Spectroscopic study of neutron-rich calcium isotopes with a realistic shell-model interaction

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We have studied neutron-rich calcium isotopes in terms of the shell model, employing a realistic effective interaction derived from the CD-Bonn nucleon-nucleon potential. The short-range repulsion of the potential is renormalized by way of the $V_{\mathrm{low-k}}$ approach. The calculated results are in very good agreement with the available experimental data, thus supporting our predictions for the hitherto unknown spectra of $^{53-56}$Ca nuclei. In this context, the possible existence of an $N = 34$ shell closure is discussed.

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I. INTRODUCTION

Calcium isotopes with mass number $A > 48$ are currently the subject of great experimental and theoretical interest. With an N/Z ratio >1.4 they lie far from the stability valley and provide a good opportunity to explore the evolution of shell structure when approaching the neutron drip line. In this context, it should be mentioned that the appearance of $N = 34$ as a neutron magic number for unstable nuclei was predicted more than three decades ago within the framework of the energy density formalism [1]. Recently, some shell-model calculations [2,3] have revived this issue indicating the existence of a large shell gap at $N = 34$. As a consequence, a large number of experiments have been performed in the region of neutron-rich nuclei around ^{48}Ca [4–13], aiming at obtaining information about the evolution of the single-particle (SP) orbitals.

The experimental data on Ti and Cr isotopes do not evidence such a shell closure [6,14–16], even if it should be noted that the proton-neutron interaction, due to the presence of valence protons in the pf shell, may hide the neutron shell structure. Consequently, a major experimental issue is currently the spectroscopic study of ^{53,54}Ca, because it may provide direct and unambigous information about the existence of an $N = 34$ shell closure.

The microscopic theoretical tool to describe the spectroscopic properties of these nuclei is the shell model, which in recent years has been extensively used with different two-body effective interactions. The most frequently employed interactions are the KB3G [17], FPD6 [18], GXPF1 [19], and a new version of the latter dubbed GXPF1A [3]. The KB3G potential is a monopole-corrected version of the realistic Kuo-Brown interaction derived some 40 years ago for the pf-shell nuclei [20], while the FPD6 potential has been derived starting from a modified surface one-boson-exchange potential and then fitting 61 energy data from 12 nuclei in the mass range 41 to 49 [18]. The GXPF1 potential has been obtained starting from a G-matrix interaction based on the Bonn C nucleon-nucleon (NN) potential [21] and then modifying the two-body matrix elements (TBME) to fit about 700 energy data in the mass range $A = 47$–66 [19]. These TBME have been recently slightly modified to improve the description of neutron-rich pf-shell nuclei [3], thus leading to the GXPF1A interaction.

The above semiempirical approaches to the derivation of the effective shell-model interaction have been considered a necessary remedy for the deficiencies of the original realistic interactions [22]. During the past few years, however, significant progress has been made in the derivation of realistic shell-model effective interactions. This is based on the advent of a new generation of high-precision NN potentials and on a new way to renormalize their strong short-range repulsion, the $V_{\mathrm{low-k}}$ approach [23,24], which has proved to be an advantageous alternative to the traditional Brueckner G-matrix method. This has led to the derivation of effective interactions capable of describing with remarkable accuracy the spectroscopic properties of nuclei in various mass regions [25–27].

On these grounds, we have found it challenging to perform a shell-model study of the Ca isotopic chain employing an effective interaction derived from the CD-Bonn potential renormalized by way of the $V_{\mathrm{low-k}}$ approach.

The aim of the present study is twofold. The first aim is to ascertain if our effective interaction does not suffer from the deficiences that have plagued previous realistic effective interactions. The second, if the answer is in the affirmative, is to investigate the shell structure of neutron-rich Ca isotopes.

The article is organized as follows. In Sec. II we give a brief outline of our calculations and some details about the choice of the SP energies. Section III is devoted to the presentation of the results for the calcium isotopes beyond ^{48}Ca up to $A = 56$. In Sec. IV we discuss our results, focusing attention on the $N = 34$ isotope, and make some concluding remarks. In the Appendix the calculated TBME, the employed SP energies, and the effective single-particle quadrupole operator $E2$ are reported.

II. OUTLINE OF CALCULATIONS

Our shell-model effective interaction has been derived within the framework of the perturbation theory [27], starting, as mentioned in the Introduction, from the CD-Bonn NN potential [28]. More explicitly, we have first renormalized

the high-momentum repulsive components of the bare NN potential by way of the so-called $V_{\mathrm{low-k}}$ approach [23,24], which provides a smooth potential preserving exactly the on-shell properties of the original NN potential. Next, we have derived the TBME using the well-known $\hat{Q}$-box plus folded-diagram method [27], where the $\hat{Q}$-box is a collection of irreducible valence-linked Goldstone diagrams that we have calculated through third order in the $V_{\mathrm{low-k}}$.

The effective interaction V_{eff} can be written in an operator form as

$$V_{\mathrm{eff}} = \hat{Q} - \hat{Q}' \int \hat{Q} + \hat{Q}' \int \hat{Q} \int \hat{Q} - \hat{Q}' \int \hat{Q} \int \hat{Q} \int \hat{Q} + \cdots, \tag{1}$$

where the integral sign represents a generalized folding operation, and $\hat{Q}'$ is obtained from $\hat{Q}$ by removing terms of first order in $V_{\mathrm{low-k}}$. The folded-diagram series is summed up to all orders using the Lee-Suzuki iteration method [29].

The model space we have chosen to derive our shell-model effective interaction is spanned by the four neutron SP levels $0f_{7/2}$, $0f_{5/2}$, $1p_{3/2}$, and $1p_{1/2}$, located above the doubly closed ^{40}Ca core. The same choice has been performed in most of the studies on neutron-rich Ca isotopes, and therefore it allows a direct comparison between our results and those of other shell-model calculations.

As regards the choice of the neutron SP energies, we have determined them by reproducing the observed energies of the $(\frac{3}{2}^-)_1$ state in ^{47}Ca and of the $(\frac{1}{2}^-)_1$, $(\frac{5}{2}^-)_2$ states in ^{49}Ca, whose SP nature is evidenced by the experimental spectroscopic factors [30]. Our adopted values are $\epsilon_{3/2} - \epsilon_{7/2} = 2.7$ MeV, $\epsilon_{1/2} - \epsilon_{7/2} = 5.5$ MeV, and $\epsilon_{5/2} - \epsilon_{7/2} = 8.5$ MeV. The absolute energy of the neutron $0f_{7/2}$ orbital was placed at -8.2 MeV to reproduce the experimental binding energy of ^{49}Ca with respect to ^{40}Ca.

The TBME and SP energies used in the present calculation can be found in the Appendix where, for the sake of completeness, also the proton-proton and proton-neutron TBME are reported. It should be pointed out that for protons the Coulomb force has been explicitly added to the $V_{\mathrm{low-k}}$ before constructing V_{eff}.

III. RESULTS

We have performed shell-model calculations, using the Oslo shell-model code [31], for the heavy-mass calcium isotopes from ^{49}Ca up to ^{56}Ca. In Table I the experimental and calculated negative-parity levels of ^{49}Ca are reported up to 5.5 MeV excitation energy. It can been seen that, as regards the $(\frac{1}{2}^-)_1$ and $(\frac{5}{2}^-)_2$ states which we have used to determine the SP energies, the calculated one-neutron pickup spectroscopic factors are in very good agreement with experiment, as is the case for the $\frac{3}{2}^-$ ground state. From Table I it also appears that the calculated energies of the $(\frac{5}{2}^-)_1$ and $(\frac{3}{2}^-)_{2,3}$ states are in a good agreement with the experimental values, while above the yrast state the theory does not predict any other $\frac{1}{2}^-$ state below 7.5 MeV.

TABLE I. Experimental negative-parity energy levels (in MeV) of ^{49}Ca [30] up to 5.5 MeV excitation energy compared with the calculated ones. The values in parenthesis are the one-neutron pickup spectroscopic factors [40].

J^π	Expt.	Calc.
$\frac{3}{2}^-$	0.000 (0.84)	0.000 (0.86)
$\frac{1}{2}^-$	2.023 (0.91)	2.029 (0.91)
$\frac{7}{2}^-$		3.158
$\frac{5}{2}^-$	3.585	3.300
$\frac{7}{2}^-$		3.731
$\frac{5}{2}^-$	3.991 (0.84)	4.073 (0.86)
$\frac{3}{2}^-$	4.072	3.790
$\frac{1}{2}^-$	4.261	
$\frac{1}{2}^-$	4.272	
$\frac{9}{2}^-$		4.489
$\frac{11}{2}^-$		4.898
$\frac{1}{2}^-$	5.444	
$\frac{5}{2}^-$		5.608
$\frac{3}{2}^-$	5.539	5.730

The calculated and experimental [9] positive-parity states of ^{50}Ca are reported in Table II, where we see that our calculations reproduce quite well the observed energies. As regards the structure of the states, we find that the four lowest excited 2^+ states are dominated by the configurations $\nu(0f_{7/2})^8(1p_{3/2})^2$, $\nu(0f_{7/2})^8(1p_{3/2})^1(1p_{1/2})^1$, $\nu(0f_{7/2})^7(1p_{3/2})^3$, $\nu(0f_{7/2})^8(0f_{5/2})^1(1p_{3/2})^1$, respectively. The $\nu(0f_{7/2})^8(1p_{3/2})^1(1p_{1/2})^1$ configuration provides also the structure of the first excited 1^+ state, which is predicted to

TABLE II. Observed positive-parity energy levels (in MeV) of ^{50}Ca [9,30] up to 5.2 MeV excitation energy compared with the calculated ones. The energies of the states whose parity and/or angular momentum are uncertain are reported in parentheses.

J^π	Expt.	Calc.
0^+	0.000	0.000
2^+	1.026	0.953
2^+	(3.004)	2.941
1^+	(3.532)	3.547
2^+	(4.036)	3.582
0^+	(4.470)	4.926
4^+	4.515	4.567
3^+		4.645
4^+		4.798
5^+		5.131
1^+		5.167
2^+	(4.870)	5.231

TABLE III. Experimental negative-parity energy levels (in MeV) of ^{51}Ca [9] up to 4.5 MeV excitation energy compared with the calculated ones. The energies of the states whose parity and/or angular momentum are uncertain are reported in parentheses.

J^π	Expt.	Calc.
$\frac{3}{2}^-$	(0.000)	0.000
$\frac{1}{2}^-$	(1.721)	1.586
$\frac{5}{2}^-$	(2.379)	2.269
$\frac{3}{2}^-$	(2.937)	2.932
$\frac{7}{2}^-$	(3.437)	3.429
$\frac{5}{2}^-$	(3.479)	3.552
$\frac{9}{2}^-$	(4.322)	4.435
$\frac{1}{2}^-$		4.470
$\frac{7}{2}^-$		4.488

lie above the second 2^+ state, in agreement with what is observed. This, as mentioned in Refs. [9,32], may be related to the larger spatial overlap between $1p_{3/2}$ and $1p_{1/2}$ orbits in the 2^+ state relative to the 1^+ state as due to the requirement of antisymmetrization.

We have also calculated the $B(E2; 2_1^+ \to 0_1^+)$ transition rates employing an effective operator obtained at third order in perturbation theory, consistently with the derivation of $H_{\rm eff}$. The calculated value is 10.9 e^2 fm^4 to be compared with the value 7.5 ± 0.2 e^2 fm^4 obtained in a recent experiment [33]. In Tables AV and AVI we report the effective reduced single-neutron and -proton matrix elements of the $E2$ operator.

Our calculation predicts two 4^+ states in a very small energy interval $4.6 \div 4.8$ MeV. The first one belongs mainly to the $\nu(0f_{7/2})^7(1p_{3/2})^3$ configuration and may be identified with the observed state at 4.515 MeV excitation energy [9], while the second one essentially arises from the $\nu(0f_{7/2})^8(1p_{3/2})^1(0f_{5/2})^1$ configuration.

The experimental (0_2^+) state at 4.47 MeV [34] may contain significant contributions from 2p-2h $Z = 20$ cross-shell excitations. As a matter of fact, in ^{48}Ca two excited 0^+ states are observed; the first one at 4.28 MeV excitation energy is associated with the above-mentioned 2p-2h excitations [35], while the second one at 5.46 MeV excitation energy belongs mainly to the $\nu(0f_{7/2})^6(1p_{3/2})^2$ configuration. In this connection, it should be mentioned that our calculated energy of the latter state is 5.22 MeV. So, it would be desirable to obtain more experimental information about the first two 0^+ excited states also in ^{50}Ca to have a better understanding of the role of $Z = 20$ cross-shell excitations.

In Table III we have reported experimental and calculated negative-parity states of ^{51}Ca. We see that also for this nucleus the comparison between theory and experiment is remarkably good, the largest discrepancy being about 100 keV.

As regards our calculated wave functions, all low-lying states are mainly constructed as 8 neutrons in the $0f_{7/2}$ orbital—the ^{48}Ca core—plus the three extra neutrons in the remaining SP levels, except the $(\frac{7}{2}^-)_1$ state whose main configuration is made up by one neutron-hole in ^{48}Ca core and four neutrons filling the $1p_{3/2}$ orbital. More precisely, the $(\frac{3}{2}^-)_1$ ground state is dominated by the $^{48}\text{Ca} \otimes (\nu 1p_{3/2})^3$ configuration, the $(\frac{1}{2}^-)_1, (\frac{5}{2}^-)_1, (\frac{3}{2}^-)_2$ states by the $^{48}\text{Ca} \otimes (\nu 1p_{3/2})^2(\nu 1p_{1/2})^1$ configuration and the $(\frac{5}{2}^-)_2, (\frac{9}{2}^-)_1$ states by the $^{48}\text{Ca} \otimes (\nu 1p_{3/2})^2(\nu 0f_{5/2})^1$ configuration.

TABLE IV. Low-lying positive-parity energy levels (in MeV) of ^{52}Ca [7,9,30] compared with the calculated ones. The energies of the states whose parity and/or angular momentum are uncertain are reported in parenthesis.

J^π	Expt.	Calc.
0^+	0.000	0.000
2^+	2.562	2.396
1^+	(3.150)	3.135
0^+		4.040
2^+		4.432
3^+		4.568
4^+		4.743

The nucleus ^{52}Ca is the last one of this isotopic chain for which a few experimental excited states have been observed [7–9]. Its energies are reported in Table IV together with the calculated ones up to 5 MeV. Note that the neutron binding energy for ^{52}Ca is about 4.7 MeV [36].

The jump in energy of the first excited 2^+ state, when going from ^{50}Ca to ^{52}Ca, reflects the subshell filling of the $1p_{3/2}$ orbital. In fact, to construct the 2_1^+ state in ^{52}Ca a pair of neutrons in the $1p_{3/2}$ orbital has to be broken and one neutron promoted to the $1p_{1/2}$ SP level.

For the heavier Ca isotopes ^{53,54,55}Ca, only the ground states have been identified with spin and parity assignment [10]. In Tables V, VI, VII we have reported our predicted spectra for the three nuclei up to 4.0 MeV excitation energy.

IV. DISCUSSION AND CONCLUDING REMARKS

Shell-model effective interactions derived from the free NN potential were proposed for the pf shell in Refs. [20,21]. It has been shown, however, that while these interactions give a good description of the spectroscopy of few-valence-nucleon

TABLE V. Theoretical negative-parity energy levels (in MeV) of ^{53}Ca up to 4.0 MeV excitation energy.

J^π	Calc.
$\frac{1}{2}^-$	0.000
$\frac{5}{2}^-$	2.039
$\frac{3}{2}^-$	2.402

TABLE VI. Theoretical positive-parity energy levels (in MeV) of ^{54}Ca up to 4.0 MeV excitation energy.

J^π	Calc.
0^+	0.000
2^+	2.061
3^+	2.748
0^+	3.138

systems, they fail for many-valence-particle nuclei. This is evidenced by the poor description of the closure properties of ^{48}Ca and ^{56}Ni [21,37] and justifies the use of empirically modified versions of these interactions in this mass region.

As mentioned in the Introduction, our realistic effective interaction is based on recent progress achieved in its derivation, and the good agreement of our results with the available experimental data seems to testify to its reliability. This is further confirmed by the inspection of Fig. 1, where the experimental excitation energies of the yrast 2^+ state are reported as a function of A and compared with those calculated with both our shell-model Hamiltonian and the GXPF1A one. It can be seen that our calculations reproduce nicely the observed energies of the first excited 2^+ states without any need of monopole modification. The good quality of the $T = 1$ monopole part of our interaction is also evidenced in Fig. 2, where we have plotted the calculated binding energies per valence neutron as a function of A. We see a good agreement with the experimental data along all the isotopic chain, at variance with the Kuo-Brown interaction, whose results are reported for comparison.

We have pointed out in the Introduction that an issue of great interest in the study of heavy-mass calcium isotopes is the possible appearance of the "magic number" $N = 34$. Our results do not provide evidence of this magic number,

TABLE VII. Theoretical negative-parity energy levels (in MeV) of ^{55}Ca up to 4.0 MeV excitation energy.

J^π	Calc.
$\frac{5}{2}^-$	0.000
$\frac{1}{2}^-$	1.104
$\frac{3}{2}^-$	1.541
$\frac{7}{2}^-$	1.931
$\frac{5}{2}^-$	2.390
$\frac{9}{2}^-$	2.914
$\frac{5}{2}^-$	3.472
$\frac{3}{2}^-$	3.547
$\frac{3}{2}^-$	3.938

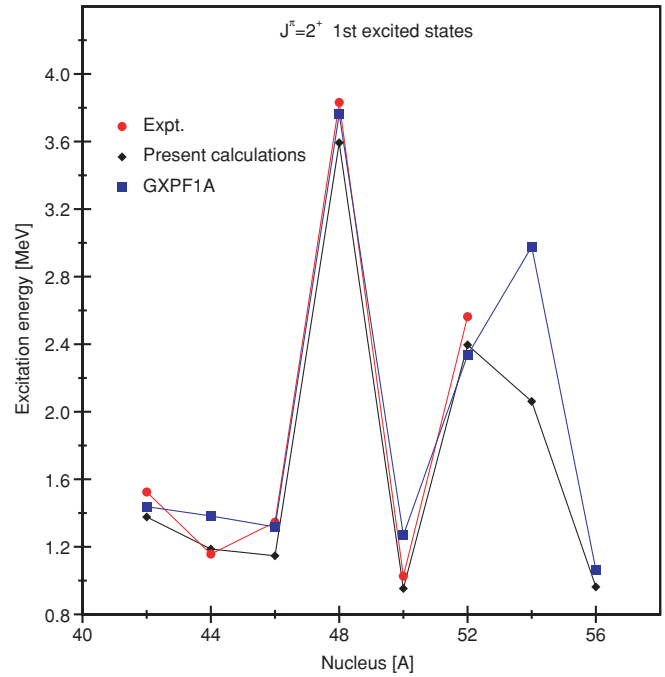

FIG. 1. (Color online) Experimental [30] and calculated excitation energies of the yrast $J^\pi = 2^+$ states for calcium isotopes from $A = 42$ to 56. Black diamonds refer to present calculations, blue squares to those with GXPF1A potential.

because they do not predict an increase of the 2_1^+ excitation energy in ^{54}Ca with respect to ^{52}Ca. It should be mentioned that calculations performed with the KB3G [38] and FPD6 [17] interactions do not predict a shell closure at $N = 34$ that is instead predicted when using the GXPF1A interaction [3].

To understand the different behavior of the two theoretical curves of Fig. 1, it is useful to consider the effective single-particle energies (ESPE) for calcium isotopes (see for instance Ref. [39]).

We recall here that the ESPE are related to the monopole part of the shell-model Hamiltonian, thus reflecting the angular-momentum-averaged effects of the two-body interaction for a given nucleus. The ESPE of a level is defined as the one-neutron separation energy of this level and is calculated in terms of the bare ϵ_j and the monopole part of the interaction, $\mathrm{ESPE}(j) = \epsilon_j + \sum_{j'} V_{jj'} n_{j'}$, where the sum runs on the model-space levels j', n_j being the number of particles in the level j and $V_{jj'}$ the angular-momentum-averaged interaction $V_{jj'} = \sum_J (2J+1)\langle jj'|V|jj'\rangle_J / \sum_J (2J+1)$.

In Fig. 3 we report the ESPE of the neutron $1p_{1/2}$ and $0f_{5/2}$ orbits relative to the $1p_{3/2}$ orbit as a function of the neutron number. The appearance of the $N = 34$ magic number is obviously related to the existence of a large gap between the $1p_{1/2}$ and $0f_{5/2}$ orbits. For $N = 28$ the two effective interactions predict almost the same gap of about 2 MeV, but, when adding neutrons, this gap remains essentially unchanged up to $N = 34$ in our calculations, while the GXPF1A interaction predicts that the difference between the two ESPE increases rapidly up to a value of about 3.6 MeV for $N = 34$. These contrasting scenarios for the shell evolution are related to the different $T = 1$ monopole properties of the two

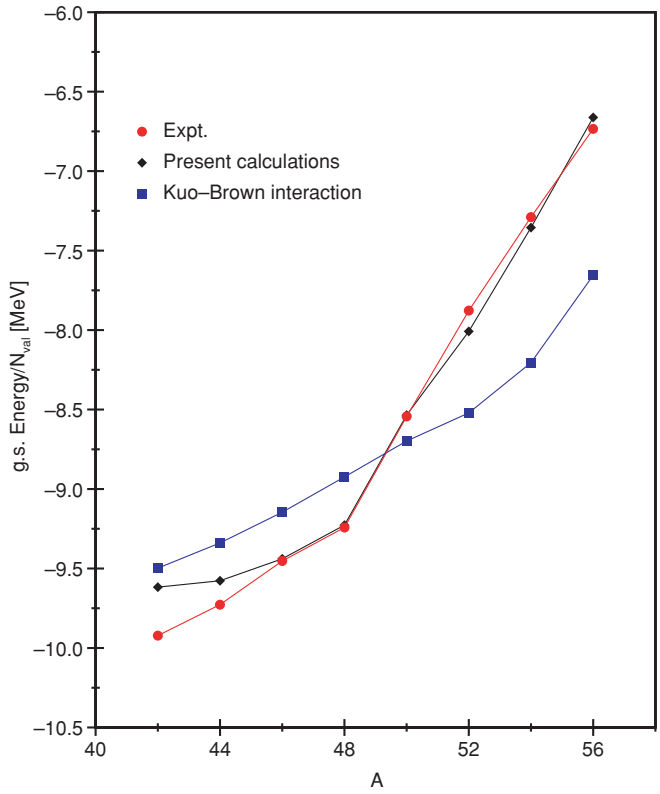

FIG. 2. (Color online) Experimental [36] and calculated ground-state energies per valence neutron for calcium isotopes from $A = 42$ to 56. N_{val} is the number of valence neutrons. Black diamonds refer to present calculations, blue squares to those with Kuo-Brown interaction.

effective interactions. In this connection, it should be pointed out that for the $(0f_{5/2}1p_{3/2})$ configuration the monopole is -0.09 MeV for our interaction and 0.12 MeV for GXPF1A. For the $(0f_{5/2}1p_{1/2})$ configuration, the present interaction gives a monopole equal to 0.02 MeV, while GXPF1A gives 0.08 MeV.

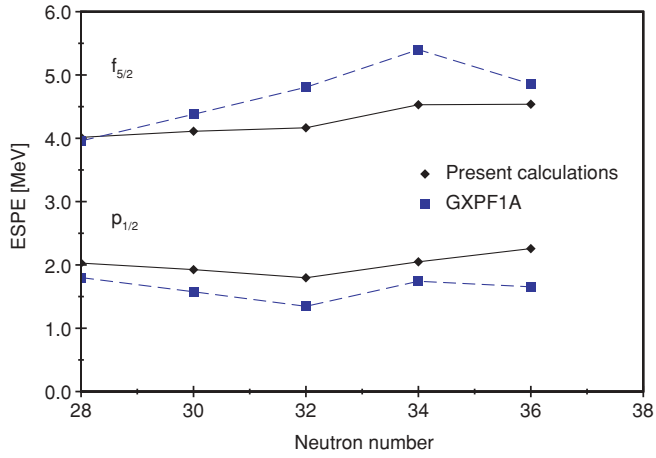

FIG. 3. (Color online) Effective single-particle energies of the neutron $1p_{1/2}$ and $0f_{5/2}$ orbits relative to the $1p_{3/2}$ from $N = 28$ to 36. Black diamonds refer to present calculations, blue squares to those with GXPF1A potential.

For the sake of completeness, it should be mentioned that recently new results have been reported from a one-neutron knockout reaction on ^{56}Ti [12]. These data establish that the ground state of ^{55}Ti has $J^\pi = \frac{1}{2}^-$. However, both shell-model predictions using GXPF1A and our interaction are in agreement with this assignment, showing that it does not help shedding light on the problem of the $N = 34$ shell closure.

We hope that the present work may contribute to the understanding of the shell evolution and nuclear structure properties when moving toward the neutron drip line in the Ca region.

APPENDIX

TABLE AI. Neutron-neutron TBME (in MeV). They are anti-symmetrized and normalized.

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	0	−1	−1.959
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	0	−1	−2.807
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	0	−1	−1.328
$0f_{7/2}0f_{7/2}1p_{1/2}1p_{1/2}$	0	−1	−1.068
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	0	−1	−0.949
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	0	−1	−1.024
$0f_{5/2}0f_{5/2}1p_{1/2}1p_{1/2}$	0	−1	−0.477
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	0	−1	−1.130
$1p_{3/2}1p_{3/2}1p_{1/2}1p_{1/2}$	0	−1	−1.240
$1p_{1/2}1p_{1/2}1p_{1/2}1p_{1/2}$	0	−1	−0.204
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	1	−1	0.183
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	1	−1	−0.194
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{1/2}$	1	−1	−0.059
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	1	−1	0.091
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{1/2}$	1	−1	−0.099
$1p_{3/2}1p_{1/2}1p_{3/2}1p_{1/2}$	1	−1	0.333
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	2	−1	−1.015
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	2	−1	0.169
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	2	−1	−0.672
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	2	−1	−0.713
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	2	−1	0.564
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{1/2}$	2	−1	−0.716
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	2	−1	−0.411
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{1/2}$	2	−1	−0.456
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	2	−1	−0.149
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	2	−1	0.004
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	2	−1	−0.677
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	2	−1	0.408
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{1/2}$	2	−1	−0.446
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{3/2}$	2	−1	−0.059
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{1/2}$	2	−1	−0.156
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	2	−1	−1.045
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	2	−1	−0.697
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	2	−1	0.490
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{1/2}$	2	−1	−1.277
$0f_{7/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	−1	−0.593
$0f_{7/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	−1	−0.828
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	2	−1	−0.397
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	2	−1	0.053
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{1/2}$	2	−1	−0.273
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	2	−1	−0.196
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{1/2}$	2	−1	−0.408

TABLE AI. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	2	−1	0.122
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{1/2}$	2	−1	0.583
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	−1	0.226
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	−1	0.315
$0f_{5/2}1p_{1/2}0f_{5/2}1p_{1/2}$	2	−1	−0.336
$0f_{5/2}1p_{1/2}1p_{3/2}1p_{3/2}$	2	−1	−0.405
$0f_{5/2}1p_{1/2}1p_{3/2}1p_{1/2}$	2	−1	−0.543
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	−1	−0.217
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	−1	−0.706
$1p_{3/2}1p_{1/2}1p_{3/2}1p_{1/2}$	2	−1	−0.528
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	3	−1	0.313
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	3	−1	−0.283
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{1/2}$	3	−1	0.160
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	3	−1	−0.194
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{1/2}$	3	−1	−0.037
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	3	−1	0.163
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{1/2}$	3	−1	0.019
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	3	−1	0.072
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{1/2}$	3	−1	−0.075
$0f_{7/2}1p_{1/2}0f_{7/2}1p_{1/2}$	3	−1	0.281
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{3/2}$	3	−1	0.170
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{1/2}$	3	−1	−0.101
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	3	−1	0.193
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{1/2}$	3	−1	0.022
$0f_{5/2}1p_{1/2}0f_{5/2}1p_{1/2}$	3	−1	0.265
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	4	−1	−0.196
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	4	−1	−0.564
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	4	−1	−0.471
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{1/2}$	4	−1	−0.474
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	4	−1	−0.508
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	4	−1	0.674
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	4	−1	0.127
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	4	−1	−0.236
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{1/2}$	4	−1	−0.065
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	4	−1	−0.509
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	4	−1	0.835
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	4	−1	−0.112
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{1/2}$	4	−1	−0.763
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	4	−1	−0.290
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	4	−1	0.916
$0f_{7/2}1p_{1/2}0f_{7/2}1p_{1/2}$	4	−1	−0.281
$0f_{7/2}1p_{1/2}0f_{5/2}0f_{5/2}$	4	−1	−0.379
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{3/2}$	4	−1	0.942
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	4	−1	−0.011
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	4	−1	0.232
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	4	−1	−0.489
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	5	−1	0.440
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	5	−1	−0.243
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	5	−1	0.657
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	6	−1	0.211
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	6	−1	−1.205
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	6	−1	−1.246

TABLE AII. Same as in Table AI but for proton-proton TBME.

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	0	1	−1.727
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	0	1	−2.584
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	0	1	−1.348
$0f_{7/2}0f_{7/2}1p_{1/2}1p_{1/2}$	0	1	−1.058
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	0	1	−0.719
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	0	1	−1.066
$0f_{5/2}0f_{5/2}1p_{1/2}1p_{1/2}$	0	1	−0.515
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	0	1	−0.635
$1p_{3/2}1p_{3/2}1p_{1/2}1p_{1/2}$	0	1	−0.849
$1p_{1/2}1p_{1/2}1p_{1/2}1p_{1/2}$	0	1	−0.019
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	1	1	0.588
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	1	1	−0.213
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{1/2}$	1	1	−0.057
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	1	1	0.494
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{1/2}$	1	1	−0.107
$1p_{3/2}1p_{1/2}1p_{3/2}1p_{1/2}$	1	1	0.660
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	2	1	−0.573
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	2	1	0.175
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	2	1	−0.677
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	2	1	−0.705
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	2	1	0.565
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{1/2}$	2	1	−0.740
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	2	1	−0.399
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{1/2}$	2	1	−0.468
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	2	1	0.215
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	2	1	−0.040
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	2	1	−0.631
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	2	1	0.358
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{1/2}$	2	1	−0.409
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{3/2}$	2	1	−0.065
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{1/2}$	2	1	−0.149
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	2	1	−0.652
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	2	1	−0.644
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	2	1	0.400
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{1/2}$	2	1	−1.146
$0f_{7/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	1	−0.553
$0f_{7/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	1	−0.833
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	2	1	−0.034
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	2	1	0.084
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{1/2}$	2	1	−0.268
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	2	1	−0.214
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{1/2}$	2	1	−0.407
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	2	1	0.444
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{1/2}$	2	1	0.565
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	1	0.251
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	1	0.292
$0f_{5/2}1p_{1/2}0f_{5/2}1p_{1/2}$	2	1	0.038
$0f_{5/2}1p_{1/2}1p_{3/2}1p_{3/2}$	2	1	−0.417
$0f_{5/2}1p_{1/2}1p_{3/2}1p_{1/2}$	2	1	−0.508
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	1	0.221
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	1	−0.536
$1p_{3/2}1p_{1/2}1p_{3/2}1p_{1/2}$	2	1	0.006
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	3	1	0.739
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	3	1	−0.259
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{1/2}$	3	1	0.168
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	3	1	−0.177
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{1/2}$	3	1	−0.062

TABLE AII. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	3	1	0.582
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{1/2}$	3	1	−0.033
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	3	1	0.079
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{1/2}$	3	1	−0.073
$0f_{7/2}1p_{1/2}0f_{7/2}1p_{1/2}$	3	1	0.670
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{3/2}$	3	1	0.155
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{1/2}$	3	1	−0.076
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	3	1	0.578
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{1/2}$	3	1	0.050
$0f_{5/2}1p_{1/2}0f_{5/2}1p_{1/2}$	3	1	0.608
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	4	1	0.248
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	4	1	−0.571
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	4	1	−0.453
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{1/2}$	4	1	−0.460
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	4	1	−0.536
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	4	1	0.710
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	4	1	0.534
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	4	1	−0.255
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{1/2}$	4	1	−0.085
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	4	1	−0.482
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	4	1	0.788
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	4	1	0.276
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{1/2}$	4	1	−0.760
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	4	1	−0.270
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	4	1	0.801
$0f_{7/2}1p_{1/2}0f_{7/2}1p_{1/2}$	4	1	0.125
$0f_{7/2}1p_{1/2}0f_{5/2}0f_{5/2}$	4	1	−0.340
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{3/2}$	4	1	0.825
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	4	1	0.335
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	4	1	0.247
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	4	1	−0.106
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	5	1	0.898
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	5	1	−0.233
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	5	1	1.085
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	6	1	0.673
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	6	1	−1.207
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	6	1	−0.716

TABLE AIII. Same as in Table AI but for proton-neutron TBME.

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	0	0	−1.943
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	0	0	−2.690
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	0	0	−1.168
$0f_{7/2}0f_{7/2}1p_{1/2}1p_{1/2}$	0	0	−0.954
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	0	0	−0.902
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	0	0	−0.887
$0f_{5/2}0f_{5/2}1p_{1/2}1p_{1/2}$	0	0	−0.400
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	0	0	−1.061
$1p_{3/2}1p_{3/2}1p_{1/2}1p_{1/2}$	0	0	−1.181
$1p_{1/2}1p_{1/2}1p_{1/2}1p_{1/2}$	0	0	−0.182
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	1	0	−1.236
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	1	0	1.949
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{7/2}$	1	0	−1.893
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	1	0	1.835
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	1	0	0.480

TABLE AIII. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{5/2}$	1	0	−0.429
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	1	0	−0.748
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{1/2}$	1	0	0.583
$0f_{7/2}0f_{7/2}1p_{1/2}1p_{3/2}$	1	0	−0.586
$0f_{7/2}0f_{7/2}1p_{1/2}1p_{1/2}$	1	0	0.395
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	1	0	−2.369
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{7/2}$	1	0	2.520
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	1	0	−0.479
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	1	0	0.604
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{5/2}$	1	0	−0.697
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{3/2}$	1	0	1.066
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{1/2}$	1	0	−1.126
$0f_{7/2}0f_{5/2}1p_{1/2}1p_{3/2}$	1	0	1.085
$0f_{7/2}0f_{5/2}1p_{1/2}1p_{1/2}$	1	0	0.105
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{7/2}$	1	0	−2.204
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{5/2}$	1	0	0.562
$0f_{5/2}0f_{7/2}0f_{5/2}1p_{3/2}$	1	0	−0.666
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{5/2}$	1	0	0.602
$0f_{5/2}0f_{7/2}1p_{3/2}1p_{3/2}$	1	0	−1.061
$0f_{5/2}0f_{7/2}1p_{3/2}1p_{1/2}$	1	0	1.031
$0f_{5/2}0f_{7/2}1p_{1/2}1p_{3/2}$	1	0	−1.041
$0f_{5/2}0f_{7/2}1p_{1/2}1p_{1/2}$	1	0	−0.089
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	1	0	−0.654
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	1	0	−0.562
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{5/2}$	1	0	0.524
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	1	0	0.229
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{1/2}$	1	0	−0.034
$0f_{5/2}0f_{5/2}1p_{1/2}1p_{3/2}$	1	0	0.035
$0f_{5/2}0f_{5/2}1p_{1/2}1p_{1/2}$	1	0	−0.278
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	1	0	−1.597
$0f_{5/2}1p_{3/2}1p_{3/2}0f_{5/2}$	1	0	1.734
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{3/2}$	1	0	0.204
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{1/2}$	1	0	0.545
$0f_{5/2}1p_{3/2}1p_{1/2}1p_{3/2}$	1	0	−0.576
$0f_{5/2}1p_{3/2}1p_{1/2}1p_{1/2}$	1	0	−0.995
$1p_{3/2}0f_{5/2}1p_{3/2}0f_{5/2}$	1	0	−1.483
$1p_{3/2}0f_{5/2}1p_{3/2}1p_{3/2}$	1	0	−0.213
$1p_{3/2}0f_{5/2}1p_{3/2}1p_{1/2}$	1	0	−0.538
$1p_{3/2}0f_{5/2}1p_{1/2}1p_{3/2}$	1	0	0.484
$1p_{3/2}0f_{5/2}1p_{1/2}1p_{1/2}$	1	0	0.965
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	1	0	−0.442
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{1/2}$	1	0	1.390
$1p_{3/2}1p_{3/2}1p_{1/2}1p_{3/2}$	1	0	−1.359
$1p_{3/2}1p_{3/2}1p_{1/2}1p_{1/2}$	1	0	1.037
$1p_{3/2}1p_{1/2}1p_{3/2}1p_{1/2}$	1	0	−0.840
$1p_{3/2}1p_{1/2}1p_{1/2}1p_{3/2}$	1	0	1.171
$1p_{3/2}1p_{1/2}1p_{1/2}1p_{1/2}$	1	0	0.412
$1p_{1/2}1p_{3/2}1p_{1/2}1p_{3/2}$	1	0	−0.741
$1p_{1/2}1p_{3/2}1p_{1/2}1p_{1/2}$	1	0	−0.405
$1p_{1/2}1p_{1/2}1p_{1/2}1p_{1/2}$	1	0	−0.684
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	2	0	−0.988
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	2	0	0.110
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	2	0	−0.478
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{7/2}$	2	0	−0.118
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	2	0	−0.715
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	2	0	0.354
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{1/2}$	2	0	−0.454

TABLE AIII. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{7/2}$	2	0	−0.452
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{5/2}$	2	0	−0.334
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	2	0	−0.370
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{1/2}$	2	0	−0.293
$0f_{7/2}0f_{7/2}1p_{1/2}0f_{5/2}$	2	0	−0.414
$0f_{7/2}0f_{7/2}1p_{1/2}1p_{3/2}$	2	0	0.289
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	2	0	−1.807
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	2	0	−0.679
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{7/2}$	2	0	−1.753
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	2	0	−0.471
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	2	0	−0.564
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{1/2}$	2	0	0.287
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{7/2}$	2	0	0.683
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{5/2}$	2	0	−0.799
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{3/2}$	2	0	−0.030
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{1/2}$	2	0	−0.663
$0f_{7/2}0f_{5/2}1p_{1/2}0f_{5/2}$	2	0	−0.685
$0f_{7/2}0f_{5/2}1p_{1/2}1p_{3/2}$	2	0	−0.521
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	2	0	−0.777
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{7/2}$	2	0	−0.794
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	2	0	−0.500
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	2	0	−0.630
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{1/2}$	2	0	0.152
$0f_{7/2}1p_{3/2}1p_{3/2}0f_{7/2}$	2	0	−0.252
$0f_{7/2}1p_{3/2}1p_{3/2}0f_{5/2}$	2	0	−1.066
$0f_{7/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	0	−0.390
$0f_{7/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	0	−0.831
$0f_{7/2}1p_{3/2}1p_{1/2}0f_{5/2}$	2	0	−1.385
$0f_{7/2}1p_{3/2}1p_{1/2}1p_{3/2}$	2	0	−0.153
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{7/2}$	2	0	−1.701
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{5/2}$	2	0	0.539
$0f_{5/2}0f_{7/2}0f_{5/2}1p_{3/2}$	2	0	−0.825
$0f_{5/2}0f_{7/2}0f_{5/2}1p_{1/2}$	2	0	0.683
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{7/2}$	2	0	0.618
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{5/2}$	2	0	−0.478
$0f_{5/2}0f_{7/2}1p_{3/2}1p_{3/2}$	2	0	0.025
$0f_{5/2}0f_{7/2}1p_{3/2}1p_{1/2}$	2	0	−0.488
$0f_{5/2}0f_{7/2}1p_{1/2}0f_{5/2}$	2	0	−0.241
$0f_{5/2}0f_{7/2}1p_{1/2}1p_{3/2}$	2	0	−0.626
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	2	0	−0.375
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	2	0	0.039
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{1/2}$	2	0	−0.199
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{7/2}$	2	0	−0.375
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{5/2}$	2	0	−0.050
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	2	0	−0.172
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{1/2}$	2	0	−0.262
$0f_{5/2}0f_{5/2}1p_{1/2}0f_{5/2}$	2	0	−0.182
$0f_{5/2}0f_{5/2}1p_{1/2}1p_{3/2}$	2	0	0.244
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	2	0	−0.644
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{1/2}$	2	0	0.588
$0f_{5/2}1p_{3/2}1p_{3/2}0f_{7/2}$	2	0	1.053
$0f_{5/2}1p_{3/2}1p_{3/2}0f_{5/2}$	2	0	−0.765
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	0	0.146
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	0	−0.340
$0f_{5/2}1p_{3/2}1p_{1/2}0f_{5/2}$	2	0	0.004
$0f_{5/2}1p_{3/2}1p_{1/2}1p_{3/2}$	2	0	−0.594
$0f_{5/2}1p_{1/2}0f_{5/2}1p_{1/2}$	2	0	−0.364

TABLE AIII. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{5/2}1p_{1/2}1p_{3/2}0f_{7/2}$	2	0	−1.358
$0f_{5/2}1p_{1/2}1p_{3/2}0f_{5/2}$	2	0	−0.010
$0f_{5/2}1p_{1/2}1p_{3/2}1p_{3/2}$	2	0	−0.194
$0f_{5/2}1p_{1/2}1p_{3/2}1p_{1/2}$	2	0	0.052
$0f_{5/2}1p_{1/2}1p_{1/2}0f_{5/2}$	2	0	0.061
$0f_{5/2}1p_{1/2}1p_{1/2}1p_{3/2}$	2	0	0.541
$1p_{3/2}0f_{7/2}1p_{3/2}0f_{7/2}$	2	0	−0.700
$1p_{3/2}0f_{7/2}1p_{3/2}0f_{5/2}$	2	0	0.531
$1p_{3/2}0f_{7/2}1p_{3/2}1p_{3/2}$	2	0	−0.366
$1p_{3/2}0f_{7/2}1p_{3/2}1p_{1/2}$	2	0	0.109
$1p_{3/2}0f_{7/2}1p_{1/2}0f_{5/2}$	2	0	0.156
$1p_{3/2}0f_{7/2}1p_{1/2}1p_{3/2}$	2	0	0.804
$1p_{3/2}0f_{5/2}1p_{3/2}0f_{5/2}$	2	0	−0.584
$1p_{3/2}0f_{5/2}1p_{3/2}1p_{3/2}$	2	0	−0.093
$1p_{3/2}0f_{5/2}1p_{3/2}1p_{1/2}$	2	0	−0.607
$1p_{3/2}0f_{5/2}1p_{1/2}0f_{5/2}$	2	0	−0.519
$1p_{3/2}0f_{5/2}1p_{1/2}1p_{3/2}$	2	0	−0.314
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	2	0	−0.222
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{1/2}$	2	0	−0.498
$1p_{3/2}1p_{3/2}1p_{1/2}0f_{5/2}$	2	0	−0.287
$1p_{3/2}1p_{3/2}1p_{1/2}1p_{3/2}$	2	0	0.480
$1p_{3/2}1p_{1/2}1p_{3/2}1p_{1/2}$	2	0	−1.215
$1p_{3/2}1p_{1/2}1p_{1/2}0f_{5/2}$	2	0	−0.530
$1p_{3/2}1p_{1/2}1p_{1/2}1p_{3/2}$	2	0	−0.603
$1p_{1/2}0f_{5/2}1p_{1/2}0f_{5/2}$	2	0	−0.303
$1p_{1/2}0f_{5/2}1p_{1/2}1p_{3/2}$	2	0	−0.062
$1p_{1/2}1p_{3/2}1p_{1/2}1p_{3/2}$	2	0	−1.135
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	3	0	−0.340
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	3	0	1.014
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	3	0	−0.638
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{1/2}$	3	0	0.720
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{7/2}$	3	0	−0.982
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	3	0	0.963
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	3	0	−0.105
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{1/2}$	3	0	0.157
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{7/2}$	3	0	−0.587
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{5/2}$	3	0	0.112
$0f_{7/2}0f_{7/2}1p_{3/2}1p_{3/2}$	3	0	−0.536
$0f_{7/2}0f_{7/2}1p_{1/2}0f_{7/2}$	3	0	−0.623
$0f_{7/2}0f_{7/2}1p_{1/2}0f_{5/2}$	3	0	0.126
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	3	0	−0.512
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	3	0	0.130
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{1/2}$	3	0	−0.276
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{7/2}$	3	0	0.820
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	3	0	0.566
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	3	0	0.298
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{1/2}$	3	0	0.407
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{7/2}$	3	0	0.352
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{5/2}$	3	0	−0.412
$0f_{7/2}0f_{5/2}1p_{3/2}1p_{3/2}$	3	0	0.530
$0f_{7/2}0f_{5/2}1p_{1/2}0f_{7/2}$	3	0	0.400
$0f_{7/2}0f_{5/2}1p_{1/2}0f_{5/2}$	3	0	0.372
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	3	0	−0.415
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{1/2}$	3	0	0.979
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{7/2}$	3	0	−0.440
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	3	0	0.337
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	3	0	−0.325

TABLE AIII. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{1/2}$	3	0	0.369
$0f_{7/2}1p_{3/2}1p_{3/2}0f_{7/2}$	3	0	−0.486
$0f_{7/2}1p_{3/2}1p_{3/2}0f_{5/2}$	3	0	0.409
$0f_{7/2}1p_{3/2}1p_{3/2}1p_{3/2}$	3	0	−0.783
$0f_{7/2}1p_{3/2}1p_{1/2}0f_{7/2}$	3	0	−0.922
$0f_{7/2}1p_{3/2}1p_{1/2}0f_{5/2}$	3	0	0.415
$0f_{7/2}1p_{1/2}0f_{7/2}1p_{1/2}$	3	0	−0.775
$0f_{7/2}1p_{1/2}0f_{5/2}0f_{7/2}$	3	0	0.468
$0f_{7/2}1p_{1/2}0f_{5/2}0f_{5/2}$	3	0	−0.162
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{3/2}$	3	0	0.206
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{1/2}$	3	0	0.123
$0f_{7/2}1p_{1/2}1p_{3/2}0f_{7/2}$	3	0	0.928
$0f_{7/2}1p_{1/2}1p_{3/2}0f_{5/2}$	3	0	−0.022
$0f_{7/2}1p_{1/2}1p_{3/2}1p_{3/2}$	3	0	0.871
$0f_{7/2}1p_{1/2}1p_{1/2}0f_{7/2}$	3	0	1.013
$0f_{7/2}1p_{1/2}1p_{1/2}0f_{5/2}$	3	0	0.186
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{7/2}$	3	0	−0.440
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{5/2}$	3	0	−0.551
$0f_{5/2}0f_{7/2}0f_{5/2}1p_{3/2}$	3	0	−0.419
$0f_{5/2}0f_{7/2}0f_{5/2}1p_{1/2}$	3	0	−0.419
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{7/2}$	3	0	−0.119
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{5/2}$	3	0	0.260
$0f_{5/2}0f_{7/2}1p_{3/2}1p_{3/2}$	3	0	−0.528
$0f_{5/2}0f_{7/2}1p_{1/2}0f_{7/2}$	3	0	−0.200
$0f_{5/2}0f_{7/2}1p_{1/2}0f_{5/2}$	3	0	−0.376
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	3	0	−0.704
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	3	0	−0.336
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{1/2}$	3	0	−0.586
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{7/2}$	3	0	0.335
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{5/2}$	3	0	0.303
$0f_{5/2}0f_{5/2}1p_{3/2}1p_{3/2}$	3	0	−0.084
$0f_{5/2}0f_{5/2}1p_{1/2}0f_{7/2}$	3	0	0.199
$0f_{5/2}0f_{5/2}1p_{1/2}0f_{5/2}$	3	0	−0.529
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	3	0	−0.326
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{1/2}$	3	0	−0.706
$0f_{5/2}1p_{3/2}1p_{3/2}0f_{7/2}$	3	0	−0.359
$0f_{5/2}1p_{3/2}1p_{3/2}0f_{5/2}$	3	0	0.542
$0f_{5/2}1p_{3/2}1p_{3/2}1p_{3/2}$	3	0	−0.331
$0f_{5/2}1p_{3/2}1p_{1/2}0f_{7/2}$	3	0	0.062
$0f_{5/2}1p_{3/2}1p_{1/2}0f_{5/2}$	3	0	−0.773
$0f_{5/2}1p_{1/2}0f_{5/2}1p_{1/2}$	3	0	−0.915
$0f_{5/2}1p_{1/2}1p_{3/2}0f_{7/2}$	3	0	0.454
$0f_{5/2}1p_{1/2}1p_{3/2}0f_{5/2}$	3	0	0.788
$0f_{5/2}1p_{1/2}1p_{3/2}1p_{3/2}$	3	0	−0.053
$0f_{5/2}1p_{1/2}1p_{1/2}0f_{7/2}$	3	0	−0.105
$0f_{5/2}1p_{1/2}1p_{1/2}0f_{5/2}$	3	0	−0.970
$1p_{3/2}0f_{7/2}1p_{3/2}0f_{7/2}$	3	0	−0.400
$1p_{3/2}0f_{7/2}1p_{3/2}0f_{5/2}$	3	0	0.290
$1p_{3/2}0f_{7/2}1p_{3/2}1p_{3/2}$	3	0	−0.728
$1p_{3/2}0f_{7/2}1p_{1/2}0f_{7/2}$	3	0	−0.861
$1p_{3/2}0f_{7/2}1p_{1/2}0f_{5/2}$	3	0	0.333
$1p_{3/2}0f_{5/2}1p_{3/2}0f_{5/2}$	3	0	−0.320
$1p_{3/2}0f_{5/2}1p_{3/2}1p_{3/2}$	3	0	0.256
$1p_{3/2}0f_{5/2}1p_{1/2}0f_{7/2}$	3	0	0.117
$1p_{3/2}0f_{5/2}1p_{1/2}0f_{5/2}$	3	0	0.650
$1p_{3/2}1p_{3/2}1p_{3/2}1p_{3/2}$	3	0	−1.649
$1p_{3/2}1p_{3/2}1p_{1/2}0f_{7/2}$	3	0	−0.922

TABLE AIII. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$1p_{3/2}1p_{3/2}1p_{1/2}0f_{5/2}$	3	0	0.037
$1p_{1/2}0f_{7/2}1p_{1/2}0f_{7/2}$	3	0	−0.676
$1p_{1/2}0f_{7/2}1p_{1/2}0f_{5/2}$	3	0	−0.134
$1p_{1/2}0f_{5/2}1p_{1/2}0f_{5/2}$	3	0	−0.799
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	4	0	−0.178
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	4	0	−0.414
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	4	0	−0.318
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{1/2}$	4	0	−0.331
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{7/2}$	4	0	0.399
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	4	0	−0.525
$0f_{7/2}0f_{7/2}0f_{5/2}1p_{3/2}$	4	0	0.435
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{7/2}$	4	0	−0.291
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{5/2}$	4	0	−0.404
$0f_{7/2}0f_{7/2}1p_{1/2}0f_{7/2}$	4	0	0.278
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	4	0	−1.219
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	4	0	−0.234
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{1/2}$	4	0	−0.572
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{7/2}$	4	0	−1.244
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	4	0	−0.360
$0f_{7/2}0f_{5/2}0f_{5/2}1p_{3/2}$	4	0	−0.355
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{7/2}$	4	0	0.036
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{5/2}$	4	0	−0.941
$0f_{7/2}0f_{5/2}1p_{1/2}0f_{7/2}$	4	0	−0.489
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	4	0	−0.138
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{1/2}$	4	0	−0.392
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{7/2}$	4	0	−0.044
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	4	0	−0.211
$0f_{7/2}1p_{3/2}0f_{5/2}1p_{3/2}$	4	0	−0.028
$0f_{7/2}1p_{3/2}1p_{3/2}0f_{7/2}$	4	0	0.052
$0f_{7/2}1p_{3/2}1p_{3/2}0f_{5/2}$	4	0	−0.885
$0f_{7/2}1p_{3/2}1p_{1/2}0f_{7/2}$	4	0	0.383
$0f_{7/2}1p_{1/2}0f_{7/2}1p_{1/2}$	4	0	−0.727
$0f_{7/2}1p_{1/2}0f_{5/2}0f_{7/2}$	4	0	−0.595
$0f_{7/2}1p_{1/2}0f_{5/2}0f_{5/2}$	4	0	−0.266
$0f_{7/2}1p_{1/2}0f_{5/2}1p_{3/2}$	4	0	−0.584
$0f_{7/2}1p_{1/2}1p_{3/2}0f_{7/2}$	4	0	−0.403
$0f_{7/2}1p_{1/2}1p_{3/2}0f_{5/2}$	4	0	−1.401
$0f_{7/2}1p_{1/2}1p_{1/2}0f_{7/2}$	4	0	−0.382
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{7/2}$	4	0	−1.150
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{5/2}$	4	0	0.386
$0f_{5/2}0f_{7/2}0f_{5/2}1p_{3/2}$	4	0	−0.959
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{7/2}$	4	0	0.206
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{5/2}$	4	0	−0.280
$0f_{5/2}0f_{7/2}1p_{1/2}0f_{7/2}$	4	0	−0.479
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	4	0	−0.010
$0f_{5/2}0f_{5/2}0f_{5/2}1p_{3/2}$	4	0	0.148
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{7/2}$	4	0	−0.167
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{5/2}$	4	0	−0.136
$0f_{5/2}0f_{5/2}1p_{1/2}0f_{7/2}$	4	0	0.216
$0f_{5/2}1p_{3/2}0f_{5/2}1p_{3/2}$	4	0	−0.809
$0f_{5/2}1p_{3/2}1p_{3/2}0f_{7/2}$	4	0	0.855
$0f_{5/2}1p_{3/2}1p_{3/2}0f_{5/2}$	4	0	−0.328
$0f_{5/2}1p_{3/2}1p_{1/2}0f_{7/2}$	4	0	−1.384
$1p_{3/2}0f_{7/2}1p_{3/2}0f_{7/2}$	4	0	−0.151
$1p_{3/2}0f_{7/2}1p_{3/2}0f_{5/2}$	4	0	0.002
$1p_{3/2}0f_{7/2}1p_{1/2}0f_{7/2}$	4	0	0.311
$1p_{3/2}0f_{5/2}1p_{3/2}0f_{5/2}$	4	0	−0.722

TABLE AIII. *(Continued.)*

$n_a l_a j_a n_b l_b j_b n_c l_c j_c n_d l_d j_d$	J	T_z	TBME
$1p_{3/2}0f_{5/2}1p_{1/2}0f_{7/2}$	4	0	−0.570
$1p_{1/2}0f_{7/2}1p_{1/2}0f_{7/2}$	4	0	−0.647
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	5	0	−0.628
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	5	0	0.916
$0f_{7/2}0f_{7/2}0f_{7/2}1p_{3/2}$	5	0	−0.913
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{7/2}$	5	0	−0.896
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{5/2}$	5	0	0.304
$0f_{7/2}0f_{7/2}1p_{3/2}0f_{7/2}$	5	0	−0.817
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	5	0	0.174
$0f_{7/2}0f_{5/2}0f_{7/2}1p_{3/2}$	5	0	0.205
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{7/2}$	5	0	0.218
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{5/2}$	5	0	0.957
$0f_{7/2}0f_{5/2}1p_{3/2}0f_{7/2}$	5	0	0.382
$0f_{7/2}1p_{3/2}0f_{7/2}1p_{3/2}$	5	0	−1.313
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{7/2}$	5	0	−0.466
$0f_{7/2}1p_{3/2}0f_{5/2}0f_{5/2}$	5	0	0.056
$0f_{7/2}1p_{3/2}1p_{3/2}0f_{7/2}$	5	0	−1.585
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{7/2}$	5	0	0.206
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{5/2}$	5	0	−0.997
$0f_{5/2}0f_{7/2}1p_{3/2}0f_{7/2}$	5	0	−0.204
$0f_{5/2}0f_{5/2}0f_{5/2}0f_{5/2}$	5	0	−2.252
$0f_{5/2}0f_{5/2}1p_{3/2}0f_{7/2}$	5	0	0.188
$1p_{3/2}0f_{7/2}1p_{3/2}0f_{7/2}$	5	0	−1.188
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	6	0	0.193
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{5/2}$	6	0	−0.833
$0f_{7/2}0f_{7/2}0f_{5/2}0f_{7/2}$	6	0	0.778
$0f_{7/2}0f_{5/2}0f_{7/2}0f_{5/2}$	6	0	−2.421
$0f_{7/2}0f_{5/2}0f_{5/2}0f_{7/2}$	6	0	−1.047
$0f_{5/2}0f_{7/2}0f_{5/2}0f_{7/2}$	6	0	−2.290
$0f_{7/2}0f_{7/2}0f_{7/2}0f_{7/2}$	7	0	−2.874

TABLE AIV. Shell-model SP energies (in MeV) employed in the present work (see text for details).

nlj	SP energies
$0f_{7/2}$	0.0
$1p_{3/2}$	2.7
$1p_{1/2}$	5.5
$0f_{5/2}$	8.5

TABLE AV. Effective reduced single-neutron matrix elements of the electric quadrupole operator $E2$ (in e fm^2).

$n_a l_a j_a n_b l_b j_b$	$\langle a\|\|E2\|\|b\rangle$
$0f_{7/2}0f_{7/2}$	−9.307
$0f_{7/2}0f_{5/2}$	−4.002
$0f_{7/2}1p_{3/2}$	−7.153
$0f_{5/2}0f_{7/2}$	4.002
$0f_{5/2}0f_{5/2}$	−8.456
$0f_{5/2}1p_{3/2}$	2.882
$0f_{5/2}1p_{1/2}$	−5.064
$1p_{3/2}0f_{7/2}$	−7.150
$1p_{3/2}0f_{5/2}$	−2.882
$1p_{3/2}1p_{3/2}$	−4.711
$1p_{3/2}1p_{1/2}$	−4.944
$1p_{1/2}0f_{5/2}$	−5.063
$1p_{1/2}1p_{3/2}$	4.944

TABLE AVI. Effective reduced single-proton matrix elements of the electric quadrupole operator $E2$ (in e fm^2).

$n_a l_a j_a n_b l_b j_b$	$\langle a\|\|E2\|\|b\rangle$
$0f_{7/2}0f_{7/2}$	−18.241
$0f_{7/2}0f_{5/2}$	−6.899
$0f_{7/2}1p_{3/2}$	−18.562
$0f_{5/2}0f_{7/2}$	6.899
$0f_{5/2}0f_{5/2}$	−17.313
$0f_{5/2}1p_{3/2}$	8.573
$0f_{5/2}1p_{1/2}$	−15.934
$1p_{3/2}0f_{7/2}$	−18.562
$1p_{3/2}0f_{5/2}$	−8.573
$1p_{3/2}1p_{3/2}$	−15.156
$1p_{3/2}1p_{1/2}$	−15.579
$1p_{1/2}0f_{5/2}$	−15.862
$1p_{1/2}1p_{3/2}$	15.579

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