

Faddeev calculation of the $K^-d \rightarrow \pi\Sigma n$ reaction in the $\Lambda(1405)$ resonance region

K.Miyagawa¹, J.Haidenbauer²

¹ Faculty of Applied Physics, Okayama University of Science, 1-1 Ridai-cho, Okayama, Japan

²Institute for Advanced Simulation, Forschungszentrum Jülich, D-52425 Jülich, Germany

This study is motivated by the J-PARC experiment E31 [1], which aims at a spectroscopic study of the $\Lambda(1405)$ resonance via the (K^-, n) reaction on the deuteron. Among previous theoretical predictions which took into account single and double scattering processes, our analysis [2] showed that no clear peak is seen in the relevant energy region below the $\bar{K}N$ threshold for the beam momentum $P_{K^-}=600$ MeV/c. It thereby emphasized the necessity for Faddeev-type approaches where all rescattering processes can be summed up to infinite order.

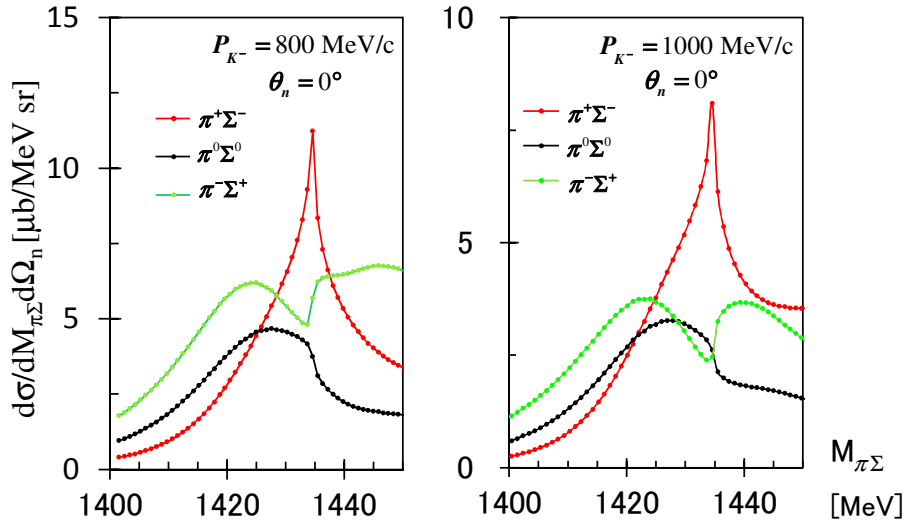


Figure 1: $\pi\Sigma$ invariant mass spectra for the reaction $K^-d \rightarrow \pi\Sigma n$. The colored lines indicate the three charge states.

In this work we solve the Faddeev equation for the coupled $\bar{K}NN - \pi\Sigma N$ systems. At present, $\bar{K}NN$ three-body scattering processes are fully incorporated, but the transition to the $\pi\Sigma N$ system is treated perturbatively with the t -matrix $t_{\pi\Sigma, \bar{K}N}$. For the $\bar{K}N - \pi\Sigma$ system, the s -wave interaction (in the isospin basis) of a chiral unitary model [3] is used. The results are shown in Fig. 1. In both cases of $P_{K^-}=800$ and 1000 MeV/c, the invariant mass spectra for the $\pi^- \Sigma^+$ final state show peaks around 1425 MeV.

In our analysis, we find that the $\bar{K}N$ interaction in the high-energy region has an influence on the spectra. A more elaborate calculation is in preparation in which the interaction in higher partial waves is incorporated, and where updated $\bar{K}N$ interaction models are used that are fitted to recent low-energy data.

- [1] S. Ajimura et al., http://j-parc.jp/researcher/Hadron/en/pac_0907/pdf/Noumi.pdf
- [2] K.Miyagawa and J.Haidenbauer, Phys. Rev. C **85**, 065201 (2012).
- [3] E. Oset and A. Ramos, Nucl. Phys. A **635**, 99 (1998).