A Faddeev calculation of $\alpha\Lambda\Lambda$ bound state with three-dimensional treatment

H. Kamada[1], K. Miyagawa[2], H. H. Oo[3]

[1]Kyushu Institute of Technology, Kitakyushu, Japan

[2]Okayama University of Science, Okayama, Japan

[3]Meiktila University, Meiktila, Myanmar

The three-dimensional scheme (no partial wave) has been developed to solve the Faddeev equation in triton [1]. Using the scheme we apply here to the $\alpha\Lambda\Lambda$ system as a simple three-boson model. There are many researchers of studying ${}^{6}_{\Lambda\Lambda}$He hyper nuclear [2]. We take simple gaussian potentials. The $\Lambda\Lambda$ potential $V_{\Lambda\Lambda}$ is given [3] in unit MeV as

$$V_{\Lambda\Lambda}(r) = 1300.3\exp(-r^2/0.5^2) - 305.3\exp(-r^2/0.9^2) - 10.5\exp(-r^2/1.5^2).$$

The $\alpha\Lambda$ potential $V_{\alpha\Lambda}$ is also a simple gaussian given [4] as

$$V_{\alpha\Lambda}(r) = 209.037\exp(-0.5915059r^2) - 178.379\exp(-0.4443259r^2) - 18.317\exp(-0.2709581r^2).$$

Table 1 shows the three-body binding energy from these potentials. The study [4] of a variational calculation shows $B_{\Lambda\Lambda}$=7.237 MeV which almost agrees with the recent data [5]. However, the potential $V_{\Lambda\Lambda}$ was prepared [3] to adjust it with the old data [6]. Our present result agrees with the old data.

Table 1: The three-body binding energy of ${}^{6}_{\Lambda\Lambda}$He $B_{\Lambda\Lambda}$. Unit is in MeV. Our result of (S-wave) is restricted only S-wave potential.

[4]	Expt. [5]	present result (3D)	Expt. [6]	present result (S-wave)
7.237	7.25 $\pm$ 0.14	11.60	10.9 $\pm$ 0.8	11.29

We would like to show more results using other model potentials in the conference.

The numerical calculations were performed on the interactive server at RCNP, Osaka University, and on the supercomputer cluster of the JSC, Jülich, Germany.

[1] J. Golak *et al.*, Few-Body Syst. **54**, 2427 (2013).

[2] e.g.; E. Hiyama *et al.*, Phys. Rev. C **66**, 024007 (2002).

[3] H. Takaki, W. Xi-cang, H. Bando, Prog. Theor. Phys. **82**, 13 (1989).

[4] S. Mahapatra, J. Nag, Pramana -J. Phys. **60**, 1179 (2003).

[5] H. Takahashi *et al.*, Phys. Rev. Lett. **87**, 212502 (2001).

[6] D. J. Prowse, Phys. Rev. Lett. **17**, 782 (1966).