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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 ϕ p scattering length is calculated based on this approach, and it is found that the experimental value of the ϕ p 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 ϕ p scattering amplitude. One of the pole, locating at (1969–i283)^TMeV 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^TMeV should be a ϕ N bound state, which has no counterpart in the PDG data.

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