



Correction to: Diquark size effects in the quark–diquark approximation for baryons

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We recently noticed an error in the final step of the computational code that allowed us to obtain masses and characteristic distances of the quark–diquark states. This error was discovered by making improvements to the calculation code, improvements that were suggested in the last paragraphs of our conclusion. After correction, we found that it had an impact on some numbers obtained in Tables 4 to 13. For example, in Table 4, a relative error can be increased from 3.1 to 3.4%, or from 0.8 to 1.1%. In the worst case, in the same Table, an error can go from 23.9 to 42.7%, or from 4.3 to 12%. In other Tables, the relative error can slightly increase or decrease. After carefully rereading the paper, since our work consisted mainly of comparing different methods that were affected in the same way by the error, we find that the conclusions fortunately remain unchanged, except for one peculiar point. It consists in using the quark–diquark approximation independently of the 3-body calculations by choosing the configuration providing the lowest mass. The corrected result seems more physical than the one obtained previously. As the precise values of the relative errors are not important, we just need to modify two paragraphs linked to this sole point.

In Sect. 5.3, it is necessary to replace:

“Before concluding, let us briefly compare the two identification methodologies mentioned at the beginning of the present section. For all the $L = 0$ states, both methodologies are aligned: the configurations $(n_D, l_D, n_{Dq}, l_{Dq}, S_D, I_D)$ chosen in Tables 6, 7, 8 and 9 and selected using the procedure

based on the internal structure are those that yield the ground state in the quark–diquark picture. The situation is different for $L = 8$ states presented in the same Tables for which, the lowest state in the quark–diquark approximation is always given by the quantum numbers $l_D = 8$ and $l_{Dq} = 0$. For the bbb baryon, the minimal value implies a relative error on the mass of 1.1%, slightly less accurate than the state with $l_D = 0$ and $l_{Dq} = 8$ in Table 6 with a relative error of 0.06%. For the nnn baryon, it implies a relative error on the mass of 5.4%, slightly less accurate than the state with $l_D = 6$ and $l_{Dq} = 2$ in Table 7, which has a relative error of 4.3%. The Pauli principle imposes strong constraints on the internal structure of these states with three identical quarks. The situation is different for baryons containing two different flavours, for which no global symmetry exists. The bbn state in Table 8 is already the lowest state, thanks to the minimisation of the centrifugal energy. The situation for nbn in Table 9 is especially interesting. With $l_D = 0$ and $l_{Dq} = 8$, which corresponds to the structure found for the three-body model (see Fig. 6), the relative error on the mass is 3.4%. But the relative error on the mass for the lowest state (with $l_D = 8$ and $l_{Dq} = 0$) is smaller with 1.4%. Overall, both methodologies result in comparable accuracies for the baryon masses. Therefore, the quark–diquark approximation can be used to estimate masses without requiring the knowledge of the full three-body solution by resorting to energy ordering. However, the current study preferred an identification based on the internal structure to make the comparison of observables as relevant as possible.”

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“Before concluding, let us briefly compare the two identification methodologies mentioned at the beginning of the present section. Both methodologies are aligned for all the states: the dominant configurations $(n_D, l_D, n_{Dq}, l_{Dq}, S_D, I_D)$ chosen in Tables 6, 7, 8 and 9 and selected using the procedure based on the internal structure are those that yield the ground state

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in the quark–diquark picture. This agreement is less obvious for the $L = 8$ states of bbb and nnn because their wave functions contain many non-negligible configurations. However, the first dominant configuration of these states always corresponds to the lowest quark–diquark mass. Overall, both methodologies result in comparable accuracies for the baryon masses. Therefore, the quark–diquark approximation can be used to estimate masses without requiring the knowledge of the full three-body solution by resorting to energy ordering. However, the current study preferred an identification based on the internal structure to make the comparison of observables as relevant as possible.”

In the conclusion, it is necessary to replace:
“For ground states, the choice of the quark–diquark configuration to compute the mass of a given baryon can be guided by a minimal energy condition. The situation is trickier for excited states for which the three-body wave function can expand on a lot of quark–diquark configurations with sig-

nificant probabilities. Sometimes, the baryon mass given by a quark–diquark configuration giving the minimal value is not the closest one to the mass obtained with the three-body model. This problem could limit the use of the quark–diquark approach for excited states, although the mass accuracy is not significantly deteriorated.”

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“The choice of the quark–diquark configuration to compute the mass of a given baryon can be guided by a minimal energy condition. This also holds for excited states whose three-body wave functions involve many quark–diquark configurations with significant probabilities, where at least one of the dominant configurations corresponds to the lowest quark–diquark mass. In general, the minimal energy condition does not substantially deteriorate the mass accuracy compared to our method.”

We can provide all the corrected tables on demand.