- E 548 and J-PARC E05 Experiments motivate us to perform our present theoretical work on kaonic nuclear study. Therefore we investigated the missing mass spectrum for the reaction $^{12}C\left(K^-,p\right)^{11}_{K^-}Be$ by using Green's function method. The missing mass spectrum were derived from the momentum of proton 1.0 GeV/c and 1.8 GeV/c.Our results are compared with the results of above two experimental results.

Key words: missing mass spectrum, Green's function method, $^{11}_{K^-}Be$.

1. Introduction

Kaonic nuclei are nuclei in which an antikaon is bound to ordinary nucleus by the strong interaction. $\overline{K}N$ interaction is very strong that antikaon forms the dense state in the nucleus. Many studies of deeply bound kaonic nuclear state have been performed both theoretically and experimentally. In the KEK- E 548 Experiment [1] they studied the in- flight $^{12}C(K^-,N)$ reaction which produced kaonic nuclei $^{11}_{K^-}Be$ and $^{11}_{K^-}B$. Recently, the J-PARC E05 [2] Experiment was performed with $^{12}C\left(K^-,p\right)$ reaction. The observed missing mass spectrum shows the significant yield in energy region $-150 \le BE \le 100$ same as KEK-E548. Kishimoto et al., [3] studied the K-nucleus interaction by fitting the missing mass spectra $^{12}C\left(K^-,N\right)$ reaction obtained from E548 experiment. It is found that a potential depth of approximately -190MeV best reproduces the spectrum of the $^{12}C\left(K^-,n\right)$ reaction and approximately -160MeV best reproduces that of the $^{12}C\left(K^-,p\right)$ reaction. Their data clearly indicates that the K^- nucleus potential is strong with about -200 MeV depth. In our research work, we are going to conduct theoretical investigation into experimental spectra of both experiments E548 and E05.

2. Mathematical Formulations

We have analyzed KEK-E548 and J-PARC E05 missing mass spectra by using Green's function method for $^{12}C\left(K^-,p\right)^{11}_{K^-}Be$ reaction. The spectral function S(E) is given by

$$S(E)=\left(-\frac{1}{\pi}\right)\mathrm{Im}\int d\vec{r}d\vec{r}'f^*\left(\vec{r}'\right)\left\langle\vec{r}'\right|\frac{1}{E-H_{K^-C}+i\varepsilon}\left|\vec{r}\right\rangle f\left(\vec{r}\right) \qquad (1)$$

The differential cross section for missing mass spectrum of the reaction is given by

$$\frac{d^3\sigma}{dE_1 d^2\Omega} = \frac{(2\pi)^4}{2\hbar^2 c^2}\frac{E_1 k_1}{2\vec{k}_0}\left|\langle t\rangle\right|^2 \frac{2\mu c^2}{\hbar^2 c^2}\left(-\frac{1}{\pi}\right)\mathrm{Im}\left[\sum_{\ell=0}^{\infty}(2\ell+1)\int dr dr'\, j_\ell^*(Qr')U^*(r')\right] \times \frac{u_\ell^0(r_<)u_\ell^+(r_>)}{w(u_\ell^0, u_\ell^+)} j_\ell(Qr)U(r) \quad (2)$$

3. Results and Discussion

We studied theoretical analysis of the missing mass spectrum from ${}^{12}C(K^-,p)_{K^-}{}^{11}Be$ reaction of a recent KEK- E548 and J-PARC E05 experiment. In our reaction model, the incident particle K^- is knock out the proton in the target ${}^{12}C$ to form ${}_{K^-}{}^{11}Be$ nuclide. The momentum of the incident K^- is 1.8GeV/c and 1.0GeV/c.

We have calculated the spectral function S(E) by employing Wood-Saxon potential $U_{opt}(r) = \frac{V_0 + iW_0}{1 + e^{\frac{r-R}{a}}}$, where, V_0 = -169 MeV and W_0 = -40 MeV.

We calculated the differential cross section of ${}^{12}C(K^-,p)_{K^-}{}^{11}Be$ reaction for incident momentum 1.8GeV/c and 1.0GeV/c with angles $\theta = 0^\cdot, 10^\cdot, 20^\cdot$ and they are shown in figure 1. (a) and (b). We found that the bound states region is between 0 MeV and 100 MeV for scattered angle 0 degree and 10 degree but no bound state at 20 degree. It is observed that differential cross section is largest at binding energy of the ${}_{K^-}{}^{11}Be$ 41.8 MeV for 1.8GeV/c and 1.0GeV/c.

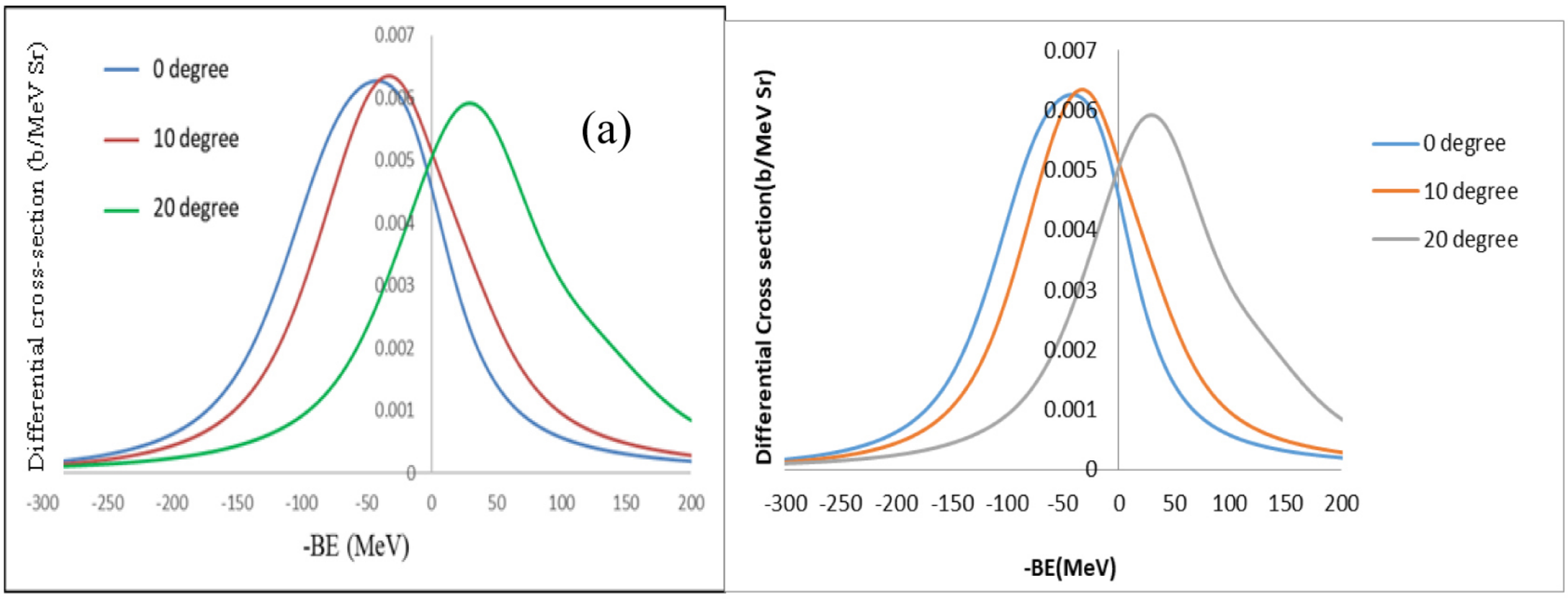


Fig.1(a)Differential cross section at various angles for incident momentum 1.8GeV/c
(b)Differential cross section at various angles for incident momentum 1.0 GeV/c.

Acknowledgements

We would like to thank ICPM2018 organization committee giving a chance to present our research work.

References

[1] T. Kishimoto et al., KEK– PS proposal E548, (2004).
[2] Y. Ichikawa, J–PARC E05 Collaboration, JAEA/ASRC Reimei Workshop: New exotic hadron matter at J–PARC (2016).
[3] T. Kishimoto et al., Prog. Theor.Phys. 118 (2007), 181.