$\rho\rho N$ and $\rho\rho\Delta$ systems in the fixed center approximation of Faddeev equations

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The $\rho\rho N$ and $\rho\rho\Delta$ three-body systems have been studied within the framework of the fixed center approximation of Faddeev equation. The $\rho\rho$ interaction in isospin $I = 0$, spin $S = 2$ is strongly attractive, and so are the $N\rho$, $\Delta\rho$ interactions. This leads to bound states of both $\rho\rho N$ and $\rho\rho\Delta$. We find peaks of the modulus squared of the scattering matrix around 2227 MeV for $\rho\rho N$, and 2372 MeV for $\rho\rho\Delta$.

In Fig. 1, we show the results of $|T|^2$ for the $N\rho\rho$ system with $\Lambda = 875$ MeV, which is suited to obtain the $f_2(1270)$ resonance. We observe a peak around 2227 MeV with a width of 100 MeV. The peak does not have a standard Breit-Wigner form. The sharp peak could be indicative of a cusp effect but the threshold for $Nf_2(1270)$ is at 2210 MeV, about 17 MeV below the peak in Fig. 1. In fact, a small cusp peak at threshold is also visible in the figure

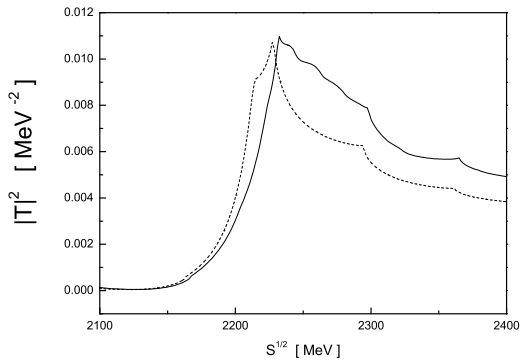

Figure 1: Modulus squared of the unitarized $N - \rho - \rho$ amplitude with $\Lambda = 875$ MeV. The solid line denotes the case with the $f_2(1270)$ decay width, and the dashed line is for the case without the $f_2(1270)$ decay width.

at this energy. On the other hand, when the convolution for the mass distribution of the

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$f_2(1270)$ due to its width is considered, the peak of the cusp disappears, but a peak in $|T|^2$, slightly shifted to higher energies, still remains with a similar or slightly larger width.

In Fig. 2, we show the results of $|T|^2$ for the $\Delta\rho\rho$ system with $\Lambda = 875$ MeV. We observe a peak around 2372 MeV. Two features can be observed from Fig. 2. The peak has now an approximate Breit-Wigner shape and the strength of $|T|^2$ at the peak is about 200 times bigger than in Fig. 1 for the $N\rho\rho$ state, although the peak is now narrower than in Fig. 1. Yet, the integrated strength of the peak is still about 40 times bigger. The large value of T in the $\Delta\rho\rho$ case indicates that in a production of the resonance in one reaction, the magnitude of the resonance excitation would be large through the consideration of the intermediate $\Delta\rho\rho$ state and its coupling to the resonance. The consideration of the width of the $f_2(1270)$ reduces the strength of the peak and increases the width of the resonance. The width is still relatively small, about 25 MeV. In our approach, once the convolution for the width of the $f_2(1270)$ is done, the main decay channel would be $\Delta\pi\pi$. This is interesting to know from the experimental point of view.

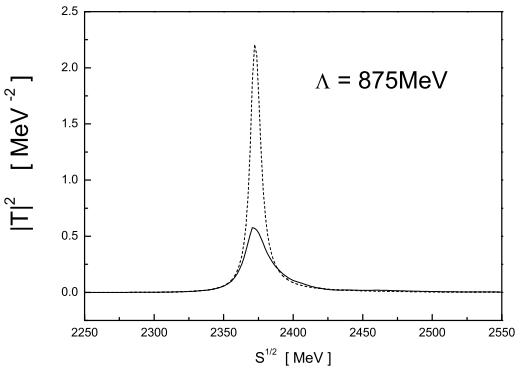

Figure 2: Modulus squared of the unitarized $\Delta - \rho - \rho$ amplitude with $\Lambda = 875$ MeV. The solid line denotes the case with the $f_2(1270)$ decay width, and the dashed line is for the case without the $f_2(1270)$ decay width.

References

[1] B. X. Sun,H. X. Chen and E. Oset, to be published in Eur. Phys. J. **A**, arXiv:1107.0209 [nucl-th] and references therein.