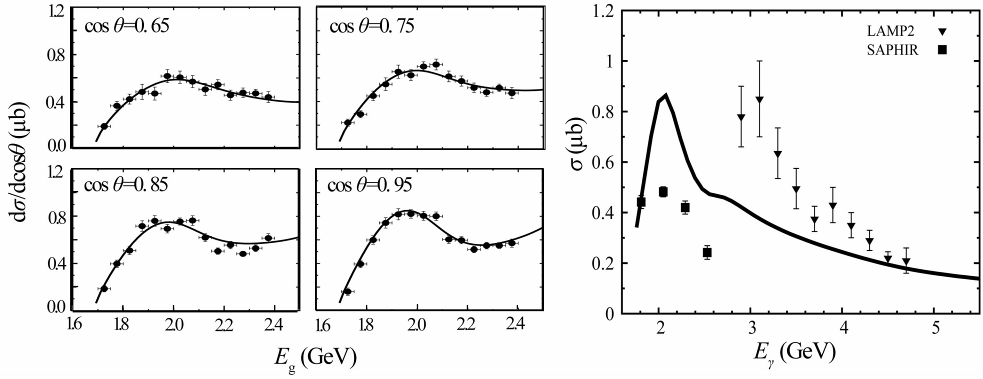

Fig. 1 The differential cross section for the Λ(1520)photoproduction(left). The total cross section for the Λ(1520)pgotoproduction(right).

With the contributions from Born terms and nucleon resonances, the experimental data about differential cross sections can be reproduced while there exists large discrepancy between experimental and theoretical results in polarized asymmetry, which suggests further improvement, such as including the coupled-channel effect, is required. The predictions about the differential cross section at energy 1.75 GeV$<E_\gamma<$ 5.50 GeV are presented in Fig. 1(right), which can be checked by the future experimental data in the CLAS eg3 and g11 runs.

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1 - 13 New Structure around 3250 MeV as D_0^* (2400)N Molecular Hadron

He Jun

Very recently the BaBar Collaboration reported a new enhancement structure in the $\Sigma_c^{++}\pi^-\pi^-$ invariant mass spectrum of the $B^-\to\Sigma_c^{++}p\pi^-\pi^-$ decay. Its mass and width are $M=(3245\pm20)$ MeV and $\Gamma=(108\pm6)$ MeV, respectively[1]. We will refer to the new structure by the name $X_c(3250)^0$. In terms of its observed decay channel, we conclude that $X_c(3250)^0$ is an isotriplet with charm number $C=+1$. How to understand this newly observed structure observed in the baryonic B decay becomes an intriguing research topic. In this work, we propose a novel approach to explain the BaBar's observation of $X_c(3250)^0$, where $X_c(3250)^0$ can be naturally explained as a molecular hadron composed of a charmed meson D_0^* (2400) and a nucleon N.

Using the covariant spectator theory, which was proposed and developed to study the wave functions and the form factor of deuteron[2], we calculated the boundary energy and decay width of $X_c(3250)^0$. In Table 1, we give the decay width of $X_c(3250)^0\to nD\pi$ corresponding to several Λ typical values, which does not strongly dependent on Λ. Since the total width of $X_c(3250)^0$ is from its dominant decay $X_c(3250)^0\to nD\pi$, we compare the calculated decay width with the BaBar's data, which shows the total width of $X_c(3250)^0$ under the assignment of the molecular state is comparable with the BaBar's measurement. The study of dominant decay channels of $X_c(3250)^0$ also supports the $nD_0^*(2400)^0$ molecular state explanation to the observed $X_c(3250)^0$.

As an important test of the molecular state assignment to $X_c(3250)^0$, in this work we also predict the existence of the isoscalar partner of $X_c(3250)^0$, which is named as $Y_c(3250)^+$. The result shown in Table 1 indicates that the width of $Y_c(3250)^+$ is also around 100 MeV. The dominant decays of $Y_c(3250)^+$ are

$nD^0\pi^+$ and $pD^0\pi^0$. We expect the contributions from BaBar, Belle, LHCb, and forthcoming BelleII, SuperB, which are ideal places to further investigate the observed $X_c(3250)^0$ and the predicted $Y_c(3250)^+$ by the B decay.

Table 1 The boundary energies and decay widths of $X_c(3250)^0$ and $Y_c(3250)^+$. The cut-off Λ, boundary energy E and decay width Γ are in units of GeV, MeV and MeV, respectively

$X_c(3250)^0$ with $I=1$			$Y_c(3250)^+$ with $I=0$		
Λ	E	Γ	Λ	E	Γ
1.17	−3	121±18	3.30	−3	118±17
1.20	−7	111±17	3.60	−6	108±16
1.23	−13	105±16	4.20	−14	96±14
1.26	−22	100±15	4.80	−23	86±13
1.30	−35	92±14	5.70	−35	76±11
BaBar	−13	108±60	——	——	——

References

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1 - 14 Open-charm Radiative and Pionic Decays of Molecular Charmonium Y(4274)

He Jun

Recently the CDF Collaboration reported an explicit enhancement structure, Y(4274), with 3.1σ significance in the $J/\psi\varphi$ invariant mass spectrum[1]. Its mass and width are $M=[4274.4^{+8.4}_{-6.7}(\text{stat})\pm1.9(\text{syst})]$ MeV and $\Gamma=[32.3^{+21.9}_{-15.3}(\text{stat})\pm7.6(\text{syst})]$ MeV, respectively. The evidence of Y(4274) revealed by CDF not only has made the spectroscopy of charmonium-like states observed in B meson decays abundant, but also stimulated theorist's interest in revealing its underlying structure. Studying Y(4274) will improve our understanding to the essential mechanism resulting in these structures.

Since Y(4274) was observed in the $J/\psi\varphi$ invariant mass spectrum, we can conclude that the quantum number of Y(4274) are $I^G(J^{PC})=0^+(J^{++})$ with $J=0,1,2$ if Y(4274)→$J/\psi\varphi$ occurs via S-wave. If explaining Y(4274) as a candidate of charmonium, Y(4274) should be a P-wave state with the second radial excitation. In Ref. [2], the predicted total widthes of the second radial excitations of χ_{c0} and χ_{c1} are larger than the width of Y(4274). In addition, X(4350), which was observed in the $\gamma\gamma\to J/\psi\varphi$ process with mass $M=4350.6^{-5.1}_{+4.6}(\text{stat})\pm0.7(\text{syst})$ MeV and width $\Gamma=13^{+13}_{-9}(\text{stat})\pm4(\text{syst})$ MeV, was explained as the candidate of the second radial excitation of χ_{c2}, where the measured parameters of Y(4274) are different from those of X(4350). Thus, to some extent we can exclude P-wave charmonium explanation to Y(4274), which stimulates the discussion of Y(4274) as exotic state just presented in this work. The mass of Y(4274) is near the threshold of $D_sD_{s0}(2317)$, which is similar to the situations of Y(4140) and Y(3930) since Y(4140) and Y(3930) are assigned as molecular states of $D_s^*D_s^*$ and D^*D^*, respectively. Thus, it is natural to deduce that Y(4274) can be as an S-wave $D_sD_{s0}(2317)$ molecular charmonium.

Carrying out the dynamical calculation of the mass spectrum of Y(4274) is seen as an important approach to test whether Y(4274) is a molecular state. Furthermore, performing the study of the decay behavior of Y(4274) can provide crucial information to test this molecular assignment to Y(4274). Just considering the above reasons and the present theoretical research status of Y(4274), we investigate the open-charm radiative and pionic decays of Y(4274) as shown in Table 1, which includes the calculation of the branching ratios and the study of line shape of these decays using the covariant spectator theory[3].