Erratum: Effects of three-body forces on the maximum mass of neutron stars in the lowest-order constrained variational formalism [Phys. Rev. C **91**, 054320 (2015)]

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The inability of our calculations in reproducing the correct value of the symmetry energy of nuclear matter at saturation density motivated us to reexamine the procedure of combining a three-body force (TBF) with the two-body interaction in our method. As a result, we found some numerical errors in our computation. In calculating the energy of the two-body clusters, we realized that the expectation value of the tensor operator in the effective two-body force was computed twice in the programming code. We also noticed that, although there is no spin-orbit operator in the effective two-body force structure, the radius-dependent parts of the three operators in this interaction were giving a small contribution to the radius-dependent part of the spin-orbit operator of the bare two-body force. We corrected these computational errors, and from these modifications, our numerical results in Tables I–IV, and Figs. 5–11 should be corrected. The references inserted in the tables and figures are intact and are the same as those introduced in the original paper.

Below we show the corrected tables and figures together with the corrections to the main text if any.

Associated with the modification in Table I, “ $X_b = 0.771$ ” that appears in the fourth paragraph of Sec. IV should read “ $X_b = 0.788$.”

Associated with the modification in Fig. 7, the 12th sentence of the fifth paragraph in Sec. IV, “In the case of the inclusion of the TBF, the saturation density and binding energy per nucleon predicted by the lowest-order constrained variational (LOCV) model is in agreement with the empirical saturation point although the value of nuclear symmetry energy at normal density is high since the equation of state (EOS) obtained by the LOCV model is generally stiff.” should read as “In the case of the inclusion of the TBF, the value of nuclear symmetry energy at normal density as well as the saturation density and binding energy per nucleon predicted by the LOCV model are in agreement with the empirically determined values.”

Associated with the modification in Fig. 9, the third sentence of the eighth paragraph in Sec. IV, “It is seen that particle fractions obtained from the AV18 + TBF calculation have, in general, larger values but the same behavior compared to those calculated by using only the AV18 interaction.” should read as “It is seen that particle fractions obtained from the AV18 + TBF calculation have, in general, larger values and different behaviors compared to those calculated by using only the AV18 interaction.”

Associated with the modification in Fig. 11 and Table IV, the sixth sentence of the tenth paragraph in Sec. IV, “More precisely, as can be seen in Fig. 11(a) calculations based on only two-body interactions result in maximum masses below $1.8 M_\odot$, while

TABLE I. The values of parameters A and U in the LOCV method (this paper) as well as the Brueckner-Hartree-Fock (BHF) approach [8].

Potential	Method	A (MeV)	U (MeV)
AV18 + $\bar{V}_{12}$	LOCV	−0.0316	0.000483
AV18 + $\bar{V}_{12}^{\text{av}}$	LOCV	−0.037	0.000474
AV18 + $\bar{V}_{12}^{\text{it}}$	LOCV	−0.040	0.000473
AV18 + the Urbana IX (UIX)	BHF [8]	−0.050	0.00042

TABLE II. Saturation density ρ_0 and saturation energy E_0/A of symmetric nuclear matter using different potentials with and without the TBF.

Potential	ρ_0 (fm ^{−3})	E_0/A (MeV)
AV18	0.32	−23.37
AV14	0.3	−19.78
UV14	0.38	−16.08
Reid68 [18]	0.29	−22.83
AV18 + $\bar{V}_{12}$	0.1720	−15.64
AV14 + $\bar{V}_{12}$	0.1692	−15.48
UV14 + $\bar{V}_{12}$	0.1732	−15.31
Reid68 + $\bar{V}_{12}$ [18]	0.1712	−15.12

TABLE III. Approximate values of saturation density as well as binding energy per nucleon and symmetry energy at normal density for a number of many-body approaches with and without the TBF.

Method	Potential	ρ_0 (fm $^{-3}$)	E_0/A (MeV)	$E_{\text{sym}}(\rho_0)$ (MeV)
LOCV (this paper)	AV18	0.32	-23.37	39.13
BHF [44,45]	AV18	0.26	-18.2	38.15
Variational [11]	AV18	0.3	-18.23	38.86
LOCV (this paper)	AV18 + TBF	0.1720	-15.64	34.17
BHF [44,45]	AV18 + TBF	0.19	-15.2	33.48
Variational [11]	AV18 + δv + UIX	0.186	-12.37	33.34
BHF [7]	AV18 + micro-TBF	0.17	-15.5	36.03
BHF [44,45]	Bonn B (BOB)	0.34	-22.07	50.68
BHF [44,45]	Bonn B + TBF	0.17	-15.87	32.9
Dirac-Brueckner-Hartree-Fock (DBHF) [46]	Bonn A (complete $p\nu$)	0.193	-16.9	36.74
DBHF [46]	Bonn A (subtracted T matrix)	0.1814	-16.3	34.36

TABLE IV. Comparison of maximum masses obtained in the present paper with those calculated within other many-body approaches.

Potential	Method	Author	$M/M_\odot$
BOB + micro-TBF	BHF	Li and Schulze (LS) [8]	2.5
AV18 + micro-TBF	BHF	LS [8]	2.3
$N93$ + micro-TBF	BHF	LS [8]	2.12
AV18 + UIX	BHF	LS [8]	1.8
AV18 + UIX	Variational	Akmal-Pandharipande-Ravenhall (APR) [11]	2.38
AV18	Variational	APR [11]	1.67
UV14 + UVII	Variational	Wiringa-Fiks-Fabrocini (WFF) [40]	2.19
AV14 + UVII	Variational	WFF [40]	2.13
UV14 + the three-nucleon interaction (TNI)	Variational	WFF [40]	1.84
AV18	LOCV	This paper	1.68
AV14	LOCV	This paper	1.67
UV14	LOCV	This paper	1.64
Reid68 [18]	LOCV	This paper	1.60
AV18 + UIX	LOCV	This paper	2.43
AV14 + UIX	LOCV	This paper	1.80
UV14 + UIX	LOCV	This paper	2.27
Reid68 + UIX [18]	LOCV	This paper	1.93

FIG. 5. The equation of state of symmetric nuclear matter using different effective two-body forces as well as using only the AV18 potential.

FIG. 6. (a) The EOS of symmetric nuclear matter for different two-body potentials supplemented by the TBF. (b) The EOS of asymmetric nuclear matter for a number of asymmetry parameter X 's as well as β -stable matter using the AV18 + $\bar{V}_{12}$ potential.

FIG. 7. Density dependence of the nuclear symmetry energy obtained by the LOCV approach as well as some other many-body techniques, such as the BHF (with the AV18, the AV18 + TBF, the Bonn B, and the Bonn B + TBF) [44,45], the BHF (the AV18 + micro-TBF) [7], the variational (the AV18, AV18 + $\delta\nu$ + UIX) [11], and the DBHF [46,47].

FIG. 8. (a) Mass energy and (b) pressure of β -stable matter using different potentials.

FIG. 9. (a) Proton, electron, and muon fractions for β -stable matter against baryon density with and without the TBF using the AV18 potential. (b) Comparison of the proton fraction obtained in the present paper (the black solid curve) with the results of the AV18 + UIX (APR) [11], the AV14 + UVII [40], the UV14 + UVII [40], the UV14 + TNI [40], the U14-DDI [43], AV18 + UIX [Zhou-Burgio-Lombardo-Schulze (ZBLS)] [7], and the AV18 + micro-TBF [7].

FIG. 10. Speed of sound as a function of baryon density for β -stable matter with and without the TBF.

FIG. 11. Mass-radius relation of a neutron star with [panel (b)] and without [panel (a)] the TBF using different two-body potentials.

the models containing TBF have maximum masses above $2 M_{\odot}$.” should read as “More precisely, as can be seen in Fig. 11(a), calculations based on only two-body interactions result in maximum masses below $1.8 M_{\odot}$, whereas the models containing AV18 and UV14 potentials combined with the TBF produce maximum masses above $2 M_{\odot}$.”

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