The formation of the deeply-bound K^-pp state in ^{3}He(in-flight K^-,n) reaction spectrum

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In the study of $\bar{K}$ properties in nuclear medium, it is important subject to verify the presence of the deeply-bound kaonic nuclei. The FINUDA collaboration at DAΦNE reported the evidence of a deeply-bound K^-pp state by using the stopped K^- reaction on several nuclear targets [1], but it is not confirmed due to the possibility of the different interpretation [2]. Among the various $\bar{K}$-nuclear systems, K^-pp is the lightest and the most fundamental kaonic nuclei. Recently, a new experimental search of K^-pp using the in-flight (K^-,n) reaction on ^{3}He target is proposed for J-PARC [3]. Our purpose is to calculate the expected spectra for preparing the forthcoming J-PARC experiment.

The formation of the K^-pp bound state by the ^{3}He(in-flight K^-,n) reaction is investigated theoretically. The inclusive and semi-exclusive spectra at $p_{K^-} = 1.0$ GeV/c and $\theta_n = 0^\circ$ are calculated in the distorted-wave impulse approximation using the Green's function method. We employ optical potentials between the K^- and "pp" core-nucleus, and demonstrate systematically the dependence of the spectral shape on V_0 and W_0, which are the real and imaginary parts of the strength for the optical potential, respectively. Some examples of the calculated inclusive and semi-exclusive spectra are shown in Figure 1 [4].

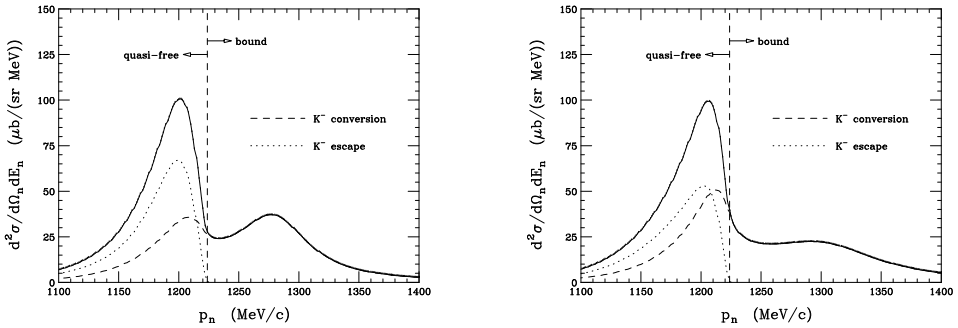

Figure 1: The calculated inclusive and semi-exclusive spectra as a function of the neutron momentum in the case of (left) $V_0 = -300$ MeV and $W_0 = -70$ MeV and (right) $V_0 = -350$ MeV and $W_0 = -100$ MeV.

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[2] V.K. Magas, E. Oset, A. Ramos and H. Toki, Phys. Rev. **C74** (2006) 025206.

[3] M. Iwasaki, T. Nagae *et al.*, J-PARC E15 experiment.

[4] T. Koike and T. Harada, submitted to Phys. Lett. **B**, nucl-th/0703037.