Double-pole structure on a prototype of kaonic nuclei "K^-pp"

Akinobu Doté[1], Takashi Inoue[2], Takayuki Myo[3]

[1]KEK Theory Center, IPNS/KEK

[2]Nihon University, College of Bioresource Sciences

[3]General Education, Faculty of Engineering, Osaka Institute of Technology

In kaonic nuclei which have been an important topic in strange nuclear physics and hadron physics, the simple three-body system, so-called "K^-pp", is focused again since several new experimental results of "K^-pp" search were reported. On the other hand, we have finished our theoretical study of the "K^-pp"($=\bar{K}NN$-$\pi\Sigma N$-$\pi\Lambda N$) by means of a coupled-channel complex scaling method + Feshbach projection (ccCSM+Feshbach method) in which we respect the resonance nature completely and the coupled-channel nature partially. Using a chiral SU(3)-based $\bar{K}N$(-πY) potential, the "K^-pp" ($J^\pi = 0^-$, $I = 1/2$) is concluded to be shallowly bound; (B.E., Γ) = (20-30, 20$\sim$70) MeV [1], which is largely deviated from the J-PARC E27 result since the binding energy is reported to be about 100 MeV by that experiment [2].

In our calculation, we request the self-consistency for the complex $\bar{K}N$ energy in the "K^-pp". (Details are explained in Ref. [1].) When we search for self-consistent solutions in the wide area of the complex $\bar{K}N$ energy plane, we have found a nearly self-consistent solution as well as a self-consistent solution that we have reported in Ref. [1] (See Fig. 1). We consider that the "K^-pp" has the double-pole structure similarly to the $\Lambda(1405)$, as already pointed out by a past study with Faddeev-AGS calculation [3]. In addition, the newly found solution involves the large binding energy and large decay width, and such a state appears near the $\pi\Sigma N$ threshold.

We will report the double-pole nature on the K^-pp revealed by the ccCSM+Feshbach method and discuss on J-PARC E27 and E15(preliminary) results.

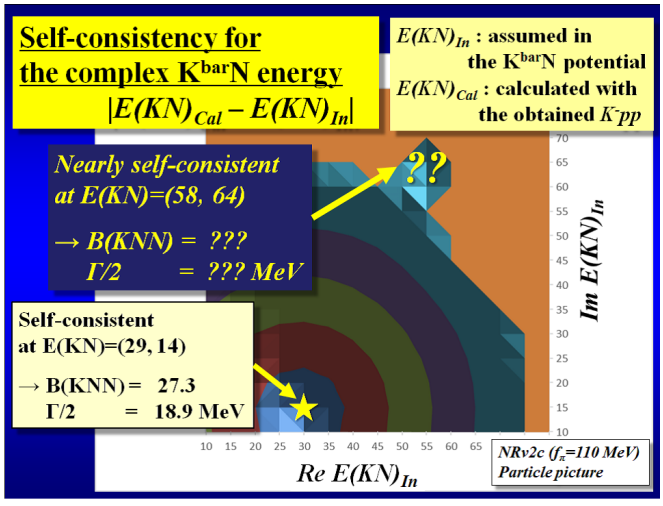

Figure 1: Self-consistency for the complex $\bar{K}N$ energy in the $\bar{K}NN$ system. The star and "??" symbols correspond the self-consistent [1] and nearly self-consistent solutions, respectively.

[1] A. Doté, T. Inoue and T. Myo, Prog. Theor. Exp. Phys. **2015**, 043D02 (2015).

[2] Y. Ichikawa *et al.* (J-PARC E27 Coll.), Prog. Theor. Exp. Phys. 101D03 (2014).

[3] Y. Ikeda, H. Kamano and T. Sato, Prog. Theor. Phys. **124**, 533 (2010).