[2] J. Schaffner-Bielich, J. Bondorf, I. Mishustin, Nucl. Phys. A, 625(1997)325; G. Mao, P. Papazoglou, S. Hofmann, et al., Phys. Rev. C, 59(1999)3381.

[3] M. Kiš, et al., NIM A, 646(2010)27.

* Foundation item: National Natural Science Foundation of China (11405227).

1 - 22 Production of the Neutral $Z^0(4430)$

Wang Xiaoyun, Xie Jujun and Chen Xurong

As an exotic charmonium-like state, the Z(4430) has attracted a lot of attention after it was found in the $\psi'\pi^-$ invariant mass distribution in $B \to \psi'\pi^-K$ decays by the Belle Collaboration[1]. In 2013, the existence of this charged $Z^\pm(4430)$ state was confirmed from a full amplitude analysis of the subsequently updated results on the $B \to \psi'\pi^-K$ decays by Belle Collaboration[2]. Very recently, the LHCb Collaboration reported the first independent confirmation of the existence of the charged $Z^-(4430)$ with 4D model-dependent amplitude method[3]. In addition, its spin parity (J^P) was measured to be $J^P = 1^+$. The most possible explanation would be considering the Z(4430) as a tetraquark state. If the charged $Z^\pm(4430)$ is indeed a tetraquark state, then the lightest charged four-quark state should be constructed by ($c\bar{c}u\bar{d}$ or $c\bar{c}d\bar{u}$) quarks.

However, the production mechanism of the neutral $Z^0(4430)$ state has still not been well understood both theoretically and experimentally. Similar to the observation of the neutral partners of $Z_c(3900)$ and $Z_c(4020)$, the neutral $Z_c^0(3900)$ and $Z_c^0(4020)$ has been reported by CLEO-c and BESIII, respectively. Hence, searching for the neutral partner of Z(4430) state in an independent production process will not only provide important information about Z(4430) but also it is a significant way to investigate and confirm its inner structure.

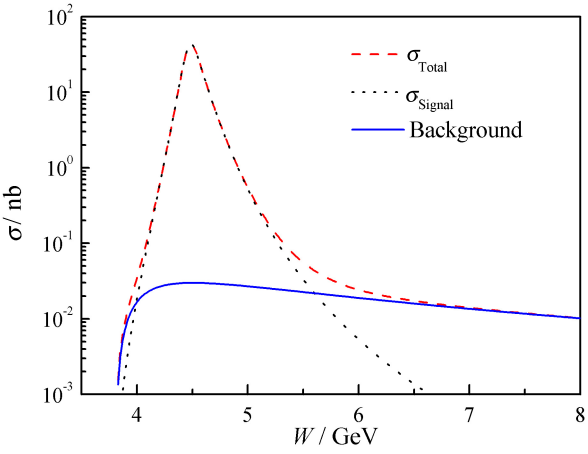

Fig. 1 (color online) The energy dependence of the total cross sections for the process of $\bar{p}p \to \psi'\pi^0$. Here, the σ_{Signal} and σ_{Total} are the results obtained from only s-channel $Z^0(4430)$ and the full model, respectively.

By assuming the Z(4430) as a tetraquark state, we study the production of the neutral $Z^0(4430)$ by antiproton-proton annihilation through s-channel using the approach of effective Lagrangian in terms of hadrons[4]. Meanwhile, as shown in Fig. 1, the background from the $\bar{p}p \to \psi'\pi^0$ process through t-channel and u-channel by exchanging a proton are also considered. From Fig. 1, it is found that there is an obvious peak for the production of signal near the Z(4430) threshold. The feasibility of searching the neutral $Z^0(4430)$ at PANDA detector are discussed, which will be important in promoting a better understanding of the exotic tetraquark candidate, both in theory and through experimentation.

References

[1] S. K. Choi, et al. Phys. Rev. Lett, 100(2008)142001.

[2] K. Chilikin, R. Mizuk, I. Adachi, et al., (Belle Collaboration), Phys. Rev. D, 88(2013)074026.

[3] R. Aaij, C. Abellan Beteta, B. Adeva, et al., Phys. Rev. Lett, 112(2014)222002.

[4] X. Y. Wang, J. J. Xie, X. R. Chen, Phys. Rev. D, 91(2015)014032.