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The ⬚ p bound state in the unitary coupled-channel approximation

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The strong attractive interaction of the ϕ meson and the proton is reported by ALICE collaboration recently. The corresponding scattering length is given as Re(f0)=0.85±0.34(stat)±0.14(syst)fm and Im(f0)=0.16±0.10(stat)±0.09(syst)fm. The fact that the real part is significant in contrast to the imaginary part indicates a dominate role of the elastic scattering, whereas the inelastic process is less important. In this work, such scattering processes are inspected based on a unitary coupled-channel approach inspired by Bethe-Salpeter equation. The ϕp scattering length is calculated based on this approach, and it is found that the experimental value of the ϕp scattering length can be obtained only if the attractive interaction of the ϕ meson and the proton is taken into account. A significant outcome of such attractive interaction is a two-pole structure in the ϕp scattering amplitude. One of the pole, locating at (1969−i283)˜MeV might correspond to N(1895)1/2− or N(1875)3/2− listed in the review of the Particle Data Group(PDG). The other one, locating at 1949−i3˜MeV should be a ϕN bound state, which has no counterpart in the PDG data.

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