Reply to "Charge-symmetry-breaking considerations for the hypertriton"*

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It is pointed out that the conclusions of the preceding comment are in error.

[NUCLEAR STRUCTURE ${}^{3}_{\Lambda}$H, Y-N potentials, separable-potential three-body calculations, B_{Λ}.]

We regret that a programming error in our original work[1] (GL) has led the authors of the preceding comment[2] (CG) to several incorrect conclusions. If the results given in our erratum[1] are compared with those in the last of CG's table, it is clear that the differences are small. The discrepancies can be attributed to minor programming peculiarities, different numerical accuracies, and the use of slightly different two-nucleon s-wave triplet effective-range parameters. With the binding energy of the deuteron taken as 2.225 MeV, CG[3] use $a = 5.37$ fm and $r_0 = 1.716$ fm while GL use $a = 5.423$ fm and $r_0 = 1.761$ fm. Actually, if we use the CG triplet N-N parameters, slightly larger values for B_{Λ} are obtained. Specifically, we reproduce the Hetherington and Schick (HS) result of 0.05 MeV[4] (our value is 0.048 MeV) with their Λ-N parameters and the Yamaguchi triplet parameters.[5] As mentioned in our erratum, and we emphasize it again, correction of the error does not alter our original conclusions about the hyperon-nucleon potentials tested.[1]

The most important point which seems to have been overlooked by CG is that when $V^i_{\Lambda p} = V^i_{\Lambda n}$ (i is the singlet or triplet), the five equations of GL must reduce to those of HS or Choudhury and Gautam.[3] It is easy to show that this does occur and the resulting coefficients are in agreement with those of HS[4] (CG[3] do not give the coefficient matrix, but refer the reader to HS). Therefore, the B_{Λ} obtained from our five equations or the three equations of CG must, in principle, be the same when $V^i_{\Lambda p} = V^i_{\Lambda n}$. Equivalently, in CG, Approx. $A \equiv$ Approx. B; also, in the first line of CG's table, Approx. $C \equiv$ Exact.

It is correct, of course, that charge-symmetry-breaking effects do not contribute in the hypertriton. Nevertheless, if appropriate charge-symmetric potentials are constructed from the potentials fitted to the scattering parameters of Nagels, Rijken, and deSwart[6] by averaging the Λ-p and Λ-n potentials for singlet and triplet, respectively, *rank-2* potentials result in each case since $V^i_{\Lambda p} \neq V^i_{\Lambda n}$. Rank-2 Λ-N potentials lead to *five* coupled equations for the hypertriton. Naturally, it is possible to approximate a rank-2 potential by a rank-1 potential with the same scattering length and effective range, but the phase shifts will differ. We considered such a procedure to be inappropriate for our purpose of comparing models A and B The point is that the charge-symmetry-breaking effect is absent even when five equations are solved as in our work.[1]

Finally, the statement in GL about charge-symmetry breaking not being properly considered in previous calculations was based upon the fact that, since the four-body hypernucleon binding energies evidently do not follow directly from the Λ-p and Λ-n interactions including charge-symmetry breaking, proceeding in the other direction to obtain a correction to the charge-symmetric part of the Λ-N interaction is not proper.[7]

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