

Experimental study of hyperon resonances below the $\bar{K}N$ threshold at J-PARC

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$\Lambda(1405)$ is a well-known hyperon resonance with the spin/parity of $1/2^-$. According to PDG, its mass and width are $1405.1(+1.3-1.0)$ MeV and 50 MeV [1]. Its light mass, located at 27 MeV below the $\bar{K}N$ mass threshold, arises a basic idea of possible deeply bound kaonic nuclear states [2].

On the other hand, there is a longstanding argument if $\Lambda(1405)$ has a so-called double-pole structure, comprises π - Σ and $\bar{K}N$ states [3,4,5]. In particular, a chiral unitary model calculation claims that the pole coupled to the $\bar{K}N$ state is located at about 1426 MeV [4], much closer to the $\bar{K}N$ mass threshold.

In order to confirm the pole structure, it is desired to measure the S-wave $\bar{K}N$ scattering amplitude in the isospin equal to 0 channel below the $\bar{K}N$ threshold.

We therefore proposed an experiment via the (K^-,n) reaction on deuteron at the K1.8BR beam line of J-PARC [6]. In the reaction, an incident negative kaon of 1 GeV/c knocks out a neutron at a forward angle and a recoiled kaon reacts with a residual nucleon.

The $d(K^-,n)$ reaction is expected to enhance the S-wave $\bar{K}N$ scattering even below the $\bar{K}N$ threshold due to a small momentum transfer of about 200 MeV/c.

Missing mass spectra of $\pi^+\pi^-\Sigma^+$, $\pi^0\Sigma^0$, and $\pi^-\Sigma^0$ in the $d(K^-,n)$ and $d(K^-,p)$ reactions were measured.

We will discuss the line shapes of the measured spectra to deduce information on a resonance coupled to the $\bar{K}N$ channel below the $\bar{K}N$ threshold.

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