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Antinucleon-nucleon interaction and the related hadron physics

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The recent development of the antinucleon-nucleon ($\bar{N}N$) interaction in chiral effective field theory [1] will be reported and the phenomenological meson-exchange models (taking Julich model as an example) will be mentioned as well. With such potentials and the distorted-wave Born approximation, we examine the influence of the antiproton-proton ($\bar{p}p$) interaction on the mass spectrum in various reactions containing the antip p pair, e.g., $J/\psi \rightarrow \gamma \bar{p}p$, $\omega \bar{p}p$, $\pi^0 \bar{p}p$ and $e+e \leftrightarrow \bar{p}p$. It turns out that the low-energy mass spectra up to excess energy of 100 MeV for all the mentioned processes can be described by our treatment of the final or initial state ($\bar{p}p$) interactions. In $J/\psi \rightarrow \gamma \bar{p}p$ the quite prominent peak near $\bar{p}p$ threshold is observed in BES experiment, and to describe it, a bound state in isospin-1 $1S_0$ is needed in our calculation [2]. The electromagnetic form factors of the proton in the time-like region are also predicted [3]. The role of $\bar{N}N$ intermediate states played in the reactions $e+e \rightarrow$ multi-pions will be also discussed, which concerns for the dip structure observed around $\bar{N}N$ threshold in the experiments.

References

1. X.-W. Kang, J. Haidenbauer and U. G. Meißner, JHEP 1402, 113 (2014).
2. X.-W. Kang, J. Haidenbauer and U. G. Meißner, arXiv:1502.00880 [nucl-th].
3. J. Haidenbauer, X.-W. Kang and U.-G. Meißner, Nucl. Phys. A 929, 102 (2014).

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