Erratum and Addendum: Empirical pairing gaps and neutron-proton correlations (Chin. Phys. C, 43(1): 014104 (2019))

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In our article we wrote the three-point mass relation based on deutron separation energies in the form

$$\begin{aligned}\Delta^{(3)}_{np}(N,Z) &= \frac{(-1)^{N+1}}{2}\left(S_d(N+1,Z+1)-S_d(N,Z)\right)\\ &= \frac{(-1)^{N+1}}{2}\left(B(N+1,Z+1)-\right.\\ &\quad \left.-2B(N,Z)+B(N-1,Z-1)\right),\end{aligned} \tag{1}$$

which holds true for the case of even-A nuclei. Factor $(-1)^{N+1}$ is taken into account to reproduce the even-odd staggering (EOS) effect for even-even and odd-odd nuclei. For the case of odd-A nuclei, on the other hand, the value of $\Delta^{(3)}_{np}(N,Z)$ was shown to oscillate near the zero value (which corresponds to EOS for odd-even and even-odd nuclei), and taking the corresponding factor into account makes no sense. The corresponding formula (39) for the case when the factor is ommited from odd-A nuclei, should properly read

$$\Delta^{(3)}_{np}(N,Z) = \\ = \frac{1}{2}\begin{cases}(\pi_n-d_n)+(\pi_p-d_p)-2(I'+I^0), & ee\\ (\pi_n+d_n)+(-\pi_p+d_p)+2I^0, & oe\\ (-\pi_n+d_n)+(\pi_p+d_p)+2I^0, & eo\\ (\pi_n+d_n)+(\pi_p+d_p)-2(I'-I^0), & oo\end{cases} \tag{2}$$

As a result, for the case of odd-A nuclei factor $(-1)^{N+1}$ leads to the change of general sign for even-N nuclei:

$$\begin{aligned}\Delta^{(3)}_{np}(N,Z) &= \frac{(-1)^{N+1}}{2}\left(S_d(N+1,Z+1)-S_d(N,Z)\right)\\ &= -\frac{1}{2}\left((-\pi_n+d_n)+(\pi_p+d_p)+2I^0\right),\end{aligned} \tag{3}$$

The inclusion of factor $(-1)^{N+1}$ for odd-A nuclei significantly affects the $\Delta^{(4)}_{np}$, resulting from the averaging of $\Delta^{(3)}_{np}(N,Z)$. Instead of expression (40) we get:

$$\Delta^{(4)}_{np}(N,Z) = \frac{1}{2}\begin{cases}\left(\pi_n+\pi_p\right)-2I', & ee,oo\\ \pi_n-\pi_p, & oe,eo\end{cases} \tag{4}$$

Since, as noted above, we are talking about values close to zero, the noted changes do not affect the main conclusions of the article. However, the ratio in Eq. (42)

$$\pi_p \approx \pi_n$$

is approximate and, as can be seen from Table 2, the values of π_p consistently exceed the values of π_n. From this point of view, the choice of the factor $(-1)^{Z+1}$ used in the expression coinciding with $\Delta^{(4)}_{np}$ in [1] is more reasonable.

One more remark concerns the formulas for Δ^{MN}_{np} first introduced in [2]. In formula (19), the proper factor should be $(-1)^{A+1}$. In (20), the two cases correspond to even and odd values of Z rather than N, while in (21), vice versa, these are the cases of even and odd N rather than Z.

References

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