Erratum: Impact of Tensor Force on β Decay of Magic and Semimagic Nuclei [Phys. Rev. Lett. 110, 122501 (2013)]

F. Minato and C. L. Bai

(Received 22 January 2016; published 23 February 2016)

DOI: 10.1103/PhysRevLett.116.089902

In the Letter, errors were found in the calculation of the Fermi function and the residual interaction of the spin-orbit part in the RPA. The former estimates the final state interaction between the outgoing electron and the daughter nucleus resulting from β decay, and the latter contributes to the A and B submatrices in the RPA. The errors have been corrected with the following consequences.

The corrections affect all the figures shown in the Letter. With the corrections, Q , $\log ft$, and the half-lives are modified. The corrected results for Q and $\log ft$ are shown in Figs. 1 and 2, and 3. Compared with the results shown in the Letter, the modifications are rather small.

However, the modifications of the half-lives are quite obvious as shown in Fig. 4, and are mainly due to the mistake in calculating the gamma function inside the Fermi function. Because of this mistake, it turned out that all the half-lives were overestimated, and those shown in Fig. 4 become shorter for all the nuclei. For this reason, the results without the tensor force (the dashed line) become closer to the experimental data than before. Even Skx without the tensor force reproduces the experimental data well, but, like the other Skyrme force used widely [1,2], SkO without the tensor force gives longer half-lives than the experimental data. The same situation also exists in the relativistic mean field plus quasiparticle random phase approximation (QRPA) calculations [3]. By including the tensor force (the solid line), the half-lives are reduced for both SkO and Skx. In the case of Skx, all the half-lives are underestimated by the inclusion of the tensor force, while they are improved for SkO, except for ^{34}Si .

It is known that there is a “quenching” of the Gamow-Teller strength, evoked by core polarization, higher order configuration mixing [4,5], and an effect mediated by mesons [6]. To account for it effectively, the ratio of the vector and axial-vector constants g_A/g_V is frequently set to unity, not to its single nucleon value of ~ -1.26 as we have done in the Letter and in Fig. 4 in this Erratum. In this sense, Fig. 4 represents the lower limit of the theoretical value. We also illustrate the result for $g_A/g_V = -1.00$ in Fig. 5, where the half-lives increase by a factor of $(1.26)^2$. As a result, the improvements produced by the tensor force are obvious both for SkO and Skx.

FIG. 1. Revised version of Fig. 1 of the Letter.

FIG. 2. Revised version of Fig. 2 of the Letter.

FIG. 3. Revised version of Fig. 3 of the Letter.

Though there are uncertainties about whether the tensor force is able to improve the half-lives systematically, the qualitative effect given in the Letter is unchanged, that is, the increases of the Q value (lowering of the excitation energy of the low-lying 1^+ state) and the reductions of the half-lives. To show them, we list in Table I the ratios of the half-lives calculated with the tensor force to those without the tensor force for the Skyrme interactions chosen in Fig. 1 of the Letter. Without exception, the effect of the tensor forces reduces the calculated half-lives. The same result is also obtained in deformed open-shell nuclei [7].

The tensor force is inherent in the nuclear force and is regarded as important for the description of the shell evolution of the nuclei, so that the half-lives calculated without it are not necessarily reliable when we predict them for nuclei far from the stability line. The present result indicates that further study, including of the tensor force, is needed for reliable predictions of the β -decay half-lives for the unmeasured nuclei, as mentioned in the summary of the Letter.

FIG. 4. Revised version of Fig. 4 of the Letter.

FIG. 5. Same as Fig. 4, but with g_A/g_V set to 1.00.

TABLE I. Ratios of the half-lives calculated with the tensor force to those without the tensor force. The numbers in parentheses represent exponents to the power of 10.

	SkO	Skx	SIII	SLy5	T43
^{132}Sn	7.00(-2)	7.62(-1)	0(0)	9.1(-11)	3.77(-2)
^{68}Ni	1.82(-1)	3.37(-1)	1.15(-3)	6.64(-4)	1.26(-1)
^{34}Si	2.02(-1)	1.34(-1)	4.27(-3)	1.11(-1)	1.06(-1)
^{78}Ni	3.58(-1)	7.69(-1)	2.20(-2)	8.51(-2)	2.93(-1)

- [1] J. Engel, M. Bender, J. Dobaczewski, W. Nazarewicz, and R. Surman, *Phys. Rev. C* **60**, 014302 (1999).
- [2] Y. F. Niu, Z. M. Niu, G. Colò, and E. Vigezzi, *Phys. Rev. Lett.* **114**, 142501 (2015).
- [3] T. Nikšić, T. Marketin, D. Vretenar, N. Paar, and P. Ring, *Phys. Rev. C* **71**, 014308 (2005).
- [4] A. Arima and H. Hyuga, in *Mesons in Nuclei*, edited by D. Wilkinson (North-Holland, Amsterdam, 1979), p. 683.
- [5] A. Bohr and B. R. Mottelson, *Nuclear Structure* (Benjamin, New York, 1975), Chaps. 3 and 5.
- [6] J. Menéndez, D. Gazit, and A. Schwenk, *Phys. Rev. Lett.* **107**, 062501 (2011).
- [7] M. T. Mustonen, T. Shafer, Z. Zenginerler, and J. Engel, *Phys. Rev. C* **90**, 024308 (2014).