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Corrigendum

Corrigendum to "Onset of η-nuclear binding in a pionless EFT approach" [Phys. Lett. B 771 (2017) 297–302]

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ABSTRACT

A three-body force acting between the η-meson and two nucleons was overlooked inadvertently in the model description and discussion in the published version of our paper "Onset of η-nuclear binding in a pionless EFT approach" [Phys. Lett. B 771 (2017) 297–302] while present in the actual numerical calculations. The stated conclusion that a stabilizing ηNN contact term was not needed is therefore incorrect. Such a three-body force, associated with a new low energy constant $d^{\Lambda}_{\eta NN}$, must be introduced at leading order to stabilize η-nucleus systems.

A three-body ηNN force was inadvertently overlooked in the potential model description and discussion in Ref. [1]. In the actual calculations, however, the leading order interaction between the η and the nucleons was composed of the ηN term discussed in Sect. 2.3, supplemented by an ηNN term

$$V_{\eta N_i N_j} = d^{\Lambda}_{\eta NN}\delta_\Lambda(r_{\eta N_i}, r_{\eta N_j}). \tag{1}$$

Here, $\delta_\Lambda(r_{\eta N_i}, r_{\eta N_j})$ is a product of normalized pairwise Gaussians $\delta_\Lambda(r_{\eta N_i})$ and $\delta_\Lambda(r_{\eta N_j})$, with range parameter inversely proportional to the momentum-scale parameter Λ, as defined by Eq. (4) of Ref. [1]. For the results presented in the paper, the low energy constant (LEC) $d^{\Lambda}_{\eta NN}$ was set equal to the nuclear NNN LEC d^{Λ}_3. Setting $d^{\Lambda}_{\eta NN} = 0$, the η-deuteron (ηd) system, and therefore any η-nucleus system, would collapse as $\Lambda \to \infty$.

The parameter $d^{\Lambda}_{\eta NN}$ is a free parameter to be fixed by experimental data. In the absence of such data one may estimate its value using the nuclear NNN LEC, $d^{\Lambda}_{\eta NN} = d^{\Lambda}_3$, as done in [1], or to set a bound on its value accepting that ηd is unbound [2], i.e. set $d^{\Lambda}_{\eta NN}$ so that $B_\eta(\eta d) = 0$. To check the sensitivity of the results in [1] to these distinct choices of $d^{\Lambda}_{\eta NN}$, we present in Figs. 1 and 2 calculations of η separation energies B_η in η^3He and η^4He, respectively, using ηN potentials $v^{\mathrm{GW}}_{\eta N}(E)$ under these two choices of $d^{\Lambda}_{\eta NN}$. Figs. 1 and 2 update the original Figs. 4 and 5 in [1].

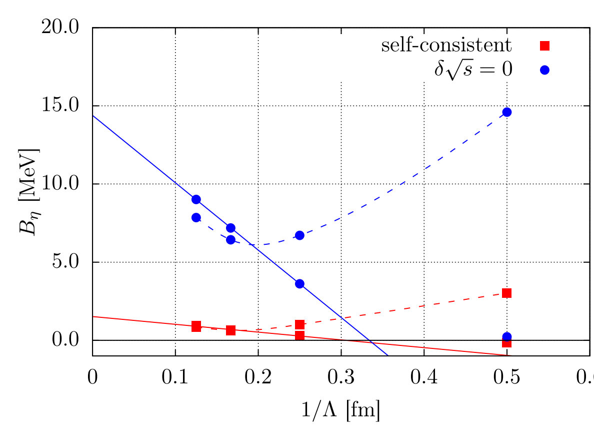

Fig. 1. $B_\eta(\eta^3\mathrm{He})$ as a function of $1/\Lambda$, calculated using ηN potentials $v^{\mathrm{GW}}_{\eta N}(E)$ for two choices of the ηNN LEC. Solid lines: $d^{\Lambda}_{\eta NN} = d^{\Lambda}_3$ [1], dashed lines: $d^{\Lambda}_{\eta NN}$ fitted to produce $B_\eta(\eta d) = 0$. Self consistent calculations are marked by squares (red); calculations using threshold values $v^{\mathrm{GW}}_{\eta N}(E_{\mathrm{th}})$ are marked by spheres (blue). Linear extrapolations to a point-like interaction, $\Lambda \to \infty$, are marked by straight lines.

Figs. 1 and 2 demonstrate that the two choices made for the three-body ηNN LEC yield practically identical values of B_η in the limit $\Lambda \to \infty$. For values of Λ near the physical breakdown scale $\Lambda \approx 4$ fm^{-1}, however, B_η differs by about 0.7 MeV for η^3He and 2 MeV for η^4He between the two choices applied in self consistent

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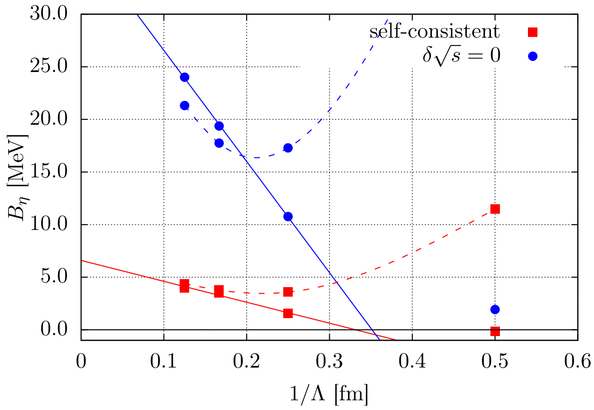

Fig. 2. Same as in Fig. 1, but for η^4He instead of η^3He.

calculations (lower group of curves). Since ηd is unbound [2], the choice marked in dashed lines in both figures is likely to somewhat overestimate B_η. Nevertheless, these η separation energies are in good agreement with the non-EFT B_η values calculated recently using the same two-body energy dependent ηN interaction [3].

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