Erratum: Nuclear response for the Skyrme effective interaction with zero-range tensor terms [Phys. Rev. C 80, 024314 (2009)]

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(Received 6 July 2011; published 14 November 2011)

DOI: 10.1103/PhysRevC.84.059904 PACS number(s): 21.30.Fe, 21.60.Jz, 21.65.Cd, 21.65.Mn, 99.10.Cd

During an exhaustive analysis of the effects of the tensor contribution of the effective Skyrme interaction on the linear responses, we found an error which concerns precisely this tensor part and a wrong use of data which modifies two curves on Fig. 2. We list here the quantities, particle-hole matrix elements, and the different linear responses which are concerned by this mistake, and we give the corrected expressions of these quantities.

First of all, it is fundamental to write the tensor part of the interaction as

$$v_{\mathrm{T}}(\mathbf{r}) = \tfrac{1}{2}t_e\{[3(\boldsymbol{\sigma}_1\cdot\mathbf{k}')(\boldsymbol{\sigma}_2\cdot\mathbf{k}') - (\boldsymbol{\sigma}_1\cdot\boldsymbol{\sigma}_2)\mathbf{k}'^2]\delta(\mathbf{r}) + \delta(\mathbf{r})[3(\boldsymbol{\sigma}_1\cdot\mathbf{k})(\boldsymbol{\sigma}_2\cdot\mathbf{k}) - (\boldsymbol{\sigma}_1\cdot\boldsymbol{\sigma}_2)\mathbf{k}^2]\}$$
$$+ \tfrac{1}{2}t_o\{[3(\boldsymbol{\sigma}_1\cdot\mathbf{k}')\delta(\mathbf{r})(\boldsymbol{\sigma}_2\cdot\mathbf{k}) - (\boldsymbol{\sigma}_1\cdot\boldsymbol{\sigma}_2)\mathbf{k}'\cdot\delta(\mathbf{r})\mathbf{k}] + [3(\boldsymbol{\sigma}_1\cdot\mathbf{k})\delta(\mathbf{r})(\boldsymbol{\sigma}_2\cdot\mathbf{k}') - (\boldsymbol{\sigma}_1\cdot\boldsymbol{\sigma}_2)\mathbf{k}\cdot\delta(\mathbf{r})\mathbf{k}']\}, \tag{4}$$

since Eq. (4) from original article is not invariant with respect to permutations of the indices of particles, although it leads to the same energy density functional. The table which gives the particle-hole matrix elements for the tensor part of the effective force must be replaced by the following one with exactly the same notations.

For the channel $S = 0$ Eqs. (16) and (17) do not change, but we have to substitute Eqs. (22) and (23) with

$$\widetilde{\widetilde{W}}_1^{(0,0)} = W_1^{(0,0)} + 9W_0^2q^4\frac{\beta_2-\beta_3}{1+q^2(\beta_2-\beta_3)\big[W_2^{(1,0)} - \frac{5}{4}(t_e+3t_o)\big]}, \tag{22}$$

$$\widetilde{\widetilde{W}}_1^{(0,1)} = W_1^{(0,1)} + W_0^2q^4\frac{\beta_2-\beta_3}{1+q^2(\beta_2-\beta_3)\big[W_2^{(1,1)} + \frac{5}{4}(t_e-t_o)\big]}. \tag{23}$$

Taking into account our error in the tensor contributions, the response functions of the $S = 1$ channels [see Eqs. (18)–(21)] have been rewritten hereafter in a more compact form:

$$\begin{aligned}\frac{\chi_{HF}}{\chi_{RPA}^{(1,0,\pm1)}} ={}& \left[1-\frac{3}{8}(t_e+3t_o)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right]^2 - \widetilde{\widetilde{W}}_1^{(1,0,\pm1)}\chi_0 + \left[W_2^{(1,0)}+\frac{1}{4}(t_e+3t_o)\right]\\ &\times\left\{\frac{1}{2}q^2\chi_0\left[1-\frac{3}{4}(t_e+3t_o)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right] - 2k_F^2\chi_2 - \frac{3}{4}(t_e+3t_o)\left(\frac{m^*k_F^5}{3\pi^2}\right)(\chi_0-\chi_2)\right\}\\ &+\left[W_2^{(1,0)}+\frac{1}{4}(t_e+3t_o)\right]^2k_F^4\left\{\chi_2^2-\chi_0\chi_4+\left(\frac{m^*\omega}{k_F^2}\right)^2\chi_0^2 - q^2\left(\frac{m^*}{6\pi^2k_F}\right)\chi_0\right\}\\ &+2\chi_0\left(\frac{m^*\omega}{q}\right)^2\frac{\big[W_2^{(1,0)}-\frac{1}{2}(t_e+3t_o)\big]\big[1+\frac{1}{2}\big(\frac{m^*k_F^3}{3\pi^2}\big)X^{(1,0,\pm1)}\big]}{1-\big(\frac{m^*k_F^3}{3\pi^2}\big)\big[W_2^{(1,0)}-\frac{1}{2}(t_e+3t_o)-\frac{1}{2}X^{(1,0,\pm1)}\big]},\end{aligned} \tag{18}$$

$$\begin{aligned}\frac{\chi_{HF}}{\chi_{RPA}^{(1,0,0)}} ={}& \left[1+\frac{3}{4}(t_e+3t_o)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right]^2 - \widetilde{\widetilde{W}}_1^{(1,0,0)}\chi_0 + \left[W_2^{(1,0)}-\frac{1}{2}(t_e+3t_o)\right]\\ &\times\left\{\frac{1}{2}q^2\chi_0\left[1+\frac{3}{2}(t_e+3t_o)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right] - 2k_F^2\chi_2 + \frac{3}{2}(t_e+3t_o)\left(\frac{m^*k_F^5}{3\pi^2}\right)(\chi_0-\chi_2)\right\}\\ &+\left[W_2^{(1,0)}-\frac{1}{2}(t_e+3t_o)\right]^2k_F^4\left\{\chi_2^2-\chi_0\chi_4+\left(\frac{m^*\omega}{k_F^2}\right)^2\chi_0^2 - q^2\left(\frac{m^*}{6\pi^2k_F}\right)\chi_0\right\}\\ &+2\chi_0\left(\frac{m^*\omega}{q}\right)^2\frac{\big[W_2^{(1,0)}+(t_e+3t_o)\big]\big[1+\big(\frac{m^*k_F^3}{3\pi^2}\big)X^{(1,0,0)}\big]}{1-\big(\frac{m^*k_F^3}{3\pi^2}\big)\big[W_2^{(1,0)}+(t_e+3t_o)-X^{(1,0,0)}\big]},\end{aligned} \tag{19}$$

$$\frac{\chi_{HF}}{\chi_{RPA}^{(1,1,\pm1)}} = \left[1+\frac{3}{8}(t_e-t_0)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right]^2 - \widetilde{\widetilde{W}}_1^{(1,1,\pm1)}\chi_0 + \left[W_2^{(1,1)}-\frac{1}{4}(t_e-t_o)\right]$$
$$\times\left\{\frac{1}{2}q^2\chi_0\left[1+\frac{3}{4}(t_e-t_o)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right]-2k_F^2\chi_2+\frac{3}{4}(t_e-t_o)\left(\frac{m^*k_F^5}{3\pi^2}\right)(\chi_0-\chi_2)\right\}$$
$$+\left[W_2^{(1,1)}-\frac{1}{4}(t_e-t_o)\right]^2k_F^4\left\{\chi_2^2-\chi_0\chi_4+\left(\frac{m^*\omega}{k_F^2}\right)^2\chi_0^2-q^2\left(\frac{m^*}{6\pi^2k_F}\right)\chi_0\right\}$$
$$+2\chi_0\left(\frac{m^*\omega}{q}\right)^2\frac{\left[W_2^{(1,1)}+\frac{1}{2}(t_e-t_o)\right]\left[1+\frac{1}{2}\left(\frac{m^*k_F^3}{3\pi^2}\right)X^{(1,1,\pm1)}\right]}{1-\left(\frac{m^*k_F^3}{3\pi^2}\right)\left[W_2^{(1,1)}+\frac{1}{2}(t_e-t_o)-\frac{1}{2}X^{(1,1,\pm1)}\right]}, \tag{20}$$

$$\frac{\chi_{HF}}{\chi_{RPA}^{(1,1,0)}} = \left[1-\frac{3}{4}(t_e-t_o)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right]^2 - \widetilde{\widetilde{W}}_1^{(1,1,0)}\chi_0 + \left[W_2^{(1,1)}+\frac{1}{2}(t_e-t_o)\right]$$
$$\times\left\{\frac{1}{2}q^2\chi_0\left[1-\frac{3}{2}(t_e-t_o)\left(\frac{m^*k_F^3}{3\pi^2}\right)\right]-2k_F^2\chi_2-\frac{3}{2}(t_e-t_o)\left(\frac{m^*k_F^5}{3\pi^2}\right)(\chi_0-\chi_2)\right\}$$
$$+\left[W_2^{(1,1)}+\frac{1}{2}(t_e-t_o)\right]^2k_F^4\left\{\chi_2^2-\chi_0\chi_4+\left(\frac{m^*\omega}{k_F^2}\right)^2\chi_0^2-q^2\left(\frac{m^*}{6\pi^2k_F}\right)\chi_0\right\}$$
$$+2\chi_0\left(\frac{m^*\omega}{q}\right)^2\frac{\left[W_2^{(1,1)}-(t_e-t_o)\right]\left[1+\left(\frac{m^*k_F^3}{3\pi^2}\right)X^{(1,1,0)}\right]}{1-\left(\frac{m^*k_F^3}{3\pi^2}\right)\left[W_2^{(1,1)}-(t_e-t_o)-X^{(1,1,0)}\right]}, \tag{21}$$

with

$$\widetilde{\widetilde{W}}_1^{(1,0,\pm1)} = W_1^{(1,0)}+\frac{q^2}{2}(3t_o-t_e)+\frac{9q^4W_0^2}{2}\frac{(\beta_2-\beta_3)}{1+q^2W_2^{(0,0)}(\beta_2-\beta_3)}-\left(\frac{m^*\omega}{q}\right)^2\frac{3}{2}(t_e+3t_o)$$
$$+\frac{9}{64}(t_e+3t_o)^2\left\{2q^2\left(\frac{m^*k_F^3}{3\pi^2}\right)+\frac{1}{4}\left[q^2-4\left(\frac{m^*\omega}{q}\right)^2\right]^2\chi_0-2k_F^2\left[q^2+4\left(\frac{m^*\omega}{q}\right)^2\right]\chi_2+4k_F^4\chi_4\right\}, \tag{24}$$

$$\widetilde{\widetilde{W}}_1^{(1,0,0)} = W_1^{(1,0)}+q^2(t_e-3t_o)+3\left(\frac{m^*\omega}{q}\right)^2(t_e+3t_o)-\left(\frac{m^*k_F^3}{3\pi^2}\right)\left\{k_F^2+\frac{q^2}{4}-\left(\frac{m^*\omega}{q}\right)^2\right\}\frac{9}{8}(t_e+3t_o)^2, \tag{25}$$

$$\widetilde{\widetilde{W}}_1^{(1,1,\pm1)} = W_1^{(1,1)}+\frac{q^2}{2}(t_e+t_o)+\frac{q^4W_0^2}{2}\frac{(\beta_2-\beta_3)}{1+q^2W_2^{(0,1)}(\beta_2-\beta_3)}+\left(\frac{m^*\omega}{q}\right)^2\frac{3}{2}(t_e-t_o)$$
$$+\frac{9}{64}(t_e-t_o)^2\left\{2q^2\left(\frac{m^*k_F^3}{3\pi^2}\right)+\frac{1}{4}\left[q^2-4\left(\frac{m^*\omega}{q}\right)^2\right]^2\chi_0-2k_F^2\left[q^2+4\left(\frac{m^*\omega}{q}\right)^2\right]\chi_2+4k_F^4\chi_4\right\}, \tag{26}$$

TABLE II. Particle-hole matrix elements for the tensor part of the effective force in terms of t_o and t_e coefficients. For the sake of simplicity we have introduced $\mathbb{K}_{\mathrm{i,j}}=[(k_{12})_i(k_{12})_j]$ and $\mathbb{K}_{\mathrm{mix}}=[(k_{12})_0(k_{12})_0+(k_{12})_{-1}(k_{12})_1]$, where $(k_{12})_M^{(1)}$ is defined in Eq. (9). The term $\delta_{SS'}\delta_{S1}\delta_{II'}\delta_{QQ'}$ is implicit everywhere.

M	I	$M'=1$	$M'=0$	$M'=-1$
1	0	$\frac{1}{2}(t_e-3t_o)q^2-\frac{1}{2}(t_e+3t_o)\mathbb{K}_{\mathrm{mix}}$	$-\frac{3}{2}(t_e+3t_o)\mathbb{K}_{0,-1}$	$-\frac{3}{2}(t_e+3t_o)\mathbb{K}_{-1,-1}$
1	1	$\frac{1}{2}(t_e+t_o)q^2+\frac{1}{2}(t_e-t_o)\mathbb{K}_{\mathrm{mix}}$	$\frac{3}{2}(t_e-t_o)\mathbb{K}_{0,-1}$	$\frac{3}{2}(t_e-t_o)\mathbb{K}_{-1,-1}$
0	0	$\frac{3}{2}(t_e+3t_o)\mathbb{K}_{0,1}$	$(t_e-3t_0)q^2+(t_e+3t_0)\mathbb{K}_{\mathrm{mix}}$	$\frac{3}{2}(t_e+3t_o)\mathbb{K}_{0,-1}$
0	1	$-\frac{3}{2}(t_e-t_o)\mathbb{K}_{0,1}$	$-(t_e+t_0)q^2-(t_e-t_0)\mathbb{K}_{\mathrm{mix}}$	$-\frac{3}{2}(t_e-t_o)\mathbb{K}_{0,-1}$
−1	0	$-\frac{3}{2}(t_e+3t_o)\mathbb{K}_{1,1}$	$-\frac{3}{2}(t_e+3t_o)\mathbb{K}_{0,1}$	$\frac{1}{2}(t_e-3t_o)q^2-\frac{1}{2}(t_e+3t_o)\mathbb{K}_{\mathrm{mix}}$
−1	1	$\frac{3}{2}(t_e-t_o)\mathbb{K}_{1,1}$	$\frac{3}{2}(t_e-t_o)\mathbb{K}_{0,1}$	$\frac{1}{2}(t_e+t_o)q^2+\frac{1}{2}(t_e-t_o)\mathbb{K}_{\mathrm{mix}}$

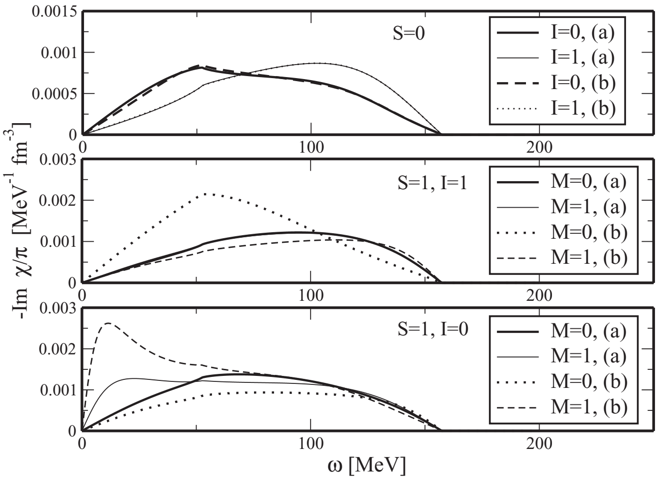

FIG. 2. Dynamical structure functions $S^{(\alpha)}(\mathrm{q}, \omega)$ calculated for the Skyrme tensor parametrization T44. For each (S, I, M) channel the responses (in MeV^{-1} fm^{-3}) are plotted as a function of ω (in MeV). All the responses are calculated for $q = k_F$ at saturation density. Cases (a) and (b) are discussed in the original article. The curves at $M = 0$ for both $S = 1$, $I = 0$ and $S = 1$, $I = 1$ channels are different from the original paper, which inadvertently shows the unperturbed response function.

$$\widetilde{\widetilde{W}}_1^{(1,1,0)} = W_1^{(1,1)} - q^2(t_e + t_o) - 3\left(\frac{m^*\omega}{q}\right)^2 (t_e - t_o) - \left(\frac{m^* k_F^3}{3\pi^2}\right)\left\{k_F^2 + \frac{q^2}{4} - \left(\frac{m^*\omega}{q}\right)^2\right\}\frac{9}{8}(t_e - t_o)^2, \tag{27}$$

$$X^{(1,0,\pm1)} = \frac{\frac{9}{8}[t_e + 3t_o]^2 q^2(\beta_2 - \beta_3)}{1 + q^2\left[W_2^{(1,0)} - \frac{1}{2}(t_e + 3t_o)\right](\beta_2 - \beta_3)}, \tag{32}$$

$$X^{(1,0,0)} = \frac{\frac{9}{8}[t_e + 3t_o]^2 q^2(\beta_2 - \beta_3)}{1 + q^2\left[W_2^{(1,0)} + \frac{7}{4}(t_e + 3t_o)\right](\beta_2 - \beta_3)}, \tag{33}$$

$$X^{(1,1,\pm1)} = \frac{\frac{9}{8}[t_e - t_o]^2 q^2(\beta_2 - \beta_3)}{1 + q^2\left[W_2^{(1,1)} + \frac{1}{2}(t_e - t_o)\right](\beta_2 - \beta_3)}, \tag{34}$$

$$X^{(1,1,0)} = \frac{\frac{9}{8}[t_e - t_o]^2 q^2(\beta_2 - \beta_3)}{1 + q^2\left[W_2^{(1,1)} - \frac{7}{4}(t_e - t_o)\right](\beta_2 - \beta_3)}. \tag{35}$$

In Fig. 2 we show the results obtained with the corrected equations.

ACKNOWLEDGMENTS

We are indebted to A. Pastore for his major and essential contribution to this Erratum, and especially for the derivation of the response functions in order to have a critical cross-check of the results.