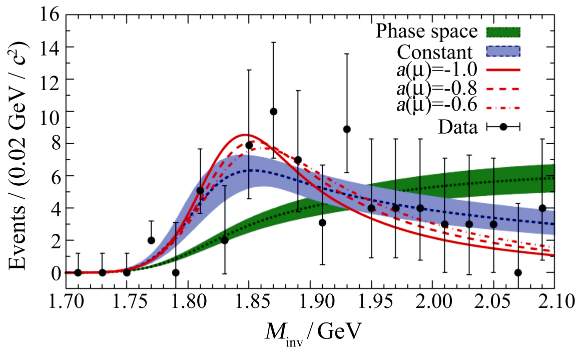

Fig. 1 (color online) The $K^{*0}\overline{K^{*0}}$ invariant mass spectrum of $J/\psi \to \eta K^{*0}\overline{K^{*0}}$ decay.

By including an h_1 state, which is dynamically generated from the interaction of $K^{*}\overline{K^{*}}$, we fit the experimental data from BES collaboration. Our results, shown in Fig. 1, can describe the experimental data fairly well. From Fig. 1, one can see that the bump structure observed by BES Collaboration in the $J/\psi \to \eta K^{*0}\overline{K^{*0}}$ naturally comes from the creation of this h_1 state with mass and width around 1 830 and 110 MeV, respectively. Our analysis shows clearly that the BES data, with an enhancement in the $K^{*0}\overline{K^{*0}}$ invariant mass spectrum close to the threshold, call for an h_1 resonance with the properties given by our fit. Yet, the data could be considerably improved, and in view of the results of our fit, it would be most advisable to do that in order to improve the present statistics, which may also revert into smaller systematic errors in the determination of the resonance properties. Hence, the more and precise experimental data on the $J/\psi \to \eta K^{*0}\overline{K^{*0}}$ decay can be used to determine the existence of this h_1 state through the $J/\psi \to \eta h_1 \to \eta K^{*0}\overline{K^{*0}}$ decay.

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1 - 17 $p\bar{p} \to \phi\phi$ Reaction in an Effective Lagrangian Approach

Xie Jujun

According to the naive constituent quark model, the ϕ meson is believed to be an almost pure $s\bar{s}$ state, while there are only up and down quarks (antiquarks) in the nucleon (antinucleon). Thus the $p\bar{p} \to \phi\phi$ reaction, with its disconnected quark lines, should be suppressed according to the Okubo-Zeig-Iizuka (OZI) rule. However, even the OZI rule is strictly enforced by nature, the $p\bar{p}$ reaction can still proceed through the non-strange quark component of the ϕ meson, because of the slight discrepancy from the ideal mixing of the vector meson singlet and octet[1]. With this small discrepancy, one can determine an upper limit for the total cross section of $p\bar{p} \to \phi\phi$ reaction by comparison to the total cross section of the related $p\bar{p} \to \omega\omega$ reaction. This yields a cross section for $p\bar{p} \to \phi\phi$ at the order of 10 nb. However, the experimental result showed that the cross section at 1.2 GeV incident anti-proton momentum, σ=2.86±0.46 μb, is two orders of magnitude larger than the estimated value. Hence, the $p\bar{p} \to \phi\phi$ reaction has attracted much attention because of the large violation of the OZI rule.

Unfortunately, all the previous models are able to predict the order of magnitude of the cross section, but not the detailed shape of the observed spectrum[2], where there is a bump around the invariant $p\bar{p}$ mass around W=2.2 GeV, which might hint at a sizable contribution from a scalar or tensor meson in the s-channel. Within an effective Lagrangian approach and the isobar model, the $p\bar{p} \to \phi\phi$ reaction is reanalyzed. In addition to the "background" contributions from the $N^*(1535)$ resonance, the s-channel contributions via either a scalar meson f_0 or a tensor meson f_2 are also considered. Unfortunately, the information about the f_0 or a tensor meson f_2 meson with mass around 2.2 GeV is scarce. Thus, the masses, total decay widths, and the coupling constants are taken as free parameters, which are fitted to the experimental data. The fitted results are shown in Fig. 1. We see that the $p\bar{p} \to \phi\phi$ reaction is dominated by the exchange of a strange tensor meson with quantum number $J^{PC} = 2^{++}$, which is in agreement with the experimental data[2]. In this respect, it is shown that how the experimental measurements for the $p\bar{p} \to \phi\phi$ reaction could lead to valuable information on tensor mesons with masses around 2.2 GeV.

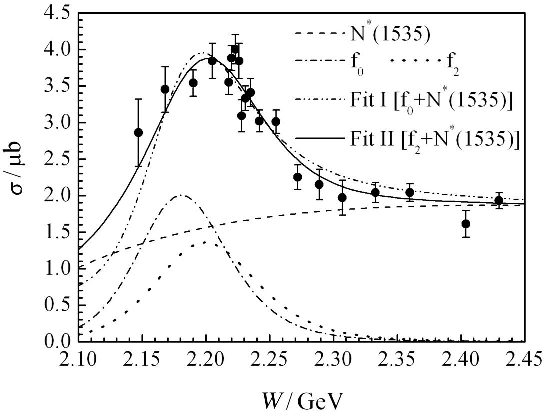

Fig. 1 (color online) Total cross sections for $p\bar{p} \to \phi\phi$ reaction.

Finally, we would like to stress that due to the important role played by the resonant contribution in the $p\bar{p} \to \phi\phi$ reaction, the bump structure around W=2.2 GeV in the total cross section can be well reproduced, and more accurate data on this reaction can be used to improve our knowledge on the strange mesons f_0 and f_2, which is at present poorly known. This work constitutes a first step in this direction.

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1 - 18 Role of the Possible $\Sigma^*(1/2^-)$ in the $\Lambda p \to \Lambda p \pi^0$ Reaction

Xie Jujun

The spectrum of the $\Sigma(1193)$ excited states, Σ^*, with isospin $I = 1$ and strangeness $S = -1$ is one of the most important issues in hadronic physics. The Σ^* resonances are mostly produced and studied in K-induced reactions. Many Σ^* resonances are now cataloged by the Particle Data Group[1]. However, our knowledge of these resonances is still very poor. In the energy region below 2 GeV, only a few of them are well established, such as the $\Sigma^*(1385)$ of spin-parity J^P=3/2$^+$, $\Sigma^*(1670)$ of J^p=3/2$^-$ and $\Sigma^*(1775)$ of J^p=5/2$^-$. The others are not well established and some of them are even of large uncertainties on their existence. Thus, the study of the Σ^* resonance with the available experimental data is necessary.

Based on the penta-quark picture, a newly possible Σ^*state, $\Sigma^*(1380)$ (J^P=1/2$^-$) was predicted around 1 380 MeV[2]. Obviously, it is helpful to check the correctness of pentaquark models by studying the possible $\Sigma^*(1380)$ state. Because the mass of this new Σ^* state is close to the well-established $\Sigma^*(1385)$ resonance, it may affects the production of $\Sigma^*(1385)$ resonance and then the analysis of the $\Sigma^*(1385)$ resonance suffers from the overlapping mass distributions and the common $\pi\Sigma$ decay mode.

The $\Sigma^*(1/2^-)$ in the $\Lambda p \to \Lambda p \pi^0$ reaction is a very good isospin 1 filter for studying the Σ^* resonances decaying to $\Lambda\pi$, and it may provide a useful tool for testing Σ^* baryon models. Thus, this reaction near threshold is studied within an effective Lagrangian method and the isobar model. The production process is described by singlepion and single-kaon exchange. In addition to the role played by the $\Sigma^*(1385)$ resonance of spin-parity J^P = 3/2$^+$, the effects of a newly proposed $\Sigma^*(J^P = 1/2^-)$ state with mass and width around 1 380 and 120 MeV are investigated. It is found that the model leads to a good description of the experimental data on the total cross section (see Fig. 1) of the $\Sigma^*(1/2^-)$ in the $\Lambda p \to \Lambda p \pi^0$ reaction by including the contributions from the possible $\Sigma^*(1/2^-)$ state. However, the theoretical calculations by considering only the $\Sigma^*(1385)$ resonance fail to reproduce the experimental data, especially for the enhancement close to the reaction threshold, which indicate that the $\Sigma^*(1/2^-)$ in the $\Lambda p \to \Lambda p \pi^0$ data support the existence of this $\Sigma^*(1380)$ state, and more accurate data for this reaction are useful to improve our knowledge on the $\Sigma^*(1380)$ properties. The present calculation provides some important clues for the mechanisms of the $\Sigma^*(1/2^-)$ in the $\Lambda p \to \Lambda p \pi^0$ reaction and makes a first effort to study the role of the $\Sigma^*(1380)$ state in a relevant reaction.

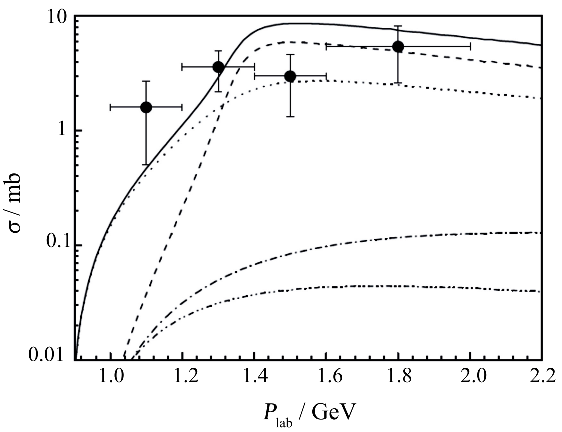

Fig. 1 Contributions of $\Sigma^*(1385)$ resonance (dashed line), $\Sigma^*(1380)$ state (dotted line), nucleon pole (dash-dotted line), and $\Sigma(1193)$ pole (dash-dot-dotted line) to the total cross sections vs the beam momentum $P_{\rm lab}$ for the $\Lambda p \to \Lambda p \pi^0$ reaction. Their total contribution is shown by solid line.

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