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DEPENDENCE OF THE GROUND STATE ENERGY AND QUADRUPOLE MOMENT ON DEFORMATION FOR HEAVY NUCLEI

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It has been pointed out[1,2] that although the sum of the single-particle energies for a nucleus is not equal to its total energy, the dependencies of the both energies on the deformation of the nucleus should be the same, at least, when the the deformation is not too large. In particular, the minima of both energies should appear at the same point (equilibrium deformation). This argument has been used for the calculation of the equilibrium deformation of a nucleus by finding the deformation at which the sum of the single-particle energies is minimal (see e.g. refs.[2-8]). In all the cited papers the single-particle energies have been calculated in an axially symmetric, volume-preserving Nilsson potential[9]. In refs.[3,5] the simple sum of these energies has been used (independent particle approximation IP). In refs.[2,4,6] the pairing forces have been taken into account with the wave function, describing a nuclear state, in the BCS form[10] (BCS approximation). In refs.[7,8] the effect of using the projected (PBCS) wave functions corresponding to a definite number of particles (PBCS approximation), instead of the BCS functions, has been investigated.

The aim of the present paper is to give the tables of the ground state energies and quadrupole moments calculated in the PBCS approximation as functions of the deformation for even nuclei in the heavy element region. The results obtained in the BCS and IP approximations have also been included to the tables for completeness. The tables have supplied a basis for ref.[8].

They allow to obtain the equilibrium deformations, quadrupole moments and deformation energies in all the three approximations[3-5,8] and to find the effect of the pairing forces and also the effect of the use of the projected wave functions, instead of the BCS ones, on all these quantities[4,8].

They can also give some orientation in the dependence of the restoring force in the equilibrium point on the neutron number N and the proton number Z , as well as in the dependence of the fission barrier on these numbers for some of the nuclei. They may be useful as well in a calculation of the equilibrium deformations of excited states [11,12].

The energy in the independent particle approximation is calculated from the formula (e.g.refs.[3,5])

$$\mathcal{E}^{IP} = \sum 2\epsilon_\nu \ , \qquad (1)$$

where ϵ_ν is the energy of a single-particle Nilsson level ν and the summation is extended from the lowest level up to the Fermi one.

In the BCS approximation the formula for the energy has the form (e.g. refs.[13,2])

$$\mathcal{E}^{BCS} = \sum_\nu \epsilon_\nu 2v_\nu^2 - \Delta^2/G \ , \qquad (2)$$

where the occupation factor of a level $2v_\nu^2 = 1-(\epsilon_\nu - \lambda)/E_\nu$ with $E_\nu = \sqrt{(\epsilon_\nu-\lambda)^2+\Delta^2}$. The chemical potential λ and the energy gap 2Δ are solutions of the equations

$$2/G = \sum_\nu 1/E_\nu$$

$$n = \sum_\nu 2v_\nu^2 \ . \qquad (3)$$

Here n is the number of particles (neutrons or protons) and G is the pairing force strength.

The PBCS approximation gives for the energy (e.g. refs.[14,8]).

$$\mathcal{E}^{PBCS} = \sum_{i=1}^{\ell} 2\epsilon_i + N^2\{ \sum_{\nu_1<\nu_2<\ldots<\nu_k} 2(\epsilon_{\nu_1} + \ldots + \epsilon_{\nu_k})\gamma_{\nu_1}^2 \ldots \gamma_{\nu_k}^2 -$$

$$- G \sum_{\sigma_1,\sigma_2} \gamma_{\sigma_1}\gamma_{\sigma_2} \sum_{\nu_2<\nu_3<\ldots<\nu_k \neq \sigma_1,\sigma_2} \gamma_{\nu_2}^2 \ldots \gamma_{\nu_k}^2 \} \ , \qquad (4)$$

where $\gamma_\nu = v_\nu/u_\nu$ with $u_\nu^2 = 1 - v_\nu^2$ and the normalization factor

$$N = (\sum_{\nu_1<\nu_2<\ldots<\nu_k} \gamma_{\nu_1}^2 \ldots \gamma_{\nu_k}^2)^{-1/2} \ .$$

The indices $i = 1,2,\ldots,\ell$ enumerate the levels for which $v_i = 1$, while the indices $\nu_i > \ell$ correspond to the levels for which $0 < v_{\nu_i} < 1$ i.e. to the levels between which the scattering of particles, due to the pairing forces, takes place. We have the equality $2(\ell + k) = n$, where n is the number of particles. The summation extends over all the combinations of k states (ordered with respect to the energy) chosen from the states for which $0 < v_{\nu_i} < 1$.

The expressions for the quadrupole moment, corresponding to the formulae (1), (2) and (4), are

$$Q^{IP} = \sum_{\nu} 2 q_{\nu\nu} \tag{5}$$

$$Q^{BCS} = \sum_{\nu} q_{\nu\nu}\, 2 v_{\nu}^{2} \tag{6}$$

$$Q^{PBCS} = \sum_{i=1} 2 q_{ii} + N^{2} \sum_{\nu_1 < \nu_2 < .. < \nu_k} 2 (q_{\nu_1 \nu_1} + \dots + q_{\nu_k \nu_k}) \gamma_{\nu_1}^{2} \dots \gamma_{\nu_k}^{2} \; , \tag{7}$$

where $q_{\nu\nu}$ is the matrix element of the quadrupole moment operator in the single-particle state $|\nu\rangle$.

All the quantities in the tables are calculated for seven values of the deformation $\eta = 0,2,3,4,5,6,7$ (for definition of the parameter η see ref. /9/).

Table 1 gives the single-particle energies ϵ_{ν} and quadrupole moment matrix elements $q_{\nu\nu}$ for proton (50 levels) and neutron (70 levels) states ordered with respect to the energy. The energies ϵ_{ν} as well as the matrix elements $q_{\nu\nu}$ are calculated in the ϵ -representation described in the Appendix A of ref. /9/. Using the notation of this ref. the formulae for ϵ_{ν} and $q_{\nu\nu}$ are

$$\epsilon_{\nu} = \hbar \mathring{\omega}_0 [(N_{\nu} + \tfrac{3}{2}) \frac{\omega_0(\epsilon)}{\mathring{\omega}_0} + r_{\nu}] + \Delta \epsilon_{\nu} \tag{8}$$

$$q_{\nu\nu} = \langle \nu | 3z'^{2} - r'^{2} | \nu \rangle = \frac{\hbar}{M \mathring{\omega}_0} (1 + \tfrac{1}{3}\epsilon + \tfrac{2}{9}\epsilon^{2}) \langle \nu | 3\zeta^{2} - \rho^{2} | \nu \rangle + \tag{9}$$
$$+ \tfrac{2}{3}\epsilon (1 + \tfrac{1}{3}\epsilon) \langle \nu | \rho^{2} | \nu \rangle + O(\epsilon^{3})] \, .$$

In the calculation of $q_{\nu\nu}$ the terms of the third order in ϵ have been dropped.

For each value of the deformation the second column in Table 1 specifies the quantum numbers of a state: $\nu = (N n_z \Lambda \Sigma)$, the third column gives the energies ϵ_{ν} in units of $\hbar\mathring{\omega}_0 = 41 A^{-\frac{1}{3}}$ MeV and the fourth column gives the corresponding matrix elements $q_{\nu\nu}$ in units of $\hbar / M \mathring{\omega}_0$. The quantities r_{ν} in eq. (8) and the wave functions $|\nu\rangle$ in eq. (9) are taken from refs. /9,3/. The values of the parameters μ and κ, to which they correspond, as well as the additional level shifts $\Delta\epsilon_{\nu}$, are specified in ref. /8/. They are the same as in variant 2 of ref. /4/. The values of ϵ_{ν} and $q_{\nu\nu}$ for $\eta = 3,5$ and for $\eta = 7$ (for which r_{ν} and $|\nu\rangle$ are not given in refs. /9,3/) are obtained from the corresponding values for $\eta = 2,4,6$ by a quadratic interpolation and extrapolation, respectively.

It should be stressed that the levels from the $N = 7$ shell for protons and from the $N = 8$ shell for neutrons have not been taken into account. These levels are probably important for the largest η at the end of the tables (the largest Z and N), but they should not have any significant effect on the energies and quadrupole moments of nuclei for the deformations not exceeding the equilibrium deformation, which is $\eta_{eq} \cong 4.5$ for the lagest Z and N in our tables/8/.

Table 2 gives the values of the energies calculated from eqs. (1),(2),(4) and of the quadrupole moments calculated from eqs. (5), (6),(7) for Z protons ($84 < Z < 104$) and N neutrons ($128 \leq N \leq 158$). All the energy values are in units of $\hbar\overset{\circ}{\omega}_0$ and the quadrupole moments in units of $\hbar/M\overset{\circ}{\omega}_0$.

As we are interested only in the dependence of the energy on the deformation and not in the energy itself, the constant, equal to the energy of the closed shells ($N = 0,1,2,3$ for protons and $N = 0,1,2,3,4$ for neutrons) for $\eta = 0$, has been dropped in all the three formulae (1), (2), (4). However all the contribution of these closed shells to the increase of the energy with the increasing deformation has been taken into account.

Column 1 of Table 2 specifies the number of particles (Z for protons and N for neutrons) and column 2 specifies the deformation η. Columns 3 and 4 give the solutions of eqs. (3): λ (in units of $\hbar\overset{\circ}{\omega}_0$) and Δ^2 (in units of $(\hbar\overset{\circ}{\omega}_0)^2$), respectively (for these solutions see also ref./15/). For solving the eqs. (3) 24 levels nearest to the Fermi surface (i.e. to the chemical potential λ) have been taken into account with the values of the pairing force strength $G_p = (32.20/A)$MeV for protons and $G_n = (26.04/A)$MeV for neutrons/4,15/. Thus, more explicitly, the equations

$$2/G_L = \sum_{s=s_0}^{s=s_0+28} \frac{1}{\sqrt{(\epsilon_s - \lambda)^2 + \Delta^2}} \tag{3a}$$

$$L - L_1 - 2(s_0 - 1) = \sum_{s=s_0}^{s=s_0+28} \left[1 - \frac{\epsilon_s - \lambda}{\sqrt{(\epsilon_s - \lambda)^2 + \Delta^2}}\right]$$

have been solved under the condition of $\sum_{s=s_0}^{s=s_0+28} (\epsilon_s - \lambda)^2 =$ minimum.

Here L stands for Z (protons) or N (neutrons), s is the number of a level as given in column I of Table 1 and L_1 is the number of particles occupying all the states lower in the energy than the states given in Table 1

($Z_1 = 40$ and $N_1 = 70$). The standard programme of the method of least squares has been employed to solve eqs. (3a).

Column (5) gives s_0 and columns 6–11 give Q^{IP}, Q^{BCS}, Q^{PBCS}, E^{IP}, E^{BCS} and E^{PBCS}, correspondingly. The quantities Q^{PBCS} and E^{PBCS} have been computed using an algorithm for calculating the elementary symmetrical polynomials /16/. For protons, the decrease- $\Delta \mathcal{E}_C = -[\mathcal{E}_C(\eta) - \mathcal{E}_C(0)]$ in the Coulomb energy $\mathcal{E}_C$ (in units of $\hbar \overset{\circ}{\omega}_0$) with the increasing deformation η is given in column 12. The energy $\mathcal{E}_C$ which is the Coulomb energy of a charged ellipsoid is calculated as described in ref. /8/.

All the calculations have been performed in the Computer Center in Dubna. We are indebted to G. Jungclaussen and A.A. Korneichuk for supplying us with the tables of the matrix elements $\langle \nu | 3\zeta^2 - \rho^2 | \nu \rangle$.

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Protons

Table 1

	$\eta = 0$		$\eta = 2$			$\eta = 3$			$\eta = 4$		
	ν	ε_ν	ν	ε_ν	$q_{\nu\nu}$	ν	ε_ν	$q_{\nu\nu}$	ν	ε_ν	$q_{\nu\nu}$
1	440+	4.52000	440+	4.41502	4.515	440+	4.35065	5.459	440+	4.28047	6.380
2	431+	4.52000	431+	4.44317	3.426	431+	4.39845	4.062	431+	4.35247	4.666
3	422+	4.52000	422+	4.49567	1.545	422+	4.48326	1.926	422+	4.47237	2.292
4	413+	4.52000	413+	4.56882	-0.896	413+	4.59693	-0.683	413+	4.62797	-0.472
5	404+	4.52000	404+	4.65957	-3.765	404+	4.73418	-3.642	431-	4.67952	6.986
6	420+	4.97000	431-	4.84612	5.668	431-	4.76168	6.421	404+	4.81217	-3.522
7	411+	4.97000	422-	4.90057	3.059	422-	4.86494	3.297	422-	4.83367	3.517
8	402+	4.97000	420+	4.91137	3.499	420+	4.87083	3.567	420+	4.83607	3.663
9	404-	4.97000	413-	4.98917	-0.078	550+	4.96618	5.779	550+	4.89461	6.699
10	431-	5.00500	411+	5.00677	0.171	541+	5.00040	4.870	541+	4.94471	5.612
11	422-	5.00500	550+	5.03285	4.887	413-	5.00535	0.020	413-	5.02602	0.133
12	413-	5.00500	541+	5.05395	4.121	411+	5.02005	0.181	532+	5.03786	3.747
13	550+	5.15000	532+	5.09520	2.687	532+	5.06623	3.222	411+	5.03862	0.227
14	541+	5.15000	404-	5.10027	-3.528	523+	5.15983	1.021	523+	5.16716	1.372
15	532+	5.15000	402+	5.12882	-3.440	404-	5.17145	-3.437	411-	5.18222	0.759
16	523+	5.15000	523+	5.15505	0.665	411-	5.17563	1.089	404-	5.24642	-3.344
17	514+	5.15000	411-	5.17847	1.609	402+	5.19896	-3.380	402+	5.27317	-3.310
18	505+	5.15000	514+	5.23180	-1.830	514+	5.27761	-1.614	514+	5.32706	-1.394
19	400+	5.25500	505+	5.32400	-4.732	505+	5.41678	-4.593	541-	5.46881	7.554
20	402-	5.25500	402-	5.35777	-3.066	402-	5.42333	-3.121	402-	5.49397	-3.135
21	411-	5.27000	400+	5.36677	-3.041	400+	5.43213	-3.103	400+	5.50262	-3.124
22	530+	5.75000	541-	5.62705	5.289	541-	5.55128	6.468	505+	5.51351	-4.456
23	521+	5.75000	532-	5.66005	3.988	532-	5.60839	4.658	532-	5.55746	5.251
24	512+	5.75000	523-	5.72255	1.718	660+	5.67923	7.217	660+	5.58695	8.447
25	503+	5.75000	660+	5.76353	6.005	651+	5.71039	6.319	651+	5.63425	7.307
26	505-	5.75000	651+	5.78228	5.304	523-	5.71050	2.046	530+	5.66316	6.481
27	660+	5.90500	530+	5.80710	5.246	530+	5.73326	5.960	523-	5.70221	2.353
28	651+	5.90500	514-	5.80930	-1.181	642+	5.77004	4.731	642+	5.72055	5.468
29	642+	5.90500	642+	5.81878	3.967	521+	5.84235	2.817	521+	5.82296	2.964
30	633+	5.90500	521+	5.86805	2.673	514-	5.84530	-1.023	633+	5.83880	3.179
31	624+	5.90500	633+	5.87158	2.122	633+	5.85430	2.660	514-	5.88591	-0.857
32	615+	5.90500	505-	5.91625	-4.524	624+	5.95978	0.210	624+	5.98380	0.563
33	606+	5.90500	624+	5.93918	-0.148	512+	5.99419	-0.617	512+	6.02906	-0.552
34	541-	5.93000	512+	5.96535	-0.650	505-	6.00593	-4.414	521-	6.03286	4.511
35	532-	5.93000	615+	6.02018	-2.771	521-	6.08161	4.867	505-	6.09991	-4.299
36	523-	5.93000	503+	6.08770	-4.356	615+	6.08382	-2.543	516+	6.15175	-2.313
37	514-	5.93000	606+	6.11348	-5.699	503+	6.17518	-4.281	503+	6.26741	-4.197
38	510+	6.28000	521-	6.14470	5.316	606+	6.22435	-5.540	512-	6.30386	0.127
39	501+	6.28000	512-	6.26860	0.522	512-	6.28171	0.280	606+	6.33980	-5.389
40	503-	6.28000	510+	6.32585	1.055	510+	6.33372	0.585	510+	6.35211	0.277
41	521-	6.38000	503-	6.42295	-4.035	503-	6.50613	-4.034	651-	6.48765	10.022
42	512-	6.38000	501+	6.50940	-3.891	501+	6.59098	-3.942	640+	6.56715	8.080
43	501-	6.53000	501-	6.62650	-3.561	651-	6.59888	8.483	642-	6.59010	7.319
44	651-	6.85000	651-	6.69973	6.635	640+	6.65804	7.429	503-	6.59481	-4.006
45	642-	6.85000	642-	6.73918	5.158	642-	6.66555	6.346	501+	6.67846	-3.952
46	633-	6.85000	640+	6.75263	6.613	501-	6.70460	-3.741	631+	6.69060	4.953
47	624-	6.85000	631+	6.79058	4.629	631+	6.73708	4.769	633-	6.73635	4.432
48	615-	6.85000	633-	6.80653	3.019	633-	6.77064	3.793	501-	6.78946	-3.839
49	640+	6.90500	622+	6.85608	1.773	622+	6.85177	1.678	622+	6.85505	1.689
50	631+	6.90500	624-	6.89313	0.530	624-	6.90064	0.983	631-	6.91180	6.667

	$\eta=5$			$\eta=6$			$\eta=7$		
	ν	ε_ν	$q_{\nu\nu}$	ν	ε_ν	$q_{\nu\nu}$	ν	ε_ν	$q_{\nu\nu}$
I	440+	4.20460	7.266	440+	4.I23I4	8.I27	440+	4.036I4	8.952
2	43I+	4.30533	5.230	43I+	4.257I4	5.759	43I+	4.20794	6.245
3	422+	4.463I0	2.643	422+	4.45554	2.978	43I-	4.44767	7.395
4	43I-	4.59974	7.34I	43I-	4.52244	7.484	422+	4.44976	3.294
5	4I3+	4.66204	-0.260	4I3+	4.69924	-0.049	550+	4.65I67	9.594
6	422-	4.80687	3.7I6	550+	4.73726	8.603	4I3+	4.73962	0.I59
7	420+	4.8072I	3.785	420+	4.78434	3.938	54I+	4.76608	7.743
8	550+	4.8I825	7.637	422-	4.78464	3.893	422-	4.76703	4.046
9	54I+	4.88702	6.336	54I+	4.82746	7.048	420+	4.76752	4.I20
I0	404+	4.89364	-3.395	404+	4.97869	-3.270	532+	4.95762	5.233
II	532+	5.0I022	4.256	532+	4.98346	4.753	404+	5.06737	-3.I43
I2	4I3-	5.05I30	0.263	4I3-	5.08I29	0.409	4I3-	5.II604	0.573
I3	4II+	5.06260	0.3I4	4II+	5.09209	0.440	4II+	5.I27I4	0.6I0
I4	523+	5.I77I5	I.7I7	523+	5.I8996	2.054	54I-	5.I8247	I0.I42
I5	4II-	5.I9836	0.630	4II-	5.224I4	0.7I3	523+	5.20562	2.384
I6	404-	5.32528	-3.239	54I-	5.2843I	9.395	4II-	5.25962	I.02I
I7	402+	5.35I56	-3.220	660+	5.37903	I0.934	660+	5.26360	I2.200
I8	54I-	5.37977	8.528	404-	5.408I4	-3.I30	65I+	5.38I76	I0.050
I9	5I4+	5.38028	-I.I68	402+	5.43424	-3.II8	532-	5.4I028	6.477
20	660+	5.48684	9.68I	5I4+	5.4374I	-0.94I	530+	5.47645	6.7I9
2I	532-	5.50738	5.753	532-	5.4583I	6.I65	404-	5.49504	-3.0I4
22	65I+	5.55402	8.255	65I+	5.46983	9.I72	5I4+	5.49850	-0.709
23	402-	5.56979	-3.095	530+	5.53466	6.872	402+	5.52I25	-2.999
24	400+	5.57834	-3.092	642+	5.6I988	6.83I	642+	5.5689I	7.457
25	530+	5.5969I	6.787	402-	5.65089	-3.009	523-	5.70I09	3.II7
26	505+	5.6I432	-4.3II	400+	5.65939	-3.0II	402-	5.73732	-2.868
27	642+	5.67045	6.I66	523-	5.6974I	2.890	400+	5.74582	-2.876
28	523-	5.69780	2.635	505+	5.7I936	-4.I70	52I+	5.80384	3.397
29	52I+	5.8I000	3.II0	52I+	5.8036I	3.254	633+	5.80437	4.606
30	633+	5.82523	3.676	633+	5.8I372	4.I54	505+	5.82867	-4.026
3I	5I4-	5.93I26	-0.683	52I-	5.9789I	4.075	52I-	5.97390	4.009
32	52I-	5.99858	4.244	5I4-	5.98I5I	-0.504	5I4-	6.03668	-0.3I7
33	624+	6.0II39	0.9I0	624+	6.04268	I.25I	624+	6.07775	I.585
34	5I2+	6.07008	-0.45I	5I2+	6.II74I	-0.3I9	65I-	6.093I4	I2.527
35	505-	6.I9832	-4.I70	65I-	6.23468	I2.062	5I2+	6.I7I08	-0.I48
36	6I5+	6.224I2	-2.074	6I5+	6.30I08	-I.83I	640+	6.3I8II	8.884
37	5I2-	6.335I8	0.068	505-	6.30I3I	-4.040	642-	6.35422	8.773
38	503+	6.36450	-4.094	5I2-	6.3758I	0.I07	6I5+	6.38269	-I.583
39	65I-	6.36620	II.2I6	640+	6.39708	8.8I7	505-	6.40892	-3.89I
40	5I0+	6.38II4	0.I40	5I0+	6.42096	0.I80	5I2-	6.42580	0.250
4I	606+	6.45998	-5.228	642-	6.43433	8.545	5I0+	6.47I6I	0.4I0
42	640+	6.480I2	8.542	503+	6.4666I	-3.983	503+	6.57377	-3.856
43	642-	6.5I298	8.053	606+	6.58503	-5.070	63I+	6.59474	5.762
44	63I+	6.65I30	5.I75	63I+	6.6I933	5.446	633-	6.6484I	5.429
45	503-	6.689I0	-3.94I	633-	6.67553	5.258	606+	6.7I502	-4.9I0
46	633-	6.70500	4.92I	503-	6.789I6	-3.847	63I-	6.77599	6.256
47	50I+	6.77I95	-3.909	63I-	6.804I3	6.26I	503-	6.89502	-3.7I6
48	63I-	6.84942	6.399	50I+	6.87I6I	-3.822	622+	6.9II84	2.42I
49	622+	6.86607	I.8I2	622+	6.88498	2.054	624-	6.9726I	2.I20
50	50I-	6.88I22	-3.843	624-	6.94808	I.947	50I+	6.97747	-3.680

	η=0		η=2			η=3			η=4		
	ν	εν	ν	εν	qνν	ν	εν	qνν	ν	εν	qνν
I	550+	5.34500	550+	5.2I974	5.390	550+	5.I4287	6.529	550+	5.05846	7.655
2	54I+	5.34500	54I+	5.24274	4.492	54I+	5.I8202	5.352	54I+	5.II84I	6.I72
3	532+	5.34500	532+	5.28659	2.880	532+	5.25397	3.458	532+	5.22I8I	4.0I0
4	523+	5.34500	523+	5.34869	0.73I	523+	5.3523I	I.096	523+	5.35846	I.453
5	5I4+	5.34500	5I4+	5.42679	-I.830	5I4+	5.4726I	-I.609	54I-	5.5I356	8.865
6	505+	5.34500	505+	5.5I900	-4.732	505+	5.6II59	-4.593	5I4+	5.52206	-I.387
7	54I-	5.85000	54I-	5.7I390	6.249	54I-	5.6I5I6	7.746	530+	5.6233I	5.948
8	532-	5.85000	530+	5.76II5	5.539	530+	5.689I3	5.736	532-	5.65II6	5.580
9	523-	5.85000	532-	5.76585	4.292	532-	5.70744	5.003	505+	5.7085I	-4.456
I0	5I4-	5.85000	52I+	5.8I9I5	2.658	52I+	5.79686	2.6I4	52I+	5.78I4I	2.648
II	530+	5.89500	523-	5.84700	I.7I8	523-	5.83406	2.075	523-	5.825II	2.394
I2	52I+	5.89500	5I2+	5.90655	-0.7I8	5I2+	5.93806	-0.770	660+	5.85695	8.447
I3	5I2+	5.89500	5I4-	5.94690	-I.240	660+	5.94923	7.2I7	65I+	5.90425	7.307
I4	503+	5.89500	503+	6.0I645	-4.366	65I+	5.98039	6.3I9	52I-	5.952II	3.503
I5	505-	5.89500	660+	6.03353	6.005	5I4-	5.98344	-I.06I	5I2+	5.9757I	-0.754
I6	52I-	6.I7500	52I-	6.03395	4.729	52I-	5.98638	3.984	642+	5.99055	5.468
I7	5I2-	6.I7500	65I+	6.05228	5.304	642+	6.04004	4.73I	5I4-	6.02456	-0.884
I8	660+	6.I7500	505-	6.06I25	-4.524	503+	6.I0456	-4.3I6	633+	6.I0880	3.I79
I9	65I+	6.I7500	642+	6.08878	3.967	633+	6.I2430	2.660	503+	6.I9746	-4.248
20	642+	6.I7500	633+	6.I4I58	2.I22	505-	6.I5093	-4.405	5I0+	6.2I746	-0.267
2I	633+	6.I7500	5I0+	6.I6990	0.2I0	5I0+	6.I8933	-0.09I	5I2-	6.2340I	-0.306
22	624+	6.I7500	5I2-	6.I84I0	0.07I	5I2-	6.20493	-0.I72	505-	6.2449I	-4.288
23	6I5+	6.I7500	624+	6.209I8	-0.I48	624+	6.22978	0.2I0	624+	6.25380	0.563
24	606+	6.I7500	6I5+	6.290I8	-2.77I	6I5+	6.35382	-2.543	6I5+	6.42I75	-2.3I3
25	5I0+	6.20000	50I+	6.32325	-4.090	50I+	6.40764	-4.I06	65I-	6.48765	I0.022
26	50I+	6.20000	503-	6.34590	-4.I52	503-	6.43096	-4.I45	50I+	6.4975I	-4.088
27	503-	6.20000	606+	6.38348	-5.699	606+	6.49435	-5.542	503-	6.52I3I	-4.I08
28	50I-	6.32500	50I-	6.43545	-3.890	50I-	6.5I775	-3.980	640+	6.567I5	8.080
29	65I-	6.85000	65I-	6.69973	6.635	65I-	6.59888	8.483	642-	6.590I0	7.3I9
30	642-	6.85000	642-	6.739I8	5.I58	640+	6.65804	7.429	50I-	6.60606	-4.0I7
3I	633-	6.85000	640+	6.75263	6.6I3	642-	6.66555	6.346	606+	6.60980	-5.389
32	624-	6.85000	63I+	6.79058	4.629	770+	6.7I467	8.I43	770+	6.6I054	9.53I
33	6I5-	6.85000	633-	6.80653	3.0I9	63I+	6.73708	4.769	76I+	6.65099	8.57I
34	640+	6.90500	770+	6.80976	6.787	76I+	6.74I27	7.389	63I+	6.69060	4.953
35	63I+	6.90500	76I+	6.82586	6.I87	633-	6.77064	3.793	752+	6.72654	6.9I7

36	622+	6.90500	622+	6.85608	I.773	752+	6.79307	5.988	633-	6.73675	4.432
37	6I3+	6.90500	752+	6.85746	5.030	622+	6.85I77	I.678	743+	6.83I74	4.8I9
38	604+	6.90500	624-	6.893I3	0.530	743+	6.86732	4.I20	622+	6.85505	I.689
39	606-	6.90500	743+	6.90366	3.395	624-	6.90064	0.983	63I-	6.9II80	6.667
40	770+	6.97000	6I3+	6.94443	-I.629	734+	6.96I38	I.868	624-	6.9I220	I.374
4I	76I+	6.97000	734+	6.9633I	I.349	63I-	6.99II2	7.050	734+	6.96229	2.376
42	752+	6.97000	6I5-	6.99393	-2.3I0	6I3+	6.99403	-I.70I	6I3+	7.05040	-I.692
43	743+	6.97000	725+	7.03539	-I.045	6I5-	7.04965	-2.074	6I5-	7.II030	-I.853
44	734+	6.97000	604+	7.05233	-5.3I3	725+	7.07296	-0.682	725+	7.II479	-0.322
45	725+	6.97000	63I-	7.08723	7.552	620+	7.I5784	2.942	620+	7.I4290	2.672
46	7I6+	6.97000	606-	7.I0673	-5.5I3	604+	7.I5862	-5.262	622-	7.I6260	2.577
47	707+	6.97000	7I6+	7.II846	-3.7I8	622-	7.I7503	2.74I	76I-	7.25829	I0.59I
48	63I-	7.26500	620+	7.I8483	3.373	7I6+	7.20037	-3.479	604+	7.27030	-5.I85
49	622-	7.26500	622-	7.I9858	3.020	606-	7.2I486	-5.380	7I6+	7.28684	-3.236
50	6I3-	7.26500	707+	7.2I296	-6.666	707+	7.34I92	-6.493	606-	7.32785	-5.245
5I	620+	7.30000	6II+	7.30833	-0.853	6II+	7.34634	-I.058	752-	7.35I69	8.207
52	6II+	7.30000	6I3-	7.334I3	-I.090	6I3-	7.37472	-I.203	750+	7.37379	I0.539
53	602+	7.30000	6II-	7.45058	0.008	76I-	7.37637	8.963	6II+	7.39320	-I.I66
54	604-	7.30000	602+	7.45I88	-4.847	752-	7.4363I	7.064	6I3-	7.42340	-I.244
55	6II-	7.50000	76I-	7.48I9I	7.296	6II-	7.47996	-0.556	74I+	7.46334	7.759
56	600+	7.5I500	604-	7.48483	-5.I84	750+	7.49II5	9.303	707+	7.47609	-6.323
57	602-	7.5I500	752-	7.5I545	5.882	743-	7.53499	4.608	743-	7.49069	5.539
58	76I-	7.65000	743-	7.57600	3.636	74I+	7.54504	7.I76	6II-	7.52050	-0.908
59	752-	7.65000	750+	7.60645	7.623	602+	7.55454	-4.96I	732+	7.59274	4.68I
60	743-	7.65000	74I+	7.63290	6.369	604-	7.58845	-5.II7	734-	7.65894	2.802
6I	734-	7.65000	734-	7.65800	0.89I	732+	7.63I47	4.555	602+	7.66320	-5.000
62	725-	7.65000	600+	7.66083	-4.8I9	734-	7.65982	I.9I4	74I-	7.69244	9.256
63	7I6-	7.65000	602-	7.67I98	-4.839	723+	7.74327	I.537	604-	7.69780	-5.039
64	750+	7.78000	732+	7.68II0	4.38I	600+	7.76036	-4.903	723+	7.75294	I.3I7
65	74I+	7.78000	723+	7.747I0	I.886	602-	7.77I77	-4.892	725-	7.84839	-0.0I6
66	732+	7.78000	725-	7.75760	-2.I82	74I-	7.80I89	8.972	600+	7.86660	-4.923
67	723+	7.78000	7I4+	7.82785	-0.984	725-	7.80409	-0.953	602-	7.87820	-4.898
68	7I4+	7.78000	7I6-	7.87295	-5.492	7I4+	7.87668	-I.782	730+	7.88924	5.485
69	705+	7.78000	705+	7.92050	-4.I48	730+	7.94647	5.96I	732-	7.9I494	5.032
70	707-	7.78000	74I-	7.92540	8.4I4	732-	7.95884	4.857	7I4+	7.93944	-2.270

	$\eta=5$			$\eta=6$			$\eta=7$		
	ν	ε_ν	$q_{\nu\nu}$	ν	ε_ν	$q_{\nu\nu}$	ν	ε_ν	$q_{\nu\nu}$
I	550+	4.96664	8.754	550+	4.86756	9.836	550+	4.76I26	I0.894
2	54I+	5.05204	6.938	54I+	4.98306	7.656	54I+	4.9II5I	8.3I7
3	532+	5.I9024	4.528	532+	5.I594I	5.0I5	532+	5.I2936	5.466
4	523+	5.36726	I.799	54I-	5.30226	9.846	54I-	5.I9275	9.660
5	54I-	5.4092I	9.569	523+	5.37886	2.I32	523+	5.39330	2.453
6	530+	5.56382	6.I68	530+	5.5I08I	6.402	530+	5.46432	6.647
7	5I4+	5.57528	-I.I63	532-	5.5455I	6.283	532-	5.49633	6.39I
8	532-	5.597I3	6.008	5I4+	5.6324I	-0.94I	660+	5.53360	I2.200
9	660+	5.75684	9.68I	660+	5.64903	I0.934	65I+	5.65I76	I0.050
I0	52I+	5.7729I	2.76I	65I+	5.73983	9.I72	5I4+	5.69350	-0.7I8
II	505+	5.80938	-4.3II	52I+	5.77I5I	2.960	52I+	5.77725	3.248
I2	523-	5.82028	2.667	523-	5.8I97I	2.893	523-	5.82345	3.068
I3	65I+	5.82402	8.255	642+	5.88988	6.83I	642+	5.8389I	7.457
I4	52I-	5.93I25	3.298	505+	5.9I436	-4.I70	52I-	5.93027	3.782
I5	642+	5.94045	6.I66	52I-	5.92396	3.385	505+	6.02348	-4.026
I6	5I2+	6.0I963	-0.664	5I2+	6.06966	-0.50I	633+	6.07437	4.606
I7	5I4-	6.07038	-0.706	633+	6.08372	4.I54	65I-	6.093I4	I2.527
I8	633+	6.09523	3.676	5I4-	6.I2I06	-0.532	5I2+	6.I2675	-0.258
I9	5I0+	6.25440	-0.308	65I-	6.23468	I2.062	5I4-	6.I7663	-0.360
20	5I2-	6.27I47	-0.323	5I0+	6.3003I	-0.2I2	770+	6.24544	I3.840
2I	624+	6.28I39	0.9I0	624+	6.3I268	I.25I	640+	6.3I8II	8.884
22	503+	6.29528	-4.I50	5I2-	6.3I746	-0.22I	76I+	6.34764	II.92I
23	505-	6.34332	-4.I6I	770+	6.37580	I2.374	624+	6.34775	I.585
24	65I-	6.36620	II.220	640+	6.39708	8.8I7	642-	6.35422	8.773
25	640+	6.480I2	8.542	503+	6.398I6	-4.032	5I0+	6.35522	0.033
26	6I5+	6.494I2	-2.074	642-	6.43433	8.545	5I2-	6.37202	0.0I2
27	770+	6.49752	I0.940	505-	6.4463I	-4.036	503+	6.506I5	-3.888
28	642-	6.5I298	8.053	76I+	6.45405	I0.835	752+	6.5I574	9.450
29	76I+	6.555I9	9.7I6	6I5+	6.57I08	-I.83I	505-	6.55392	-3.907
30	50I+	6.59298	-4.022	752+	6.58775	8.648	63I+	6.59474	5.762
3I	503-	6.6I706	-4.032	63I+	6.6I933	5.446	633-	6.6484I	5.429
32	63I+	6.65I30	5.I75	633-	6.67553	5.258	6I5+	6.65269	-I.583
33	752+	6.65804	7.80I	50I+	6.6942I	-3.920	743+	6.73I09	6.705
34	50I-	6.70050	-3.990	503-	6.7I836	-3.926	63I-	6.77599	6.256
35	633-	6.70500	4.92I	743+	6.76350	6.II2	50I+	6.80I23	-3.77I
36	606+	6.72998	-5.228	50I-	6.80I2I	-3.907	503-	6.82525	-3.78I
37	743+	6.79707	5.482	63I-	6.804I3	6.26I	76I-	6.83044	I5.I54
38	63I-	6.84942	6.399	606+	6.85503	-5.070	50I-	6.90824	-3.757
39	622+	6.86607	I.8I2	622+	6.88498	2.054	622+	6.9II84	2.42I
40	624-	6.92797	I.696	624-	6.94808	I.947	624-	6.9726I	2.I20
4I	734+	6.96620	2.868	734+	6.97330	3.344	734+	6.98365	3.804
42	6I3+	7.II369	-I.590	76I-	6.98520	I3.686	606+	6.98502	-4.9I0
43	76I-	7.I2784	I2.I60	750+	7.I3360	II.526	750+	7.0II02	II.222
44	620+	7.I40I7	2.567	620+	7.I4978	2.639	752-	7.06658	II.3I6
45	725+	7.I6I0I	0.035	752-	7.I6670	I0.333	620+	7.I7I8I	2.898
46	622-	7.I6II4	2.529	622-	7.I7I08	2.608	622-	7.I9240	2.8I9
47	6I5-	7.I7603	-I.643	6I3+	7.I8403	-I.396	74I+	7.2568I	7.956
48	750+	7.25454	II.280	725+	7.2II80	0.385	6I3+	7.26I50	-I.I02
49	752-	7.26I76	9.293	6I5-	7.24698	-I.449	725+	7.26723	0.732
50	7I6+	7.37802	-2.980	74I+	7.3I9I0	8.I62	6I5-	7.32322	-I.27I
5I	604+	7.38752	-5.070	743-	7.39295	7.242	743-	7.33976	8.0II
52	74I+	7.38796	8.089	7I6+	7.474I0	-2.72I	74I-	7.450I6	8.2I0
53	743-	7.44328	6.4I5	604+	7.5I043	-4.924	732+	7.54354	4.685
54	606-	7.44584	-5.095	6II+	7.5I403	-I.059	7I6+	7.575I4	-2.453
55	6II+	7.44905	-I.I67	74I-	7.5I645	8.892	6II+	7.5882I	-0.833
56	6I3-	7.48032	-I.205	6I3-	7.54562	-I.086	6I3-	7.6I939	-0.880
57	732+	7.56507	4.744	732+	7.54865	4.748	604+	7.63909	-4.74I
58	6II-	7.57236	-I.035	606-	7.56897	-4.94I	734-	7.64I69	4.544
59	74I-	7.59723	9.23I	6II-	7.63567	-0.926	606-	7.69733	-4.777
60	707+	7.6I562	-6.I44	734-	7.64975	4.I26	6II-	7.7I053	-0.566
6I	734-	7.65552	3.54I	707+	7.76070	-5.970	730+	7.8I674	5.74I
62	723+	7.77627	I.229	723+	7.8I345	I.28I	732-	7.8456I	5.I95
63	602+	7.77800	-4.950	730+	7.82425	5.356	723+	7.86454	I.48I
64	604-	7.8I303	-4.937	732-	7.85820	5.204	707+	7.9II39	-5.793
65	730+	7.84844	5.275	602+	7.89907	-4.8I6	725-	7.96986	0.864
66	732-	7.88I33	5.I47	725-	7.93II5	0.9I3	602+	8.0265I	-4.588
67	725-	7.89068	0.6I3	604-	7.93427	-4.820	604-	8.06I62	-4.684
68	600+	7.9797I	-4.863	600+	8.09982	-4.73I	72I+	8.I9369	2.I27
69	602-	7.99I42	-4.844	7I4+	8.I0745	-2.239	7I4+	8.2I295	-I.682
70	7I4+	8.0I630	-2.426	602-	8.III57	-4.736	600+	8.22703	-4.5I6

Table 2

Protons

Z	η	λ	Δ^2	s_0	Q^{IP}	Q^{BCS}	Q^{PBCS}	ε^{IP}	ε^{BCS}	ε^{PBCS}	$-\Delta\varepsilon_c$
1	2	3	4	5	6	7	8	9	10	11	12
	0	5.64973	0.010124	14	0	0	0	219.850	219.610	219.375	0
	2	5.60157	0.010212	13	43.864	42.805	42.303	219.946	219.834	219.560	0.057
	3	5.55635	0.015664	13	63.368	69.293	67.487	220.239	220.103	219.814	0.143
84	4	5.54341	0.024601	11	83.033	107.732	106.430	220.718	220.366	220.050	0.342
	5	5.53852	0.027467	11	171.220	150.920	151.064	220.965	220.513	220.200	0.666
	6	5.53624	0.024741	10	195.712	193.939	194.543	220.824	220.532	220.188	1.069
	7	5.54170	0.020830	11	239.266	234.458	235.087	220.749	220.454	220.133	1.512
	0	5.68734	0.016682	14	0	0	0	231.350	230.958	230.701	0
	2	5.64775	0.015093	15	51.840	49.440	49.375	231.266	231.093	230.846	0.076
	3	5.60799	0.017348	13	72.684	76.672	75.694	231.456	231.280	230.979	0.176
86	4	5.58036	0.023507	12	93.535	112.419	111.250	231.833	231.507	231.194	0.367
	5	5.57447	0.026102	11	165.030	156.268	156.452	232.104	231.645	231.316	0.705
	6	5.57631	0.022520	11	209.456	199.566	200.566	231.893	231.660	231.319	1.121
	7	5.58636	0.017874	11	233.268	239.054	239.587	231.792	231.595	231.250	1.557
	0	5.71896	0.020712	17	0	0	0	242.850	242.380	242.176	0
	2	5.68933	0.018820	15	55.276	55.661	55.767	242.711	242.442	242.180	0.096
	3	5.65189	0.018824	14	87.118	84.531	84.154	242.814	242.553	242.263	0.214
88	4	5.61758	0.021995	13	110.429	118.582	117.770	243.007	242.720	242.411	0.408
	5	5.60846	0.023950	12	158.846	161.097	161.222	243.261	242.846	242.522	0.738
	6	5.61713	0.020566	12	223.118	204.765	205.787	243.133	242.869	242.535	1.157
	7	5.63666	0.015154	12	248.182	243.151	244.186	242.930	242.829	242.476	1.591
	0	5.75102	0.024094	17	0	0	0	254.350	253.866	253.642	0
	2	5.72558	0.021413	16	67.286	61.166	61.489	254.238	253.872	253.617	0.115
	3	5.69130	0.019585	15	99.756	92.260	92.397	254.235	253.911	253.630	0.252
90	4	5.65563	0.020054	14	125.043	125.678	125.404	254.276	254.009	253.703	0.452
	5	5.64281	0.021159	13	172.420	165.657	165.674	254.455	254.114	253.792	0.765
	6	5.65780	0.018665	12	217.100	208.238	209.007	254.435	254.158	253.812	1.184
	7	5.68977	0.014468	12	254.416	245.923	246.749	254.332	254.166	253.812	1.602
	0	5.77973	0.026556	19	0	0	0	265.850	265.411	265.213	0
	2	5.75886	0.023304	17	77.894	66.413	66.936	265.803	265.369	265.120	0.134
	3	5.72837	0.019856	16	103.848	99.759	100.340	265.656	265.343	265.066	0.277
92	4	5.69575	0.017963	14	138.005	133.650	133.857	265.602	265.370	265.046	0.504
	5	5.68012	0.017866	13	163.798	170.475	170.386	265.683	265.447	265.105	0.799
	6	5.69659	0.016516	13	211.078	210.499	210.855	265.753	265.523	265.182	1.193
	7	5.73449	0.014347	13	248.680	247.580	247.888	265.807	265.600	265.258	1.612
	0	5.80937	0.028320	19	0	0	0	277.660	277.019	276.803	0
	2	5.79165	0.024142	17	88.386	71.401	72.115	277.417	276.936	276.670	0.152
	3	5.76494	0.019305	17	115.768	106.967	107.916	277.122	276.851	276.575	0.332
94	4	5.73676	0.015248	15	142.711	141.490	142.112	277.007	276.815	276.491	0.562
	5	5.72032	0.013849	14	176.130	175.550	175.556	277.024	276.858	276.514	0.834
	6	5.73623	0.013755	14	216.858	212.166	212.030	277.148	276.965	276.627	1.192
	7	5.77503	0.013389	14	242.928	248.965	248.817	277.298	277.119	276.785	1.599
	0	5.83781	0.029301	19	0	0	0	289.470	288.686	288.454	0
	2	5.82251	0.024124	18	86.024	75.707	76.622	289.036	288.566	288.304	0.167
	3	5.80281	0.018240	17	125.230	113.519	114.718	288.662	288.431	288.137	0.369
96	4	5.78227	0.012679	16	153.647	148.693	149.754	288.448	288.343	288.016	0.611
	5	5.77000	0.009810	14	181.400	181.178	181.315	288.420	288.354	287.985	0.878
	6	5.77987	0.010471	14	208.518	214.222	213.452	288.587	288.489	288.132	1.197
	7	5.81363	0.011557	16	249.722	250.392	250.163	288.906	288.716	288.408	1.603
	0	5.86506	0.029495	19	0	0	0	301.280	300.409	300.161	0
	2	5.85387	0.023368	18	93.957	79.642	80.712	300.673	300.259	299.979	0.185
	3	5.84125	0.016699	17	130.864	119.010	120.280	300.347	300.087	299.776	0.401
98	4	5.83058	0.010909	17	159.575	154.620	155.740	300.094	299.963	299.648	0.650
	5	5.82488	0.007491	16	187.620	187.029	187.411	300.040	299.954	299.623	0.922
	6	5.82676	0.007208	16	215.026	217.909	217.514	300.194	300.101	299.775	1.228
	7	5.85506	0.008555	17	258.934	251.734	251.430	300.515	300.391	300.085	1.603

Table 2

Protons

Z	η	λ	Δ^2	s_o	Q^{IP}	Q^{BCS}	Q^{PBCS}	ε^{IP}	ε^{BCS}	ε^{PBCS}	$-\Delta\varepsilon_c$
1	2	3	4	5	6	7	8	9	10	11	12
	0	5.89123	0.029121	19	0	0	0	313.090	312.180	311.917	0
	2	5.88450	0.022195	19	99.304	82.578	83.787	312.409	312.009	311.730	0.196
	3	5.88036	0.015002	18	128.818	123.097	124.477	312.038	311.816	311.506	0.423
100	4	5.87994	0.009235	17	165.933	159.214	160.440	311.771	311.679	311.347	0.684
	5	5.88703	0.005242	17	194.972	192.334	193.559	311.690	311.665	311.327	0.978
	6	5.89905	0.002783	17	223.334	223.014	223.251	311.822	311.816	311.489	1.279
	7	5.91829	0.004323	18	250.882	253.043	251.729	312.172	312.159	311.838	1.591
	0	5.91593	0.028328	20	0	0	0	324.900	323.995	323.733	0
	2	5.91670	0.020740	19	103.548	84.798	86.035	324.152	323.816	323.517	0.208
	3	5.92336	0.013411	18	134.138	125.933	127.469	323.746	323.623	323.290	0.440
102	4	5.93537	0.007816	18	164.219	162.213	163.059	323.543	323.494	323.154	0.704
	5	5.95228	0.005588	20	193.606	194.902	194.772	323.553	323.510	323.223	0.992
	6	5.97320	0.005015	19	231.484	226.713	226.849	323.779	323.702	323.409	1.310
	7	5.99415	0.005319	19	258.900	258.706	258.466	324.120	324.080	323.773	1.679
	0	5.94126	0.026654	20	0	0	0	336.710	335.860	335.579	0
	2	5.95006	0.018718	19	94.500	86.059	87.240	335.985	335.688	335.369	0.212
	3	5.96723	0.012350	19	134.558	126.763	128.020	335.666	335.517	335.190	0.446
104	4	5.99020	0.008029	19	165.345	164.031	164.661	335.511	335.423	335.100	0.717
	5	6.00519	0.005944	20	202.094	197.991	198.489	335.550	335.470	335.175	1.021
	6	6.02465	0.004761	20	230.476	229.890	230.079	335.742	335.701	335.403	1.342
	7	6.04756	0.006212	20	258.266	264.908	263.703	336.193	336.125	335.827	1.733

Table 2

Neutrons

N	η	λ	Δ^2	s_o	Q^{IP}	Q^{BCS}	Q^{PBCS}	ε^{IP}	ε^{BCS}	ε^{PBCS}
1	2	3	4	5	6	7	8	9	10	11
	0	6.73963	0.006406	27	0	0	0	344.590	344.348	344.286
	2	6.66947	0.005814	24	71.362	69.366	69.107	344.902	344.807	344.672
	3	6.59838	0.010247	20	104.834	113.354	110.823	345.498	345.384	345.151
128	4	6.57847	0.018666	18	187.827	184.246	183.345	346.318	345.923	345.669
	5	6.56953	0.018741	18	280.451	257.953	258.783	346.536	346.233	345.974
	6	6.56467	0.014099	19	319.114	324.564	325.283	346.570	346.380	346.127
	7	6.57579	0.011858	19	378.290	383.725	383.792	346.637	346.490	346.240
	0	6.76138	0.011727	28	0	0	0	358.290	357.854	357.793
	2	6.70136	0.010055	24	81.678	79.290	79.268	358.380	358.183	358.027
	3	6.63722	0.011883	21	119.693	123.276	121.936	358.814	358.626	358.401
130	4	6.60611	0.018466	19	179.793	190.026	189.205	359.530	359.116	358.865
	5	6.60056	0.018247	18	272.407	264.202	264.963	359.722	359.413	359.139
	6	6.60364	0.013904	19	336.410	331.153	332.016	359.745	359.556	359.289
	7	6.61456	0.011576	20	389.814	389.023	389.003	359.826	359.686	359.438
	0	6.78294	0.016227	28	0	0	0	371.990	371.406	371.326
	2	6.73086	0.013241	24	94.904	88.443	88.659	371.885	371.622	371.449
	3	6.67267	0.013122	21	132.385	134.215	133.558	372.145	371.943	371.705
132	4	6.63473	0.017621	19	169.015	196.405	195.619	372.750	372.367	372.099
	5	6.63016	0.017483	19	264.343	269.475	270.087	372.957	372.653	372.382
	6	6.64109	0.013594	19	347.302	336.943	338.027	372.984	372.808	372.528
	7	6.65487	0.011187	20	400.672	394.596	394.512	373.123	372.962	372.698
	0	6.80401	0.019956	28	0	0	0	385.690	385.002	384.904
	2	6.75764	0.015608	25	104.162	96.726	97.193	385.466	385.117	384.947
	3	6.70365	0.013963	23	148.671	144.423	144.342	385.575	385.325	385.109
134	4	6.66269	0.016342	20	188.077	202.824	202.172	385.971	385.673	385.406
	5	6.66041	0.016427	19	274.693	274.250	274.749	386.259	385.952	385.666
	6	6.67726	0.013198	19	357.818	341.468	342.454	386.335	386.133	385.841
	7	6.69481	0.011014	21	397.505	401.268	400.954	386.428	386.316	386.050

Table 2

N	η	λ	Δ^2	s_0	Q^{IP}	Q^{BCS}	Q^{PBCS}	ε^{IP}	ε^{BCS}	ε^{PBCS}
1	2	3	4	5	6	7	8	9	10	11
136	0	6.82414	0.022649	29	0	0	0	399.390	398.645	398.550
	2	6.78223	0.017127	27	110.200	103.639	104.445	399.079	398.669	398.520
	3	6.73425	0.014246	24	158.209	154.773	155.096	399.049	398.772	398.559
	4	6.69070	0.014658	22	205.219	209.890	209.454	399.273	399.037	398.786
	5	6.68928	0.014813	20	290.295	278.857	279.230	399.575	399.314	399.032
	6	6.71122	0.012503	20	349.978	345.441	345.902	399.723	399.530	399.243
	7	6.73553	0.011023	21	410.916	407.953	408.034	399.891	399.754	399.478
138	0	6.84439	0.024982	29	0	0	0	413.200	412.326	412.213
	2	6.80802	0.018475	27	123.774	111.074	112.043	412.699	412.268	412.102
	3	6.76536	0.014154	24	172.987	164.881	165.512	412.531	412.279	412.049
	4	6.72197	0.012949	23	215.125	217.850	217.714	412.654	412.456	412.204
	5	6.71891	0.013164	21	282.315	282.623	282.790	412.976	412.729	412.448
	6	6.74353	0.011856	22	342.126	348.445	348.468	413.160	412.992	412.724
	7	6.77074	0.011367	23	423.428	414.972	415.154	413.443	413.267	413.015
140	0	6.86444	0.026657	29	0	0	0	427.010	426.048	425.918
	2	6.83366	0.019235	27	136.148	117.970	119.096	426.351	425.920	425.736
	3	6.79581	0.013660	25	180.573	173.786	174.765	426.073	425.847	425.616
	4	6.75639	0.010977	24	228.959	226.626	226.809	426.107	425.941	425.687
	5	6.74949	0.011389	23	292.157	285.840	285.598	426.386	426.202	425.936
	6	6.77682	0.011263	23	354.350	351.173	351.138	426.687	426.518	426.252
	7	6.80449	0.011568	24	415.886	421.207	421.344	427.045	426.850	426.602
142	0	6.88426	0.027739	29	0	0	0	440.820	439.810	439.663
	2	6.85821	0.019521	28	139.694	123.704	125.031	440.063	439.621	439.437
	3	6.82728	0.013019	26	192.549	181.674	182.949	439.659	439.477	439.245
	4	6.79678	0.009160	24	237.823	235.305	235.829	439.581	439.498	439.222
	5	6.78477	0.009494	24	281.701	289.363	288.613	439.846	439.740	439.471
	6	6.80897	0.010563	25	346.536	354.233	354.071	440.289	440.109	439.862
	7	6.83633	0.011616	26	408.324	426.889	427.092	440.696	440.495	440.266
144	0	6.90393	0.028180	29	0	0	0	454.630	453.614	453.450
	2	6.88409	0.019394	28	149.754	129.283	130.712	453.778	453.374	453.172
	3	6.86108	0.012257	26	195.905	189.133	190.410	453.362	453.172	452.924
	4	6.83974	0.008152	24	247.460	243.155	243.685	453.244	453.140	452.857
	5	6.82420	0.007883	25	292.665	295.018	294.503	453.440	453.354	453.087
	6	6.84314	0.009690	26	359.058	356.241	355.829	453.898	453.766	453.520
	7	6.86945	0.011445	27	438.632	432.008	432.339	454.356	454.207	453.977
146	0	6.92344	0.027919	29	0	0	0	468.440	467.460	467.280
	2	6.90920	0.018861	29	150.814	133.663	135.202	467.564	467.179	466.977
	3	6.89480	0.011343	27	204.145	195.052	196.375	467.097	466.936	466.690
	4	6.87931	0.007458	25	250.839	249.944	250.427	466.954	466.864	466.587
	5	6.86541	0.006511	25	305.463	301.501	301.602	467.139	467.048	466.773
	6	6.87915	0.008553	27	348.918	358.682	357.384	467.608	467.495	467.249
	7	6.90339	0.011136	27	431.118	436.584	436.599	468.173	467.987	467.745
148	0	6.94276	0.027260	29	0	0	0	482.250	481.340	481.144
	2	6.93602	0.018160	29	157.604	137.482	139.020	481.371	481.034	480.815
	3	6.92942	0.010673	28	206.111	199.979	201.303	480.898	480.766	480.521
	4	6.91659	0.006711	27	264.173	256.390	257.105	480.778	480.663	480.408
	5	6.90802	0.005139	26	309.087	307.934	308.152	480.871	480.823	480.547
	6	6.91838	0.007583	27	353.026	362.271	360.325	481.378	481.296	481.034
	7	6.93530	0.010860	28	435.960	440.856	440.421	481.997	481.832	481.593
150	0	6.96202	0.026098	29	0	0	0	496.190	495.258	495.046
	2	6.96348	0.017243	29	154.346	140.264	141.731	495.260	494.942	494.707
	3	6.96401	0.010280	29	209.847	204.019	205.352	494.821	494.665	494.424
	4	6.95646	0.005551	28	266.921	262.786	263.904	494.602	494.539	494.282
	5	6.95424	0.003865	29	312.479	313.255	313.064	494.727	494.688	494.451
	6	6.95741	0.006855	28	356.920	369.013	367.225	495.274	495.175	494.920
	7	6.96696	0.010383	28	440.200	445.571	444.774	495.942	495.740	495.489

Table 2

N	η	λ	Δ^2	s_0	Q^{IP}	Q^{BCS}	Q^{PBCS}	ε^{IP}	ε^{BCS}	ε^{PBCS}
I	2	3	4	5	6	7	8	9	IO	II
	0	6.98I25	0.02440I	29	0	0	0	5I0.I30	509.2I4	508.987
	2	6.99I55	0.0I6I48	29	I57.044	I4I.999	I43.322	509.I87	508.905	508.655
	3	6.99757	0.009857	30	223.947	207.923	209.258	508.803	508.632	508.394
I52	4	7.0065I	0.004349	30	27I.673	267.835	269.468	508.527	508.50I	508.250
	5	7.02268	0.00I943	3I	3I8.2I5	3I8.428	3I8.263	508.660	508.656	508.434
	6	6.99674	0.005662	29	363.608	378.764	377.63I	509.220	509.I3I	508.880
	7	6.99724	0.009460	29	447.808	45I.453	450.305	509.909	509.709	509.46I
	0	7.00060	0.022204	29	0	0	0	524.070	523.207	522.964
	2	7.020II	0.0I4974	29	I52.424	I42.737	I43.844	523.I75	522.924	522.659
	3	7.03239	0.009275	30	220.545	2I0.306	2II.744	522.79I	522.666	522.4I3
I54	4	7.05674	0.0054I2	33	268.289	268.342	268.695	522.628	522.570	522.364
	5	7.07976	0.005628	33	3I5.035	324.489	324.348	522.887	522.773	522.577
	6	7.05I83	0.003777	3I	390.980	390.567	390.760	523.I9I	523.I77	522.922
	7	7.02923	0.007932	29	437.988	458.5I4	457.I92	523.879	523.739	523.476
	0	7.02035	0.0I9550	29	0	0	0	538.0I0	537.236	536.975
	2	7.04896	0.0I3809	29	I50.334	I42.65I	I43.498	537.245	536.998	536.720
	3	7.06743	0.0087I6	3I	2I6.396	2II.652	2I2.767	536.89I	536.769	536.5I5
I56	4	7.0952I	0.006756	34	264.583	268.9I9	268.772	536.848	536.725	536.526
	5	7.III72	0.007738	33	339.355	330.708	330.690	537.I43	536.967	536.759
	6	7.I0445	0.006I77	32	4I4.032	40I.890	402.323	537.458	537.342	537.III
	7	7.06564	0.005858	30	460.432	467.899	466.9I6	537.90I	537.835	537.567
	0	7.04047	0.0I6200	29	0	0	0	55I.950	55I.305	55I.028
	2	7.07655	0.0I248I	30	I39.708	I42.399	I42.982	55I.350	55I.I3I	550.856
I58	3	7.I0279	0.008367	33	2I5.032	2I2.00I	2I2.768	55I.036	550.944	550.705
	4	7.I292I	0.0074I9	35	263.939	270.I86	269.798	55I.078	550.953	550.756
	5	7.I3928	0.008688	35	344.489	336.7I4	336.745	55I.423	55I.223	55I.033
	6	7.I36I3	0.007679	34	4I9.3I0	4II.5I3	4I2.302	55I.758	55I.587	55I.379
	7	7.II795	0.003746	32	483.064	479.839	48I.375	552.034	552.0I7	55I.753