1 - 15 Nucleon Pole Contribution in the pp→ ppK^+K^- Reaction below the ϕ Meson Threshold

Xie Jujun

The meson production in nucleon-nucleon collisions near threshold has the potential to gain information on hadron properties and also plays an important role in exploring the baryon spectroscopy[1]. In recent years, the experimental database on the reaction of pp→ ppK^+K near threshold has been expanded significantly. In addition to the measurements of the total and differential cross sections, below the threshold of the production of the ϕ meson, performed experimentally with COSY-11 and ANKE detectors at the cooler synchrotron COSY in Germany, invariant mass distributions of various subsystems have been obtained at low energies. Unlike above the threshold of the production of the ϕ meson, in the low energy region, we do not need to separate the non-ϕ from the ϕ contribution, and due to the fact that the data were spread over a wide range of K^+K^- invariant masses, it has a special advantage to investigate the scalar mesons $a_0(980)$$ and $f_0(980)$ which are dynamically generated from the interactions of $K\bar{K}$, ππ, and πη treated as coupled channels in I=0 and I=1, respectively. Both of them couple strongly to the $K\bar{K}$ channel.

Inspired by those results obtained from the chiral unitary approach, the nucleon pole contribution in pp→ ppK^+K^- reaction is also studied within the effective Lagrangian approach. It is assumed that the K^-p final state originates from the decay of the hyperon Λ(1115) and Λ(1405). In addition to the pp final state interaction (FSI) parameterized using the Jost function, we have also considered the K^+K^- FSI with the techniques of the chiral unitary approach, where the scalar mesons $f_0(980)$ and $a_0(980)$ were dynamically generated as poles of the S-wave amplitudes. This approach has been used in the investigation of the FSI of mesons in different processes in order to get a better understanding of the nature of meson resonances. On the other hand, we have adopted the pseudoscalar (PS) and pseudovector (PV) couplings for the πNN interaction. It is found that both PS and PV couplings can describe the experimental data. The hyperon Λ(1115) plays an important role in the case of the PS coupling, while the Λ(1405) contribution is predominant the PV coupling. However, even after considering the contributions from Λ(1405) state, the invariant K^-p mass distribution can still not be reproduced, which indicates that the FSI of the four body ppK^+K^- system is extremely complex. Our results can give a reasonable description of the experimental data[2] on the total cross section and most of the differential cross sections in the considered energy region. Meanwhile, our calculation offers some important clues for the mechanisms of the pp→ ppK^+K^- reaction and makes a first effort to study the K^+K^-FSI with the chiral unitary approach.

Nevertheless, taking the pp and K^+K^-FSI into account, the energy dependence of the total cross sections below the threshold of the production of the ϕ meson can be well reproduced by considering the contributions from the nucleon pole, hyperon Λ(1115) term, and Λ(1405) state. However, the strong K^-p FSI is still required to be studied by further theoretical works because it is always connected with the controversial Λ(1405) state.

References

[1] B. S. Zou, Chin. Phys. C, 33(2009)1113,.

[2] Q. J. Ye, M. Hartmann, D. Chiladze, et al., Phys. Rev. C, 87(2013)065203.

1 - 16 Signature of an h_1 State in the $J/\psi \to \eta h_1 \to \eta K^{*0}\overline{K^{*0}}$ Decay

Xie Jujun

In 2010, the BES Collaboration[1] found a clear enhancement in the $K^{*0}\overline{K^{*0}}$ mass distribution in the $J/\psi \to \eta K^{*0}\overline{K^{*0}}$ decay. Such an enhancement is usually a signature of an L=0 resonance around threshold, which in this case would corresponds to an h_1 state with quantum numbers $I^G(J^{PC})$=$0^-(1^{+-})$. This h_1 state was predicted by the Chiral Unitary theory in the $K^*\overline{K^*}$ interaction. Because of the conversation law, this state can only decay to $K^{*0}\overline{K^{*0}}$ channel, and can be studied efficiently in the $J/\psi \to \eta K^{*0}\overline{K^{*0}}$ decay.