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Internal structure of X(3872) by compositeness with coupled channel potential

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We study the properties of the hadron-hadron potentials and quark-antiquark potentials from the viewpoint of the channel coupling[1]. We introduce the effective hadron-hadron potential with coupled to the quark channel.
As an application, we construct a coupled-channel model of $c\bar{c}$ and $D\bar{D}$ to describe exotic hadron $X(3872)$[2].

To investigate the internal structure of the $X(3872)$, we introduce the direct 4-point interaction of the hadron channel, in addition to the contribution of the coupling to the quark channel. We study the dominant compornent of the $X(3872)$ by annalyzing wavefunctions, compositeness, scattering length, effective range, and phase shift. We study the changes of these quantities by varying model parameters such as quark channel enrgy, cut-off, and potential strength of hadron channel in addition to a physical obsearvable binding energy.

[1] I. Terashima and T. Hyodo, Phys. Rev. C 108, 035204 (2023).
[2] M. Takizawa and S. Takeuchi, PTEP 2013, 093D01 (2013).

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