Lawrence Berkeley National Laboratory

Recent Work

Title

TABULATION OF POTENTIAL FUNCTIONS AND DYNAMIC CORRECTION TERMS FOR THE HYDROGEN MOLECULAR ION

Permalink

<https://escholarship.org/uc/item/7w88j7cz>

Authors

Cohen, Stanley
Judd, David L.
Riddell, Robert J.

Publication Date

1959-06-18

UNIVERSITY OF
CALIFORNIA
Ernest O. Lawrence
Radiation
Laboratory

TABULATIONS OF POTENTIAL FUNCTIONS
AND DYNAMIC CORRECTION TERMS
FOR THE HYDROGEN MOLECULAR ION

TWO-WEEK LOAN COPY

This is a Library Circulating Copy
which may be borrowed for two weeks.
For a personal retention copy, call
Tech. Info. Division, Ext. 5545

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

UNIVERSITY OF CALIFORNIA
Lawrence Radiation Laboratory
Berkeley, California
Contract No. W-7405-eng-48

TABULATION OF POTENTIAL FUNCTIONS AND DYNAMIC CORRECTION
TERMS FOR THE HYDROGEN MOLECULAR ION

Stanley Cohen, David L. Judd, and Robert J. Riddell, Jr.

June 18, 1959

Printed for the U. S. Atomic Energy Commission

Printed in USA. Price \$1.25. Available from the
Office of Technical Services
U. S. Department of Commerce
Washington 25, D.C.

TABULATION OF POTENTIAL FUNCTIONS AND DYNAMIC CORRECTION TERMS
FOR THE HYDROGEN MOLECULAR ION^{*}

Stanley Cohen, David L. Judd, and Robert J. Riddell, Jr.

Lawrence Radiation Laboratory
University of California
Berkeley, California

June 18, 1959

ABSTRACT

Potential functions and first-order dynamic correction terms for the generalized hydrogen molecular ion are tabulated. A brief discussion of the meaning of the various functions is included.

* This work was performed under the auspices of the U.S. Atomic Energy Commission.

TABULATION OF POTENTIAL FUNCTIONS AND DYNAMIC CORRECTION TERMS
FOR THE HYDROGEN MOLECULAR ION

Stanley Cohen, David L. Judd, and Robert J. Riddell, Jr.

Lawrence Radiation Laboratory
University of California
Berkeley, California

June 18, 1959

INTRODUCTION

A previous paper¹ described a method by which an approximate solution to the generalized hydrogen molecular ion could be obtained. Such a system consists of a light negatively charged particle, referred to here as a meson, bound to two heavier positively charged particles, referred to as nuclei; each of the particles is assumed to have a unit electrical charge. Although this method was developed primarily for the investigation of the behavior of μ^- mesons in liquid hydrogen,² it has become apparent that the method can be used to advantage in the studies of other molecular problems. In order that the results of the approximation may be available for further investigations, tabulations of the numerical values of the functions described in the previous report are given here. It is assumed that this previous report will have been read and that a detailed description of the meaning of the various functions is therefore not necessary. A short description of the approximation is, however, included.

-3-

LOWEST-ORDER CALCULATION

The lowest-order calculation is similar to that of the usual Born-Oppenheimer approximation³ in that the adiabatic effects of the presence of the meson on the motion of the two nuclei are replaced by effective potentials. These potentials are obtained by solving the mesonic problem for the case in which the two nuclei are assumed to have various fixed separations. The solutions to these two-fixed-center problems can in principle be obtained exactly,⁴ but for practical purposes can be more readily approximated by variational methods.

We have chosen variational functions for the lowest symmetric mesonic wave function of the form

$$\psi^+ = A_+ \cosh(Q_+ \eta/2) \exp(-P_+ \xi/2) ,$$

where A_+ is the normalization constant and η and ξ are the usual confocal elliptic coordinates. The variational parameters Q_+ and P_+ were chosen to minimize the expectation value of the energy, W_+ , for the two-fixed-center problem and are functions of the internucleus separation. Appendix I contains the results of these variational calculations.

Similarly, for the lowest antisymmetric mesonic wave function, we have chosen variational functions of the form

$$\psi^- = A_- \{\xi\} \sinh(Q_- \eta/2) \exp(-P_- \xi/2) ,$$

where $\{\xi\}$ indicates that a factor of ξ was included if this led to lower value of the energy. The results of these calculations are given in Appendix II.

-4-

DYNAMIC CORRECTION TERMS

With the assumed analytic forms for the mesonic wave functions it was possible to calculate the lowest-order dynamic corrections to the nuclear motion. The inclusion of these corrections led to refinements in the calculation which contain many of the distinguishing features for the case in which the masses of the nuclei are unequal. With the inclusion of these corrections the radial wave functions for the nuclear motion can be shown to satisfy the pair of differential equations of the form (see Section 1 of Reference 1)

$$\begin{aligned} \frac{d^2 \phi_+}{dr_n^2} + \frac{1}{\epsilon} \left[W - (W_+ + \frac{2}{r_n} + \epsilon \{ g_{++} + \frac{l(l+1)}{r_n^2} \}) \right] \phi_+ \\ = g_{+-} \phi_- - 2 f_{+-} \frac{d\phi_-}{dr_n} - \frac{df_{+-}}{dr_n} \phi_- \end{aligned}$$

and

$$\begin{aligned} \frac{d^2 \phi_-}{dr_n^2} + \frac{1}{\epsilon} \left[W - (W_- + \frac{2}{r_n} + \epsilon \{ g_{--} + \frac{l(l+1)}{r_n^2} \}) \right] \phi_- \\ = g_{+-} \phi_+ + 2 f_{+-} \frac{d\phi_+}{dr_n} + \frac{df_{+-}}{dr_n} \phi_+ , \end{aligned}$$

where ϵ is defined as the ratio of the meson mass to that of the reduced mass of the two nuclei. The functions g_{ij} and f_{+-} are the dynamic correction terms mentioned above and are of the form

$$g_{ij} = \int \vec{\nabla} \psi^i \cdot \vec{\nabla} \psi^j d\tau$$

and

$$f_{+-} = \left| \int \psi^+ \vec{\nabla} \psi^- d\tau \right| .$$

As detailed in Reference 1, two wave functions are necessary to describe the nuclear problem because the meson can be associated with either of the two nuclei.

For the case in which the two nuclear masses are equal g_{+-} and f_{+-} are identically zero and the two equations are uncoupled. The dynamic corrections are therefore manifested as corrections to the potential functions. For the equal-mass case the functions g_{++} and g_{--} are tabulated in Appendix III.

Appendix IV contains the results for the calculation of g_{++} , g_{--} , g_{+-} and f_{+-} for the unequal-mass case, in which the nuclei have masses in the ratio of 2:1.

Appendix I. The Symmetric Case

In this appendix we have tabulated the results of the variational calculation for the fixed-nuclei problem in which the electronic wave function is assumed to be of the form

$$\psi^+ = A_+ \cosh(Q_+ \eta/2) \exp(-P_+ \xi/2) .$$

These tabulations consist of four columns: R , the internucleus spacing, measured in units of the mesonic Bohr radius; W_+ , the minimized value for the energy, in units of the corresponding Rydberg; and the two parameters, P_+ and Q_+ , which led to this minimum value. The tabulations are given in intervals of R of 0.05, from 0.05 to 20.00.

In these and subsequent tabulations the entries are interpreted as follows:

- (a) The first eight digits correspond to a decimal number between 1.0000000 and 9.9999999.
- (b) The next two digits less 50 represent the power of ten by which the decimal number is to be multiplied.
- (c) A minus sign following these indicates that the number is negative. For example,

3601205051- is interpreted as $-3.6012050 \times 10^{51-50} = -36.012050$
and

9971229048 is interpreted as $9.9712290 \times 10^{48-50} = .099712290$.

-7-

R	W+	P+	Q+
5000000048	3601205051	9971229048	7114643948
1000000049	1604354951	1980006349	1218827249
1500000049	9421981050	2940919949	1729843749
2000000049	6142925050	3876456549	2268717149
2500000049	4203132650	4785689249	2818030949
3000000049	2933584550	5668574049	3355374149
3500000049	2046876650	6526327049	3885835849
4000000049	1398948450	7360406949	4403007749
4500000049	9095852049	8171602949	4912955149
5000000049	5305707049	8961054749	5415979549
5500000049	2311893049	9731535149	5907766949
6000000049	9037200047-	1048225750	6395687449
6500000049	2042762049-	1121675950	6873126749
7000000049	3646267049-	1193353450	7347489349
7500000049	4974733049-	1263568550	7813961949
8000000049	6083324049-	1332345150	8274660149
8500000049	7014006049-	1399857250	8728165049
9000000049	7799214049-	1465928250	9180426549
9500000049	8464386049-	1530983450	9624510449
1000000050	9029697049-	1594729350	1006784550
1050000050	9511335049-	1657600350	1050395150
1100000050	9922421049-	1719278950	1093950750
1150000050	1027367050-	1780106550	1137016950
1200000050	1057391650-	1840034850	1179770350
1250000050	1083048250-	1899211650	1222088350
1300000050	1104948750-	1957388050	1264436350
1350000050	1123607750-	2014901850	1306400050
1400000050	1139459850-	2071687850	1348142750
1450000050	1152873650-	2127880750	1389559550
1500000050	1164163550-	2183227950	1431043950
1550000050	1173600050-	2238143650	1472126150
1600000050	1181414850-	2292279150	1513291650
1650000050	1187808250-	2345946150	1554214550
1700000050	1192954650-	2399075750	1595018850
1750000050	1197004650-	2451691650	1635725650
1800000050	1200089950-	2503824650	1676346150
1850000050	1202325150-	2555489050	1716893550
1900000050	1203812350-	2606713750	1757381750
1950000050	1204639750-	2657516050	1797823450
2000000050	1204885850-	2707914450	1838227950
2050000050	1204619250-	2757931150	1878611750
2100000050	1203901750-	2807583150	1918978250
2150000050	1202787250-	2856962050	1959280150
2200000050	1201324050-	2905853650	1999718450
2250000050	1199554450-	2954585550	2040053050
2300000050	1197517250-	3002863050	2080530250
2350000050	1195246250-	3051003650	2120932350
2400000050	1192771550-	3098797250	2161434450
2450000050	1190120750-	3146263650	2202037350

-8-

R	W+	P+	Q+
2500000050	1187318350-	3193553550	2242654450
2550000050	1184385750-	3240607250	2283337650
2600000050	1181342650-	3287441150	2324101450
2650000050	1178206950-	3334065150	2364945150
2700000050	1174994050-	3380547750	2405853350
2750000050	1171718750-	3426781150	2446889650
2800000050	1168393150-	3472773650	2488068850
2850000050	1165029050-	3518718650	2529292650
2900000050	1161636950-	3564389250	2570694450
2950000050	1158225950-	3609970950	2612197050
3000000050	1154804550-	3655462950	2653800250
3050000050	1151380350-	3700769850	2695566450
3100000050	1147960050-	3745952050	2737471050
3150000050	1144550050-	3791022850	2779524950
3200000050	1141155050-	3835933850	2821750450
3250000050	1137781150-	3880801250	2864109550
3300000050	1134431750-	3925620750	2906615650
3350000050	1131111550-	3970308150	2949303550
3400000050	1127823350-	4014876750	2992181050
3450000050	1124571350-	4059460550	3035195850
3500000050	1121357350-	4103941850	3078404550
3550000050	1118184550-	4148365850	3121797150
3600000050	1115054550-	4192695350	3165383850
3650000050	1111969850-	4237058850	3209139450
3700000050	1108931850-	4281312850	3253106250
3750000050	1105942150-	4325602050	3297243750
3800000050	1103001850-	4369827750	3341593850
3850000050	1100112350-	4414000750	3386151850
3900000050	1097274550-	4458227650	3430889650
3950000050	1094488750-	4502365450	3475852750
4000000050	1091755850-	4546535450	3521010050
4050000050	1089076650-	4590710650	3566377550
4100000050	1086451350-	4634868950	3611954850
4150000050	1083880050-	4679052750	3657741350
4200000050	1081362850-	4723268750	3703735450
4250000050	1078900050-	4767440750	3749949750
4300000050	1076491750-	4811683950	3796366950
4350000050	1074137550-	4855897250	3843010350
4400000050	1071837150-	4900189250	3889856050
4450000050	1069590550-	4944482250	3936920550
4500000050	1067397450-	4988783350	3984200550
4550000050	1065257350-	5033150250	4031693950
4600000050	1063169950-	5077539550	4079395950
4650000050	1061134750-	5121998150	4127310050
4700000050	1059151150-	5166466250	4175434950
4750000050	1057218850-	5210990550	4223771350
4800000050	1055336750-	5255572750	4272313650
4850000050	1053505050-	5300210650	4321061250
4900000050	1051722050-	5344867150	4370012350
4950000050	1049988050-	5389610450	4419166050

-9-

R	W+	P+	Q+
5000000050	1048301450-	5434388050	4468519450
5050000050	1046662350-	5479230750	4518073850
5100000050	1045069450-	5524141050	4567818950
5150000050	1043522050-	5569110650	4617758050
5200000050	1042019250-	5614135050	4667882650
5250000050	1040560950-	5659246350	4718195250
5300000050	1039145350-	5704389450	4768686750
5350000050	1037772050-	5749600150	4819360450
5400000050	1036440250-	5794879250	4870207750
5450000050	1035149250-	5840227250	4921205050
5500000050	1033897850-	5885660250	4972407950
5550000050	1032685550-	5931134350	5023745150
5600000050	1031511250-	5976694450	5075240550
5650000050	1030374650-	6022316050	5126889150
5700000050	1029273350-	6067988850	5178695350
5750000050	1028208350-	6113742450	5230634850
5800000050	1027177950-	6159582350	5282720650
5850000050	1026181250-	6205480050	5334944150
5900000050	1025217050-	6251433350	5387276650
5950000050	1024285650-	6297458050	5439745450
6000000050	1023385350-	6343544150	5492328650
6050000050	1022515550-	6389731150	5545028650
6100000050	1021675150-	6435935650	5597847350
6150000050	1020863650-	6482236350	5650757750
6200000050	1020079950-	6528599250	5703779150
6250000050	1019323950-	6575024750	5756867550
6300000050	1018594150-	6621539950	5810068250
6350000050	1017889850-	6668095250	5863337350
6400000050	1017210850-	6714724250	5916675850
6450000050	1016556250-	6761404850	5970098250
6500000050	1015924350-	6808167250	6023585050
6550000050	1015315950-	6854969650	6077137650
6600000050	1014729150-	6901837650	6130730150
6650000050	1014163950-	6948770750	6184399750
6700000050	1013619550-	6995728350	6238088850
6750000050	1013094950-	7042795450	6291839950
6800000050	1012589450-	7089900250	6345629850
6850000050	1012103150-	7137058450	6399454250
6900000050	1011634750-	7184276650	6453286350
6950000050	1011183950-	7231537750	6507149150
7000000050	1010750150-	7278857250	6561034950
7050000050	1010332950-	7326240950	6614950450
7100000050	1009931050-	7373644450	6668868150
7150000050	1009544550-	7421126250	6722794150
7200000050	1009172850-	7468664650	6776723950
7250000050	1008815150-	7516223750	6830660550
7300000050	1008471750-	7563832250	6884591550
7350000050	1008141450-	7611511350	6938515850
7400000050	1007823550-	7659207950	6992425450
7450000050	1007518350-	7706980250	7046357950

-10-

R	W+	P+	Q+
7500000050	1007224650-	7754776750	7100221350
7550000050	1006942650-	7802643750	7154127650
7600000050	1006671950-	7850565850	7207955050
7650000050	1006410950-	7898475350	7261797750
7700000050	1006160950-	7946446750	7315619750
7750000050	1005920550-	7994436750	7369387750
7800000050	1005689450-	8042473550	7423165550
7850000050	1005467450-	8090538850	7476783550
7900000050	1005254250-	8138652150	7530519450
7950000050	1005049550-	8186804650	7584192550
8000000050	1004852950-	8234999850	7637847050
8050000050	1004664250-	8283210950	7691417250
8100000050	1004483250-	8331479850	7745091150
8150000050	1004309350-	8379772350	7798611050
8200000050	1004142050-	8428048350	7852115850
8250000050	1003981850-	8476460950	7905561550
8300000050	1003827750-	8524774950	7958948850
8350000050	1003679650-	8573222350	8012330650
8400000050	1003537750-	8621644950	8065638650
8450000050	1003401450-	8670047150	8118859350
8500000050	1003271250-	8718594850	8172190050
8550000050	1003145250-	8767086150	8225375150
8600000050	1003025150-	8815652050	8278543550
8650000050	1002909450-	8864243050	8331601650
8700000050	1002798150-	8912792050	8384673050
8750000050	1002691950-	8961439050	8437668850
8800000050	1002589350-	9010108150	8490661450
8850000050	1002491250-	9058696850	8543612050
8900000050	1002397350-	9107414850	8596591250
8950000050	1002306750-	9156147250	8649426550
9000000050	1002219550-	9204819250	8702190950
9050000050	1002136550-	9253622550	8755001750
9100000050	1002056650-	9302354150	8807718450
9150000050	1001979850-	9351107350	8860368650
9200000050	1001906350-	9399927550	8913017650
9250000050	1001835450-	9448779050	8965596850
9300000050	1001766950-	9497593550	9018156550
9350000050	1001702950-	9546441850	9070707250
9400000050	1001639950-	9595376550	9123220550
9450000050	1001580050-	9644231650	9175615450
9500000050	1001522350-	9693180250	9228056050
9550000050	1001466950-	9742101950	9280356150
9600000050	1001413950-	9791021050	9332697250
9650000050	1001363350-	9839951450	9384940050
9700000050	1001313850-	9888996350	9437227150
9750000050	1001267050-	9937877450	9489426750
9800000050	1001221850-	9986889850	9541583750
9850000050	1001178550-	1003595251	9593716650
9900000050	1001137350-	1008505151	9645865450
9950000050	1001097150-	1013399251	9697869350

-11-

R	W+	P+	Q+
1000000051	1001058450-	1018312051	9749924350
1005000051	1001021750-	1023211551	9801958550
1010000051	1000986650-	1028119251	9853874050
1015000051	1000952550-	1033030351	9905819750
1020000051	1000920350-	1037941951	9957691750
1025000051	1000888550-	1042858751	1000960551
1030000051	1000858250-	1047762551	1006143951
1035000051	1000829150-	1052673851	1011326251
1040000051	1000801350-	1057590251	1016501551
1045000051	1000774050-	1062514051	1021674651
1050000051	1000748250-	1067430451	1026851251
1055000051	1000723750-	1072336351	1032016051
1060000051	1000699950-	1077254351	1037184951
1065000051	1000677450-	1082180351	1042341751
1070000051	1000655550-	1087107551	1047510351
1075000051	1000634150-	1092026551	1052667551
1080000051	1000613950-	1096948451	1057822951
1085000051	1000594150-	1101859651	1062974151
1090000051	1000575350-	1106790951	1068124551
1095000051	1000557650-	1111719751	1073271051
1100000051	1000540350-	1116640551	1078424251
1105000051	1000523150-	1121577551	1083563851
1110000051	1000507550-	1126497551	1088705851
1115000051	1000491650-	1131421951	1093846351
1120000051	1000476450-	1136347651	1098982751
1125000051	1000462750-	1141293751	1104115151
1130000051	1000448250-	1146202951	1109249951
1135000051	1000435050-	1151144251	1114377451
1140000051	1000422450-	1156080351	1119507351
1145000051	1000410050-	1161008651	1124635851
1150000051	1000398650-	1165945051	1129759851
1155000051	1000387350-	1170877051	1134884851
1160000051	1000375450-	1175805951	1140008251
1165000051	1000364950-	1180738451	1145127551
1170000051	1000354950-	1185668851	1150244951
1175000051	1000344950-	1190612551	1155358151
1180000051	1000335450-	1195557251	1160473251
1185000051	1000326150-	1200488151	1165585451
1190000051	1000317450-	1205430751	1170695451
1195000051	1000308850-	1210370751	1175806251
1200000051	1000300150-	1215312251	1180914651
1205000051	1000292250-	1220248151	1186020351
1210000051	1000284650-	1225190851	1191125751
1215000051	1000277550-	1230127951	1196229651
1220000051	1000270350-	1235069651	1201331851
1225000051	1000263150-	1240012751	1206434351
1230000051	1000256650-	1244954551	1211529551
1235000051	1000250150-	1249905751	1216630451
1240000051	1000243950-	1254848851	1221728251
1245000051	1000237950-	1259779251	1226825151

-12-

R	W+	P+	Q+
1250000051	1000232250-	1264731851	1231915651
1255000051	1000226550-	1269668551	1237003451
1260000051	1000221050-	1274606551	1242098751
1265000051	1000215850-	1279572751	1247193551
1270000051	1000210950-	1284509051	1252266851
1275000051	1000205750-	1289447551	1257379251
1280000051	1000200650-	1294411251	1262462051
1285000051	1000196450-	1299353951	1267549651
1290000051	1000191850-	1304306151	1272639451
1295000051	1000187450-	1309249751	1277715551
1300000051	1000183350-	1314198351	1282806651
1305000051	1000178950-	1319144251	1287874451
1310000051	1000175050-	1324095051	1292965051
1315000051	1000171750-	1329051151	1298042451
1320000051	1000167350-	1333990151	1303127051
1325000051	1000164450-	1338950551	1308203651
1330000051	1000160750-	1343903751	1313284851
1335000051	1000157650-	1348853051	1318358251
1340000051	1000154150-	1353803251	1323440951
1345000051	1000150750-	1358744451	1328510751
1350000051	1000147750-	1363705451	1333583051
1355000051	1000145150-	1368665251	1338656051
1360000051	1000142150-	1373616851	1343731451
1365000051	1000138850-	1378557551	1348795251
1370000051	1000136450-	1383520251	1353871651
1375000051	1000133650-	1388469051	1358940051
1380000051	1000131150-	1393428851	1364011951
1385000051	1000128750-	1398377751	1369069551
1390000051	1000125750-	1403337951	1374152551
1395000051	1000123850-	1408284051	1379213751
1400000051	1000121750-	1413242051	1384281651
1405000051	1000119450-	1418196151	1389345551
1410000051	1000117350-	1423150951	1394414351
1415000051	1000115250-	1428112051	1399478751
1420000051	1000112950-	1433074451	1404546151
1425000051	1000110450-	1438029251	1409606551
1430000051	1000109250-	1442973551	1414670651
1435000051	1000106850-	1447948951	1419732151
1440000051	1000105350-	1452897851	1424793051
1445000051	1000103750-	1457868851	1429853251
1450000051	1000101550-	1462821851	1434916351
1455000051	1000100050-	1467788751	1439975251
1460000051	1000098350-	1472733051	1445032151
1465000051	1000096550-	1477704551	1450093151
1470000051	1000095350-	1482660751	1455140251
1475000051	1000093450-	1487615051	1460206651
1480000051	1000092150-	1492571651	1465263051
1485000051	1000090350-	1497534951	1470328051
1490000051	1000089150-	1502486151	1475381351
1495000051	1000087950-	1507480051	1480431851

-13-

R	W+	P+	Q+
1500000051	1000086250-	1512408751	1485490351
1505000051	1000084950-	1517375451	1490536451
1510000051	1000083850-	1522333851	1495583851
1515000051	1000082750-	1527288451	1500650851
1520000051	1000080650-	1532279851	1505708451
1525000051	1000079350-	1537237351	1510775351
1530000051	1000078150-	1542191351	1515819151
1535000051	1000076850-	1547154651	1520863151
1540000051	1000076050-	1552126951	1525933051
1545000051	1000075150-	1557079451	1530984451
1550000051	1000073850-	1562053051	1536022251
1555000051	1000072550-	1567022851	1541087651
1560000051	1000071750-	1571979451	1546130151
1565000051	1000070650-	1576940251	1551175651
1570000051	1000069750-	1581921851	1556222151
1575000051	1000068650-	1586857251	1561270151
1580000051	1000067950-	1591835051	1566312651
1585000051	1000066750-	1596803651	1571369651
1590000051	1000065450-	1601769151	1576418551
1595000051	1000064750-	1606731151	1581473551
1600000051	1000064050-	1611692251	1586508451
1605000051	1000063150-	1616665151	1591568151
1610000051	1000062450-	1621630451	1596607351
1615000051	1000061450-	1626588551	1601648051
1620000051	1000060450-	1631569151	1606699351
1625000051	1000060150-	1636530951	1611739851
1630000051	1000058450-	1641497551	1616783051
1635000051	1000058150-	1646465151	1621832851
1640000051	1000057450-	1651431351	1626872551
1645000051	1000057050-	1656404551	1631915551
1650000051	1000055650-	1661377351	1636959651
1655000051	1000055350-	1666330351	1642003751
1660000051	1000054750-	1671295351	1647046751
1665000051	1000053850-	1676275751	1652087951
1670000051	1000052850-	1681236751	1657136851
1675000051	1000052350-	1686200551	1662173851
1680000051	1000051850-	1691173251	1667216551
1685000051	1000050650-	1696143651	1672264651
1690000051	1000050850-	1701113151	1677297951
1695000051	1000050050-	1706095051	1682339151
1700000051	1000049350-	1711037051	1687378451
1705000051	1000048750-	1716004751	1692412051
1710000051	1000048250-	1720996451	1697465251
1715000051	1000047850-	1725962851	1702501451
1720000051	1000047050-	1730931551	1707554851
1725000051	1000046650-	1735910851	1712579751
1730000051	1000045750-	1740860351	1717619051
1735000051	1000045150-	1745848151	1722653151
1740000051	1000044750-	1750812551	1727692751
1745000051	1000044250-	1755794551	1732733551

-14-

R	W+	P+	Q+
1750000051	1000044150-	1760741251	1737785651
1755000051	1000043650-	1765712451	1742817751
1760000051	1000042650-	1770689051	1747847351
1765000051	1000041950-	1775668151	1752903551
1770000051	1000041650-	1780667651	1757927451
1775000051	1000040550-	1785621451	1762965651
1780000051	1000040550-	1790578451	1768008551
1785000051	1000039750-	1795547751	1773039751
1790000051	1000039550-	1800521451	1778097051
1795000051	1000039450-	1805498451	1783131451
1800000051	1000038850-	1810478351	1788161251
1805000051	1000038550-	1815444151	1793189651
1810000051	1000037450-	1820429051	1798215051
1815000051	1000037550-	1825387051	1803247351
1820000051	1000036950-	1830359651	1808293351
1825000051	1000036650-	1835358751	1813326751
1830000051	1000036250-	1840311251	1818337951
1835000051	1000035850-	1845293951	1823395351
1840000051	1000034950-	1850243951	1828423851
1845000051	1000035150-	1855245451	1833456151
1850000051	1000034550-	1860209351	1838495951
1855000051	1000034550-	1865178151	1843532151
1860000051	1000033550-	1870158751	1848569351
1865000051	1000033550-	1875154651	1853607751
1870000051	1000033450-	1880142351	1858621951
1875000051	1000032750-	1885072051	1863657651
1880000051	1000032650-	1890063351	1868697251
1885000051	1000032450-	1895021151	1873724851
1890000051	1000031950-	1900003051	1878748751
1895000051	1000031750-	1904976451	1883780551
1900000051	1000031050-	1909963951	1888815951
1905000051	1000030950-	1914924351	1893844051
1910000051	1000030450-	1919911651	1898878751
1915000051	1000029950-	1924867551	1903904351
1920000051	1000029750-	1929834751	1908932351
1925000051	1000029650-	1934838951	1913961851
1930000051	1000029150-	1939780451	1918992251
1935000051	1000028950-	1944779051	1924021951
1940000051	1000028250-	1949734651	1929063951
1945000051	1000028450-	1954746551	1934091051
1950000051	1000027750-	1959692951	1939125451
1955000051	1000027650-	1964729651	1944153651
1960000051	1000027350-	1969633551	1949192251
1965000051	1000026850-	1974610651	1954204851
1970000051	1000026850-	1979614051	1959207151
1975000051	1000026750-	1984600951	1964269351
1980000051	1000026250-	1989573451	1969281951
1985000051	1000026250-	1994513251	1974322251
1990000051	1000025450-	1999545851	1979358451
1995000051	1000026250-	2004511951	1984382551
2000000051	1000025850-	2009471451	1989389451

Appendix II. The Antisymmetric Case

In this appendix we have tabulated the results of the variational calculation for the fixed-nuclei problem in which the electronic wave function is assumed to be either of the form

$$(a) \quad \psi^- = A_- \xi \sinh(Q_- \eta/2) \exp(-P_- \xi/2)$$

or

$$(b) \quad \psi^- = A_- \sinh(Q_- \eta/2) \exp(-P_- \xi/2) .$$

These tabulations consist of four columns: R , the internuclear spacing, measured in units of the mesonic Bohr radius; W_- , the minimized value for the energy, in units of the corresponding Rydberg; and the two parameters, P_- and Q_- , which led to this minimum value. The tabulations are given in intervals of R of 0.05, from 0.05 to 20.00.

For values of R less than 1.65, Solution (a) was found to give lower values for W_- . For values of R larger than this, Solution (b) gave lower values. We have tabulated the results of (a) for values of R less than 1.50 and those of (b) for R larger than 1.95. For the intermediate region a linear interpolation between the two results for W_- is presented. Values for the variational parameters of both sets of solutions are given in this intermediate region.

		-16-			
		Without ξ		With ξ	
R	W-	P-	Q-	P-	Q-
5000000048	3899966751			5002705948	7437745448
1000000049	1899866951			1002160249	9313827348
1500000049	1233034451			1507267149	1076654749
2000000049	8994699050			2017154849	1407384349
2500000049	6991739750			2533353749	1988790649
3000000049	5654806650			3057348649	2327530949
3500000049	4698193750			3590570749	2782286649
4000000049	3979052050			4134411449	3156603849
4500000049	3418025650			4690214049	3526947349
5000000049	2967505950			5259201849	3934304949
5500000049	2597202650			5842527649	4343477549
6000000049	2286928150			6441172949	4751966849
6500000049	2022713450			7056150449	5172885549
7000000049	1794589750			7688254849	5596552449
7500000049	1595255750			8337694349	6021716349
8000000049	1419246550			9005264049	6449026149
8500000049	1262394450			9690444149	6889140049
9000000049	1121470650			1039351050	7330704749
9500000049	9939391049			1111406950	7772758749
1000000050	8777842049			1185068850	8226742949
1050000050	7713883049			1260303850	8684450949
1100000050	6734398049			1336969650	9145371849
1150000050	5828683049			1414922950	9611450349
1200000050	4987913049			1494036350	1008158450
1250000050	4204801049			1574066550	1055514550
1300000050	3473223049			1654946250	1103945550
1350000050	2788059049			1736435350	1152654250
1400000050	2144953049			1818394750	1201271950
1450000050	1540191049			1900649550	1250360950
1500000050	9704165048	1196583550	1299865450	1983096250	1299800950
1550000050	4310528048	1255222150	1350504950	2065604050	1349688650
1600000050	7981690047-	1314673750	1400638850	2148014550	1399578350
1650000050	5639198048-	1374346050	1451561050	2230230050	1449870250
1700000050	1022820549-	1434656350	1502109450	2312203650	1500182750
1750000050	1457954049-	1495177750	1552989950	2393798850	1550921850
1800000050	1870652449-	1555867750	1604137250	2474993150	1601637350
1850000050	2262154249-	1616870350	1655183450	2555726550	1652396950
1900000050	2633617149-	1678117950	1706126150	2635924150	1703386650
1950000050	2986129049-	1739380150	1757292450	2715584450	1754411050
2000000050	3316279049-	1800705350	1808523950		
2050000050	3629410049-	1861977350	1859817750		
2100000050	3926537049-	1923395950	1910858550		
2150000050	4208590049-	1984691950	1962026950		
2200000050	4476437049-	2045860950	2013328250		
2250000050	4730889049-	2107000350	2064444650		
2300000050	4972698049-	2168077650	2115459450		
2350000050	5202564049-	2228968050	2166523450		
2400000050	5421144049-	2289661250	2217602850		
2450000050	5629054049-	2350239950	2268554950		

-17-

R	W-	P-	Q-
2500000050	5826874049-	2410645850	2319491250
2550000050	6015145049-	2470862950	2370356650
2600000050	6194366049-	2530885750	2421158750
2650000050	6365028049-	2590716250	2471840650
2700000050	6527569049-	2650336350	2522516450
2750000050	6682414049-	2709746050	2573143850
2800000050	6829965049-	2768966050	2623631050
2850000050	6970590049-	2827945950	2674114750
2900000050	7104653049-	2886710650	2724509050
2950000050	7232477049-	2945256050	2774853050
3000000050	7354379049-	3003570850	2825160150
3050000050	7470660049-	3061684450	2875388450
3100000050	7581598049-	3119580250	2925526550
3150000050	7687459049-	3177273450	2975598050
3200000050	7788491049-	3234734850	3025631350
3250000050	7884931049-	3291991950	3075604850
3300000050	7977006049-	3349040350	3125526450
3350000050	8064929049-	3405882050	3175399750
3400000050	8148897049-	3462522950	3225185250
3450000050	8229101049-	3518958150	3274949950
3500000050	8305722049-	3575198350	3324655250
3550000050	8378929049-	3631247250	3374311050
3600000050	8448886049-	3687100550	3423911050
3650000050	8515747049-	3742769250	3473475150
3700000050	8579653049-	3798259750	3522994250
3750000050	8640746049-	3853561150	3572475450
3800000050	8699156049-	3908684750	3621920350
3850000050	8755009049-	3963642950	3671318950
3900000050	8808417049-	4018428450	3720690350
3950000050	8859500049-	4073054250	3770029650
4000000050	8908359049-	4127507650	3819338550
4050000050	8955098049-	4181804250	3868612250
4100000050	8999809049-	4233431550	3916372950
4150000050	9042594049-	4289944150	3967101250
4200000050	9083528049-	4343465750	4017409450
4250000050	9122701049-	4397172950	4066561350
4300000050	9160191049-	4451049750	4114643850
4350000050	9196071049-	4504172850	4164821350
4400000050	9230410049-	4557468350	4213926250
4450000050	9263289049-	4610924450	4262041950
4500000050	9294757049-	4663956750	4311131050
4550000050	9324882049-	4716862950	4360240550
4600000050	9353724049-	4769381650	4410220150
4650000050	9381339049-	4822314650	4458395050
4700000050	9407783049-	4874869650	4507447650
4750000050	9433102049-	4927317350	4556527150
4800000050	9457342049-	4979410950	4606399550
4850000050	9480562049-	5031879050	4654651350
4900000050	9502796049-	5083778350	4704504550
4950000050	9524091049-	5135814250	4753533050

-18-

R	W-	P-	Q-
5000000050	9544482049-	5187746650	4802582550
5050000050	9564016049-	5239589050	4851602250
5100000050	9582721049-	5291335250	4900676550
5150000050	9600637049-	5343004750	4949724250
5200000050	9617798049-	5394766950	4998113250
5250000050	9634237049-	5446056550	5047868250
5300000050	9649981049-	5497473750	5096956950
5350000050	9665063049-	5548975050	5145416650
5400000050	9679508049-	5600048250	5195161450
5450000050	9693344049-	5651401050	5243640350
5500000050	9706597049-	5702327050	5293371550
5550000050	9719293049-	5753372450	5342525450
5600000050	9731453049-	5804326950	5391688050
5650000050	9743103049-	5855392450	5440298150
5700000050	9754259049-	5906238650	5489486950
5750000050	9764945049-	5956988250	5538692150
5800000050	9775180049-	6007546550	5588450650
5850000050	9784989049-	6058356550	5637186750
5900000050	9794378049-	6108815250	5686932350
5950000050	9803374049-	6159370550	5736205650
6000000050	9811987049-	6209867450	5785507750
6050000050	9820239049-	6260307850	5834800050
6100000050	9828141049-	6310832850	5883704850
6150000050	9835709049-	6361063650	5933502450
6200000050	9842958049-	6411339350	5982868850
6250000050	9849900049-	6461606350	6032266450
6300000050	9856547049-	6511945550	6081258050
6350000050	9862910049-	6562002450	6131130950
6400000050	9869007049-	6612128850	6180584050
6450000050	9874842049-	6662350750	6229672950
6500000050	9880431049-	6712309050	6279557050
6550000050	9885781049-	6762441650	6328718450
6600000050	9890904049-	6812293150	6378627050
6650000050	9895806049-	6862270650	6428213850
6700000050	9900501049-	6912297750	6477453850
6750000050	9904994049-	6962092150	6527408950
6800000050	9909294049-	7012028450	6576726550
6850000050	9913413049-	7061782250	6626716550
6900000050	9917355049-	7111698150	6676091950
6950000050	9921126049-	7161462750	6725794350
7000000050	9924733049-	7211159050	6775829250
7050000050	9928190049-	7260951150	6825302150
7100000050	9931497049-	7310676350	6875089550
7150000050	9934659049-	7360263650	6925163650
7200000050	9937683049-	7409950750	6974980250
7250000050	9940577049-	7459569650	7024822250
7300000050	9943350049-	7509297550	7074432150
7350000050	9945997049-	7558820850	7124580750
7400000050	9948531049-	7608476350	7174254550
7450000050	9950953049-	7657996650	7224431150

-19-

R	W-	P-	Q-
7500000050	9953275049-	7707534850	7274362550
7550000050	9955489049-	7757148750	7324132550
7600000050	9957611049-	7806657950	7374150650
7650000050	9959636049-	7856115150	7424357350
7700000050	9961571049-	7905614950	7474418250
7750000050	9963429049-	7955187750	7524245850
7800000050	9965198049-	8004638750	7574339250
7850000050	9966889049-	8054140650	7624434050
7900000050	9968506049-	8103561550	7674598750
7950000050	9970056049-	8152994050	7724688950
8000000050	9971530049-	8202387450	7775028750
8050000050	9972944049-	8251851650	7825043050
8100000050	9974291049-	8301232250	7875262750
8150000050	9975579049-	8350652550	7925613550
8200000050	9976812049-	8400073550	7975675450
8250000050	9977987049-	8449448950	8025928550
8300000050	9979108049-	8498792750	8076316450
8350000050	9980181049-	8548167450	8126621950
8400000050	9981205049-	8597541550	8176900050
8450000050	9982182049-	8646952450	8227091250
8500000050	9983110049-	8696277050	8277554450
8550000050	9984006049-	8745679650	8327754050
8600000050	9984854049-	8794973350	8378237750
8650000050	9985662049-	8844322750	8428608750
8700000050	9986437049-	8893602750	8478984050
8750000050	9987178049-	8943081450	8529265450
8800000050	9987879049-	8992327950	8579804350
8850000050	9988549049-	9041719150	8630236650
8900000050	9989191049-	9091074150	8680546550
8950000050	9989798049-	9140369650	8731133150
9000000050	9990384049-	9189715050	8781474450
9050000050	9990935049-	9239046050	8831962350
9100000050	9991466049-	9288362250	8882529150
9150000050	9991968049-	9337642050	8933053450
9200000050	9992450049-	9387018150	8983435750
9250000050	9992905049-	9436314050	9033966550
9300000050	9993339049-	9485662850	9084466550
9350000050	9993755049-	9534943850	9135093350
9400000050	9994149049-	9584304550	9185587150
9450000050	9994524049-	9633617950	9236215550
9500000050	9994882049-	9682888450	9286750250
9550000050	9995222049-	9732278950	9337266150
9600000050	9995551049-	9781579150	9387851150
9650000050	9995853049-	9830912450	9438438550
9700000050	9996146049-	9880163550	9489092450
9750000050	9996424049-	9929598650	9539668450
9800000050	9996689049-	9978927150	9590229650
9850000050	9996937049-	1002828751	9640872950
9900000050	9997178049-	1007753651	9691487750
9950000050	9997407049-	1012685251	9742120050

-20-

R	W-	P-	Q-
1000000051	9997617049-	1017619351	9792812750
1005000051	9997824049-	1022553651	9843391050
1010000051	9998018049-	1027489151	9894059950
1015000051	9998202049-	1032424851	9944771950
1020000051	9998373049-	1037358451	9995378450
1025000051	9998542049-	1042291951	1004604551
1030000051	9998696049-	1047226451	1009672151
1035000051	9998845049-	1052167951	1014729351
1040000051	9998985049-	1057097051	1019801851
1045000051	9999118049-	1062024451	1024877051
1050000051	9999240049-	1066969151	1029940751
1055000051	9999363049-	1071901151	1035003851
1060000051	9999471049-	1076834651	1040073351
1065000051	9999580049-	1081783151	1045139851
1070000051	9999679049-	1086720551	1050210551
1075000051	9999769049-	1091653151	1055279751
1080000051	9999860049-	1096578651	1060349451
1085000051	9999948049-	1101521251	1065413951
1090000051	1000002650-	1106461051	1070489051
1095000051	1000009950-	1111399151	1075558351
1100000051	1000017250-	1116342551	1080625951
1105000051	1000024050-	1121281851	1085686551
1110000051	1000029850-	1126218151	1090759151
1115000051	1000035550-	1131159951	1095832251
1120000051	1000041150-	1136099051	1100903151
1125000051	1000046250-	1141037351	1105970151
1130000051	1000050750-	1145973151	1111042751
1135000051	1000055350-	1150921951	1116110451
1140000051	1000059450-	1155860251	1121181051
1145000051	1000063150-	1160798151	1126250651
1150000051	1000067650-	1165738051	1131318451
1155000051	1000070850-	1170675151	1136387151
1160000051	1000073850-	1175620151	1141460351
1165000051	1000076450-	1180563451	1146522151
1170000051	1000079150-	1185503051	1151597951
1175000051	1000081550-	1190448351	1156662451
1180000051	1000083850-	1195398851	1161733751
1185000051	1000086150-	1200350151	1166803051
1190000051	1000087950-	1205284451	1171865451
1195000051	1000089850-	1210231151	1176938751
1200000051	1000091350-	1215174351	1182008051
1205000051	1000092650-	1220112451	1187073951
1210000051	1000094150-	1225049451	1192142751
1215000051	1000094950-	1230012351	1197211651
1220000051	1000096250-	1234953651	1202278651
1225000051	1000097050-	1239906751	1207344551
1230000051	1000098250-	1244853451	1212412751
1235000051	1000098850-	1249811851	1217479551
1240000051	1000099250-	1254751251	1222546751
1245000051	1000099950-	1259688751	1227612151

-21-

R	W-	P-	Q-
1250000051	1000100250-	1264636751	1232675551
1255000051	1000100050-	1269575051	1237742851
1260000051	1000100850-	1274543351	1242812151
1265000051	1000100650-	1279489051	1247875551
1270000051	1000101150-	1284431151	1252928051
1275000051	1000101150-	1289383251	1257990851
1280000051	1000100750-	1294337951	1263074951
1285000051	1000100650-	1299277851	1268135351
1290000051	1000100450-	1304234751	1273205851
1295000051	1000100150-	1309183951	1278270051
1300000051	1000099950-	1314135151	1283323851
1305000051	1000099550-	1319094551	1288390851
1310000051	1000099550-	1324041051	1293448751
1315000051	1000099150-	1328993751	1298513351
1320000051	1000098450-	1333952351	1303584951
1325000051	1000098450-	1338895151	1308636251
1330000051	1000097750-	1343861351	1313694251
1335000051	1000097350-	1348799251	1318758051
1340000051	1000096850-	1353768251	1323825551
1345000051	1000096250-	1358709451	1328883551
1350000051	1000095650-	1363670351	1333947451
1355000051	1000094950-	1368619451	1339000751
1360000051	1000094150-	1373570551	1344063651
1365000051	1000093450-	1378529251	1349121551
1370000051	1000092650-	1383480551	1354183251
1375000051	1000092350-	1388451651	1359237551
1380000051	1000092050-	1393400451	1364300151
1385000051	1000091150-	1398359951	1369357651
1390000051	1000089950-	1403309251	1374418351
1395000051	1000089550-	1408260451	1379474551
1400000051	1000088650-	1413222151	1384530451
1405000051	1000087850-	1418183351	1389590651
1410000051	1000087350-	1423147351	1394641151
1415000051	1000086250-	1428090151	1399696051
1420000051	1000086050-	1433060651	1404755751
1425000051	1000085150-	1438025751	1409807751
1430000051	1000084450-	1442967151	1414868951
1435000051	1000083450-	1447935651	1419922551
1440000051	1000082850-	1452882751	1424971051
1445000051	1000081950-	1457845851	1430032151
1450000051	1000080850-	1462803351	1435087551
1455000051	1000080650-	1467763851	1440135651
1460000051	1000079250-	1472725751	1445188851
1465000051	1000078950-	1477677451	1450242351
1470000051	1000077950-	1482639751	1455297451
1475000051	1000077450-	1487608851	1460355451
1480000051	1000076450-	1492575751	1465404451
1485000051	1000075850-	1497527451	1470458451
1490000051	1000074450-	1502491551	1475509651
1495000051	1000074350-	1507453051	1480557251

-22-

R	W-	P-	Q-
1500000051	1000073650-	1512410551	1485603551
1505000051	1000072850-	1517365051	1490662051
1510000051	1000072150-	1522317151	1495707951
1515000051	1000070650-	1527276151	1500760951
1520000051	1000070050-	1532272951	1505814351
1525000051	1000069250-	1537246451	1510861351
1530000051	1000068950-	1542172851	1515915551
1535000051	1000068250-	1547152951	1520965351
1540000051	1000067350-	1552127651	1526014151
1545000051	1000066450-	1557069751	1531053551
1550000051	1000065750-	1562030451	1536096451
1555000051	1000064850-	1566997451	1541149751
1560000051	1000064550-	1571968351	1546180451
1565000051	1000063350-	1576935551	1551250851
1570000051	1000062650-	1581897551	1556288851
1575000051	1000062550-	1586853951	1561329651
1580000051	1000061550-	1591836251	1566391251
1585000051	1000061150-	1596815951	1571427351
1590000051	1000060450-	1601735651	1576472351
1595000051	1000059850-	1606726351	1581520151
1600000051	1000058950-	1611700651	1586564951
1605000051	1000058250-	1616679551	1591611551
1610000051	1000057750-	1621641151	1596651251
1615000051	1000057250-	1626604751	1601695351
1620000051	1000056350-	1631570251	1606742551
1625000051	1000055650-	1636528851	1611779651
1630000051	1000055050-	1641488451	1616828051
1635000051	1000054650-	1646476251	1621873251
1640000051	1000054350-	1651458051	1626912351
1645000051	1000053450-	1656401151	1631953251
1650000051	1000052850-	1661372051	1637002051
1655000051	1000052550-	1666338851	1642039251
1660000051	1000051350-	1671313351	1647073351
1665000051	1000051250-	1676249151	1652127251
1670000051	1000050350-	1681229351	1657164051
1675000051	1000049950-	1686196651	1662206051
1680000051	1000049850-	1691187351	1667241451
1685000051	1000048750-	1696147151	1672279851
1690000051	1000047850-	1701097251	1677324651
1695000051	1000047950-	1706066251	1682368651
1700000051	1000047050-	1711034551	1687396751
1705000051	1000046550-	1716001251	1692458051
1710000051	1000046450-	1720993751	1697474751
1715000051	1000045950-	1725972251	1702536751
1720000051	1000045350-	1730932451	1707545451
1725000051	1000044750-	1735900751	1712586651
1730000051	1000044450-	1740885751	1717641751
1735000051	1000043950-	1745857551	1722676351
1740000051	1000043050-	1750792451	1727712751
1745000051	1000043150-	1755764151	1732748251

-23-

R	W-	P-	Q-
1750000051	1000042250-	1760772751	1737795951
1755000051	1000041250-	1765721651	1742832451
1760000051	1000040650-	1770701551	1747871951
1765000051	1000040650-	1775651351	1752911551
1770000051	1000040250-	1780621251	1757932851
1775000051	1000039850-	1785607551	1763000651
1780000051	1000039950-	1790572651	1768023551
1785000051	1000038550-	1795556551	1773056151
1790000051	1000038550-	1800519051	1778085151
1795000051	1000038050-	1805488551	1783126851
1800000051	1000037750-	1810493351	1788148451
1805000051	1000037350-	1815421951	1793193651
1810000051	1000037050-	1820403751	1798213351
1815000051	1000036750-	1825390451	1803258351
1820000051	1000036750-	1830378751	1808287151
1825000051	1000035850-	1835335651	1813335551
1830000051	1000035250-	1840317151	1818362351
1835000051	1000035250-	1845245451	1823400651
1840000051	1000034750-	1850283951	1828446351
1845000051	1000034950-	1855246851	1833485251
1850000051	1000033750-	1860210151	1838497251
1855000051	1000034050-	1865163751	1843526951
1860000051	1000033350-	1870145651	1848555051
1865000051	1000032850-	1875116551	1853594851
1870000051	1000032550-	1880082651	1858638151
1875000051	1000032250-	1885059051	1863666051
1880000051	1000032250-	1890074751	1868695551
1885000051	1000031950-	1895013351	1873729951
1890000051	1000031250-	1899998951	1878749951
1895000051	1000030950-	1904960351	1883790651
1900000051	1000030750-	1909969251	1888815051
1905000051	1000029850-	1914940351	1893854051
1910000051	1000030250-	1919904851	1898878851
1915000051	1000030050-	1924875351	1903912851
1920000051	1000029750-	1929849451	1908944551
1925000051	1000029150-	1934802251	1913988451
1930000051	1000028950-	1939816551	1918997851
1935000051	1000028650-	1944777451	1924044551
1940000051	1000027950-	1949733351	1929072151
1945000051	1000028250-	1954767551	1934111251
1950000051	1000027950-	1959702751	1939130651
1955000051	1000027250-	1964693351	1944144351
1960000051	1000027250-	1969666851	1949188051
1965000051	1000026850-	1974637051	1954201851
1970000051	1000027050-	1979654451	1959248451
1975000051	1000026450-	1984579751	1964254251
1980000051	1000026150-	1989559051	1969288451
1985000051	1000026350-	1994547751	1974324751
1990000051	1000025650-	1999525351	1979353051
1995000051	1000025050-	2004478551	1984366151
2000000051	1000025050-	2009477751	1989427651

Appendix III. The Equal-Mass Case

For the case in which the two nuclei have the same mass the first-order dynamic corrections consist of two terms, g_{++} and g_{--} . These terms have been calculated from the variational mesonic wave functions and are tabulated in this appendix. For values of R between 1.50 and 1.95 the values of g_{--} are those obtained from a linear interpolation of the results of two possible solutions (see Appendix II).

-25-

R	G++	G--
5000000048	2544143848	8178185652
1000000049	4043590248	2023349352
1500000049	6863859348	8930531651
2000000049	9351376048	5003698351
2500000049	1142239649	3204266951
3000000049	1306855649	2224375851
3500000049	1431235049	1635505551
4000000049	1529093749	1253592851
4500000049	1609825649	9920319850
5000000049	1663807649	8051860650
5500000049	1706454149	6671456850
6000000049	1737665749	5623317450
6500000049	1760033949	4809096750
7000000049	1779345549	4163745650
7500000049	1785854949	3643676350
8000000049	1788460449	3218056850
8500000049	1794810149	2864928750
9000000049	1795682149	2568700850
9500000049	1794044949	2316784250
1000000050	1791889949	2100655950
1050000050	1787937249	1913775850
1100000050	1787041649	1750583750
1150000050	1779230049	1607302650
1200000050	1771656349	1480482150
1250000050	1769402849	1368015050
1300000050	1767423649	1267910250
1350000050	1759887049	1178279950
1400000050	1753103549	1098033550
1450000050	1751152049	1026123250
1500000050	1747566649	9626567649
1550000050	1743733449	9055988149
1600000050	1742894849	8543120949
1650000050	1737984549	8082374349
1700000050	1735761949	7667903049
1750000050	1733911949	7292728049
1800000050	1732527949	6954695549
1850000050	1731618549	6649233449
1900000050	1731108649	6371617749
1950000050	1731106249	6119294149
2000000050	1731526249	5880366049
2050000050	1732349249	5661882649
2100000050	1732373649	5461866149
2150000050	1735378549	5279134349
2200000050	1737642949	5110885849
2250000050	1740051649	4955460949
2300000050	1743171549	4812736349
2350000050	1745345249	4681488649
2400000050	1751224249	4559555749
2450000050	1755352749	4446316049

-26-

R	G++	G--
2500000050	1758847549	4341523549
2550000050	1763719049	4244043949
2600000050	1768910449	4153137149
2650000050	1773736249	4068437649
2700000050	1779673949	3989518849
2750000050	1787434049	3915323749
2800000050	1793279049	3845991549
2850000050	1799987849	3781186649
2900000050	1807837049	3720091149
2950000050	1813970349	3662818049
3000000050	1821662549	3608736249
3050000050	1830226849	3557568849
3100000050	1838398549	3509291749
3150000050	1847356849	3463876949
3200000050	1855970949	3420966249
3250000050	1863836749	3380198949
3300000050	1872960749	3341629049
3350000050	1883125549	3304944749
3400000050	1892149049	3270180949
3450000050	1901285549	3237227749
3500000050	1911464849	3205767949
3550000050	1921760049	3175870349
3600000050	1931496449	3147420749
3650000050	1941609049	3120274849
3700000050	1951886749	3094446149
3750000050	1961992749	3069857049
3800000050	1973052049	3046259949
3850000050	1983237549	3023744849
3900000050	1993865249	3002272349
3950000050	2004811149	2981772549
4000000050	2015136149	2962168049
4050000050	2025943749	2953472349
4100000050	2036659849	2923339649
4150000050	2047113849	2903178649
4200000050	2058083149	2896687849
4250000050	2068797949	2871352949
4300000050	2079477049	2860385449
4350000050	2090104249	2850911349
4400000050	2100494249	2828080449
4450000050	2111340649	2814445649
4500000050	2121744749	2806131549
4550000050	2131994349	2797819049
4600000050	2142158749	2782361149
4650000050	2152353649	2766671149
4700000050	2162537149	2759805149
4750000050	2172358549	2752977749
4800000050	2182066349	2739684249
4850000050	2191868949	2729583549
4900000050	2201387849	2724079649
4950000050	2210712949	2711630049

-27-

R	G++	G---
5000000050	2220021649	2703057449
5050000050	2229001249	2694889949
5100000050	2237849649	2687033949
5150000050	2246608049	2676483549
5200000050	2255067349	2671999849
5250000050	2263476049	2668164749
5300000050	2271798549	2655746349
5350000050	2279785049	2651819049
5400000050	2287434549	2645856849
5450000050	2295061149	2639500049
5500000050	2302610449	2636706249
5550000050	2309698749	2628611649
5600000050	2316686249	2620903949
5650000050	2323683549	2615514949
5700000050	2330336549	2613190849
5750000050	2336633949	2610813249
5800000050	2342930649	2604178649
5850000050	2349004149	2599420449
5900000050	2354865449	2597569349
5950000050	2360609049	2591451449
6000000050	2365986649	2587586249
6050000050	2371451649	2582018349
6100000050	2376656949	2580200049
6150000050	2381517749	2578865849
6200000050	2386267249	2573683149
6250000050	2390780749	2568669449
6300000050	2395296649	2567316049
6350000050	2399515049	2566361049
6400000050	2403661049	2560069949
6450000050	2407646449	2558801649
6500000050	2411476549	2556522749
6550000050	2415136349	2553984249
6600000050	2418653249	2553217549
6650000050	2422137549	2547867549
6700000050	2425264849	2546993949
6750000050	2428370849	2545229049
6800000050	2431453649	2542994849
6850000050	2434220149	2541093149
6900000050	2436914149	2537898249
6950000050	2439606249	2538580949
7000000050	2442137349	2535875149
7050000050	2444640249	2532987749
7100000050	2446914249	2533663449
7150000050	2449001549	2532167849
7200000050	2451210249	2529631849
7250000050	2453329649	2527223249
7300000050	2455154849	2526810849
7350000050	2456992849	2525807749
7400000050	2458865749	2524359849
7450000050	2460452649	2524193949

-28-

R	G++	G--
7500000050	2462053549	2521315849
7550000050	2463489949	2520324649
7600000050	2465010849	2520888649
7650000050	2466690549	2519906849
7700000050	2467948449	2517292949
7750000050	2469309249	2516391949
7800000050	2470200149	2516356249
7850000050	2471404949	2515661349
7900000050	2472959449	2514913249
7950000050	2473951949	2514557749
8000000050	2474908449	2513411949
8050000050	2476200449	2512207649
8100000050	2477232749	2512500949
8150000050	2477974249	2511204049
8200000050	2478680249	2510263749
8250000050	2479463949	2510710449
8300000050	2480371249	2510207849
8350000050	2481009649	2509161749
8400000050	2481764349	2508107649
8450000050	2482586349	2508146749
8500000050	2483362649	2507667949
8550000050	2483834049	2507229049
8600000050	2484186049	2507365249
8650000050	2484916949	2506603349
8700000050	2485533049	2505505049
8750000050	2485893749	2505589749
8800000050	2486845149	2505834849
8850000050	2487544949	2504512749
8900000050	2487686149	2504359649
8950000050	2487983949	2504284749
9000000050	2488504349	2504212349
9050000050	2489013049	2504141649
9100000050	2489416449	2504076049
9150000050	2489695649	2503110849
9200000050	2489947849	2502767549
9250000050	2490398649	2502878949
9300000050	2490991049	2502902049
9350000050	2491200649	2502619249
9400000050	2491389249	2502292649
9450000050	2491736049	2502430649
9500000050	2491913449	2501704149
9550000050	2492268649	2501553649
9600000050	2492645749	2501690549
9650000050	2492696949	2501810049
9700000050	2493257849	2501351949
9750000050	2493466449	2500776549
9800000050	2493318949	2500973249
9850000050	2493570649	2501178349
9900000050	2494018249	2501100749
9950000050	2494106549	2500935349

-29-

R	G++	G--
1000000051	2494512749	2500633749
1005000051	2494684749	2500414149
1010000051	2494565149	2500614549
1015000051	2494762049	2500430049
1020000051	2494921249	2500266749
1025000051	2495409449	2500325749
1030000051	2495649249	2499832349
1035000051	2495489149	2499994949
1040000051	2495299949	2500692749
1045000051	2495676949	2500053249
1050000051	2496222049	2499605649
1055000051	2496265649	2499930749
1060000051	2495904849	2499577849
1065000051	2495970349	2499493349
1070000051	2496460749	2499889549
1075000051	2496526349	2500090549
1080000051	2496824049	2499699049
1085000051	2496718149	2499466049
1090000051	2496470849	2499671249
1095000051	2497020749	2499393749
1100000051	2496916249	2499153449
1105000051	2496909949	2499390649
1110000051	2497421049	2499607149
1115000051	2497371949	2499506549
1120000051	2496910149	2499438349
1125000051	2497465049	2499530549
1130000051	2497617849	2499312049
1135000051	2497121749	2499219749
1140000051	2497626249	2499495749
1145000051	2497662049	2499395949
1150000051	2497682449	2499387749
1155000051	2497999049	2499388149
1160000051	2498019649	2499128249
1165000051	2498011049	2499290549
1170000051	2497786249	2499324649
1175000051	2497591349	2499004349
1180000051	2498005149	2499013849
1185000051	2498069549	2499192849
1190000051	2497994449	2499355649
1195000051	2498125049	2499344649
1200000051	2498238149	2499383749
1205000051	2498268849	2499499149
1210000051	2498335849	2499057949
1215000051	2498404249	2498987649
1220000051	2498368349	2499137349
1225000051	2498342449	2499082049
1230000051	2498249649	2499018449
1235000051	2498408549	2499188549
1240000051	2498848749	2499587049
1245000051	2498590549	2499338349

-30-

R	G++	G--
1250000051	2498385949	2499380549
1255000051	2498841649	2499107749
1260000051	2498495849	2498949149
1265000051	2498226049	2499145649
1270000051	2499154349	2498997649
1275000051	2498938149	2499404149
1280000051	2498466449	2499666249
1285000051	2498908849	2499353049
1290000051	2498762949	2499300949
1295000051	2498909349	2499110949
1300000051	2498797049	2498978649
1305000051	2498787849	2499199149
1310000051	2498880149	2499286649
1315000051	2499056549	2499354649
1320000051	2499023849	2499342249
1325000051	2498777649	2498931349
1330000051	2499000549	2499303549
1335000051	2499139649	2499437849
1340000051	2499296349	2499333849
1345000051	2498934949	2499419249
1350000051	2498725549	2499230749
1355000051	2499024649	2499395049
1360000051	2499266049	2499333949
1365000051	2499101949	2499338049
1370000051	2499122149	2499075749
1375000051	2499134449	2499183449
1380000051	2498999249	2499477049
1385000051	2499216349	2499459449
1390000051	2499420849	2499605149
1395000051	2499205749	2499314649
1400000051	2499170749	2499243949
1405000051	2499281849	2499147849
1410000051	2499218549	2499398349
1415000051	2499114149	2499452149
1420000051	2499211849	2499068149
1425000051	2499501149	2499628749
1430000051	2499190549	2499606849
1435000051	2499121749	2499324649
1440000051	2499202549	2499546449
1445000051	2499229149	2499529249
1450000051	2499311749	2499372749
1455000051	2499402649	2499279049
1460000051	2499372049	2499549149
1465000051	2499061049	2499586649
1470000051	2499456149	2499402449
1475000051	2499650349	2499268249
1480000051	2499501249	2499518649
1485000051	2499592849	2499617849
1490000051	2498853949	2499374149
1495000051	2499386449	2499418749

-31-

R	G++	G--
1500000051	2499753549	2499728649
1505000051	2499101149	2499834849
1510000051	2499664049	2499664849
1515000051	2499338949	2499081649
1520000051	2499369749	2498829649
1525000051	2499796149	2500023649
1530000051	2499326549	2499937749
1535000051	2499474449	2499115449
1540000051	2499842649	2499597749
1545000051	2499309549	2499703249
1550000051	2499280549	2499534949
1555000051	2499690249	2499210049
1560000051	2499513849	2499489249
1565000051	2499196549	2499813149
1570000051	2499682449	2499506449
1575000051	2499661549	2499562849
1580000051	2499315049	2499197649
1585000051	2499656949	2499935249
1590000051	2499753249	2499901649
1595000051	2499629949	2499107249
1600000051	2499529249	2499307349
1605000051	2499586249	2499464549
1610000051	2499530449	2499663949
1615000051	2499486249	2499737049
1620000051	2499476649	2499728049
1625000051	2499571349	2499829549
1630000051	2499644249	2499524349
1635000051	2499628349	2499097449
1640000051	2499450649	2499739849
1645000051	2499444949	2500034849
1650000051	2499792849	2499653549
1655000051	2499892049	2499382649
1660000051	2499453449	2500110849
1665000051	2499635249	2500058449
1670000051	2499838349	2499433849
1675000051	2499575749	2499275049
1680000051	2499669449	2499369949
1685000051	2499605749	2500110449
1690000051	2499340749	2500054849
1695000051	2499866449	2499558849
1700000051	2499939149	2499842749
1705000051	2499426149	2499369449
1710000051	2499549449	2499218349
1715000051	2499890149	2499637649
1720000051	2499574849	2499434349
1725000051	2499650549	2499769049
1730000051	2499652249	2499682549
1735000051	2499472449	2500138849
1740000051	2499662449	2500117149
1745000051	2500128949	2499239249

-32-

R	G++	G--
1750000051	2500161749	2499655349
1755000051	2499417349	2499928949
1760000051	2499660749	2499989949
1765000051	2499312049	2499858149
1770000051	2499439949	2499731249
1775000051	2500301749	2499902049
1780000051	2499985449	2499424149
1785000051	2499955549	2499570949
1790000051	2499942149	2499886949
1795000051	2499486249	2499216449
1800000051	2499572149	2499864449
1805000051	2499437149	2500125749
1810000051	2499611749	2499324949
1815000051	2500055749	2499408549
1820000051	2499538449	2499885949
1825000051	2499377749	2499962449
1830000051	2499880749	2500220049
1835000051	2500209549	2499669449
1840000051	2499585649	2499320549
1845000051	2499596449	2499881049
1850000051	2500099549	2499845949
1855000051	2499843749	2499797649
1860000051	2499538549	2499715549
1865000051	2499182649	2500145649
1870000051	2500026649	2499928349
1875000051	2500280649	2499092249
1880000051	2499837449	2499737749
1885000051	2499735749	2499978649
1890000051	2499593949	2499766849
1895000051	2499681649	2499528349
1900000051	2499834649	2499418749
1905000051	2499817549	2500018349
1910000051	2499870049	2499950249
1915000051	2500020849	2499923349
1920000051	2499440749	2500286149
1925000051	2499845349	2499477649
1930000051	2499891549	2499437849
1935000051	2499895349	2500438149
1940000051	2499689549	2499379349
1945000051	2499757549	2499632949
1950000051	2499438249	2499808749
1955000051	2500107649	2499635249
1960000051	2500601849	2499921449
1965000051	2498862849	2499381949
1970000051	2499377549	2499927349
1975000051	2499963149	2500165749
1980000051	2500258349	2499774949
1985000051	2499783749	2499753049
1990000051	2499331049	2499911049
1995000051	2499866449	2500018849
2000000051	2499546549	2500313549

Appendix IV. Unequal Mass Case

For the case in which the two nuclei do not have equal mass there are four dynamic correction terms. We have computed these corrections for the particular case in which the ratio of the masses of the two nuclei is 2:1.

Tabulated values for the diagonal correction terms g_{++} and g_{--} are given along with the off diagonal coupling terms g_{+-} and f_{+-} . For values of R between 1.50 and 1.95 the values of g_{--} , g_{+-} and f_{+-} are those obtained from a linear interpolation of the two sets of results (see Appendix II).

-34-

R	G++	G--	F+-	G+-
5000000048	1355823449	8178461652	9320585948-	4185438650
1000000049	1481624149	2023623952	9346095648-	1770127350
1500000049	1730930149	8933238651	9383438248-	1243675950
2000000049	1942409649	5006351151	9429665248-	1021441350
2500000049	2110360249	3206852651	9482216948-	8194784649
3000000049	2235496249	2226881651	9539196248-	7128319349
3500000049	2321209049	1637920051	9598764248-	6301497649
4000000049	2381846049	1255905951	9659486648-	5680095949
4500000049	2426999049	9942353850	9719791248-	5199894349
5000000049	2447190349	8072735650	9778439948-	4820380349
5500000049	2458104649	6691137850	9834152248-	4510526049
6000000049	2459324749	5641782650	9885340648-	4252407349
6500000049	2453677849	4826344450	9931220248-	4035830049
7000000049	2446572649	4179846850	9970232248-	3850797649
7500000049	2428385649	3658697450	1000114049-	3686814049
8000000049	2407838849	3232123950	1002321849-	3541470349
8500000049	2392539649	2878203250	1003516749-	3415445649
9000000049	2372990249	2581321950	1003590849-	3300183749
9500000049	2352296149	2329021850	1002557849-	3194335249
1000000050	2332142849	2112749650	1000239749-	3097831249
1050000050	2311371949	1925941450	9967417648-	3008550049
1100000050	2294570449	1763102350	9919468648-	2927012749
1150000050	2271833549	1620412850	9859476248-	2848281449
1200000050	2250201749	1494480050	9787647648-	2774621949
1250000050	2234732249	1383083150	9704623248-	2708471449
1300000050	2220220349	1284235350	9610538648-	2647111449
1350000050	2200888149	1196057950	9506936248-	2586759649
1400000050	2182962749	1117384950	9394486948-	2530255849
1450000050	2170505949	1047121550	9274481948-	2480136149
1500000050	2156935449	9874907849	9118870348-	2436924449
1550000050	2143701149	9340195149	8960036048-	2396140349
1600000050	2133918249	8930190449	8797946948-	2358799249
1650000050	2120557049	8428632149	8634399548-	2321498249
1700000050	2110324849	8039925449	8470131748-	2287409249
1750000050	2100880749	7686981249	8305736848-	2254993949
1800000050	2092295149	7367618149	8141864948-	2224285349
1850000050	2084551849	7077608449	7979072848-	2195261849
1900000050	2077556649	6812358949	7817767048-	2167688749
1950000050	2071397549	6569506849	7658238348-	2141446549
2000000050	2065971449	6329669749	7517918948-	2114265549
2050000050	2061242649	6109999649	7377865948-	2088569049
2100000050	2055994049	5908616249	7238321648-	2063925749
2150000050	2053999749	5724286049	7099777348-	2041703649
2200000050	2051495849	5554238949	6961828948-	2020145649
2250000050	2049394149	5396869849	6825431948-	1999710049
2300000050	2048212249	5252068549	6689918348-	1980502249
2350000050	2046316849	5118602749	6556269348-	1961912149
2400000050	2048324049	4994329849	6424009948-	1945462849
2450000050	2048769849	4878665449	6293191948-	1929070949

-35-

R	G++	G--	F+-	G+-
2500000050	2048776549	4771369049	6164261948-	1913216049
2550000050	2050338149	4671315449	6037103948-	1898535749
2600000050	2052390949	4577778149	5911759948-	1884588949
2650000050	2054241349	4490403949	5788251648-	1871092549
2700000050	2057365049	4408773749	5666747948-	1858610849
2750000050	2062455449	4331841049	5547003648-	1847289649
2800000050	2065769249	4259756549	5428982648-	1835733049
2850000050	2070094249	4192184849	5313144348-	1825030749
2900000050	2075682449	4128317749	5198949948-	1815124649
2950000050	2079686649	4068274949	5086755948-	1805029249
3000000050	2085375049	4011429449	4976557648-	1795909649
3050000050	2092048649	3957513049	4868091348-	1787458649
3100000050	2098441549	3906502449	4761461048-	1779220849
3150000050	2105729649	3858376949	4656642648-	1771642349
3200000050	2112774049	3812776549	4553548348-	1764255749
3250000050	2119174049	3769348049	4452327648-	1756894449
3300000050	2126931549	3728146149	4352935648-	1750313049
3350000050	2135819449	3688862049	4255197048-	1744379049
3400000050	2143652849	3651531949	4159078648-	1738300449
3450000050	2151690249	3616048249	4064806048-	1732558849
3500000050	2160850949	3582095249	3972121048-	1727416249
3550000050	2170207549	3549743449	3881065048-	1722574849
3600000050	2179079349	3518878249	3791560048-	1717758849
3650000050	2188406049	3489357949	3703755048-	1713312149
3700000050	2197964949	3461196349	3617403348-	1709147849
3750000050	2207424549	3434315449	3532706048-	1705145449
3800000050	2217901549	3408468349	3449467648-	1701666349
3850000050	2227566549	3383746649	3367674348-	1698080249
3900000050	2237738549	3360110149	3287460048-	1694861649
3950000050	2248283049	3337489549	3208587148-	1691938149
4000000050	2258265349	3315805949	3131209948-	1688978149
4050000050	2268785049	3305073849	3055245548-	1687576249
4100000050	2279263849	3272661849	2981892348-	1683255049
4150000050	2289531549	3250836249	2907452448-	1680822349
4200000050	2300363649	3242432749	2836257248-	1680093649
4250000050	2310983349	3215231349	2765695648-	1676878049
4300000050	2321614049	3202440749	2695912548-	1675567649
4350000050	2332231749	3191180949	2628576748-	1674554749
4400000050	2342655149	3166606149	2561983248-	1671751449
4450000050	2353571249	3151267749	2496056048-	1670380949
4500000050	2364079849	3141288349	2431934548-	1669653649
4550000050	2374470249	3131350449	2369091348-	1668933149
4600000050	2384806949	3114306749	2307992848-	1667322949
4650000050	2395206849	3097065049	2247053048-	1665715649
4700000050	2405622349	3088686549	2187806948-	1665405349
4750000050	2415704349	3080384349	2129758248-	1665029949
4800000050	2425699149	3065654949	2073375748-	1663827349
4850000050	2435813349	3054146649	2017166248-	1663126349
4900000050	2445664649	3047278449	1963042148-	1663074949
4950000050	2455345649	3033494249	1909571648-	1662029849

-36-

R	G++	G--	F+-	G+-
5000000050	2465028849	3023620849	1857207648-	1661594749
5050000050	2474402249	3014184949	1805927848-	1661169549
5100000050	2483661449	3005093649	1755768948-	1660816949
5150000050	2492846749	2993339849	1706658248-	1660113949
5200000050	2501746649	2987677349	1658201048-	1660223549
5250000050	2510610749	2982705649	1611653748-	1660509449
5300000050	2519398649	2969175849	1565688548-	1659577549
5350000050	2527861649	2964158949	1520354548-	1659795449
5400000050	2535997249	2957149049	1476826348-	1659729549
5450000050	2544117549	2949758549	1433521048-	1659573149
5500000050	2552170949	2945972049	1391959148-	1660018549
5550000050	2559766449	2936906649	1350989648-	1659615649
5600000050	2567267849	2928252749	1311003048-	1659261949
5650000050	2574782849	2921937649	1271587548-	1659290349
5700000050	2581956749	2918719249	1233440848-	1659736049
5750000050	2588777549	2915469949	1196253348-	1660098149
5800000050	2595600449	2907995549	1160309548-	1659885749
5850000050	2602200949	2902408949	1124574248-	1659932549
5900000050	2608587449	2899764349	1090374748-	1660409649
5950000050	2614856549	2892869649	1056711148-	1660223949
6000000050	2620757849	2888249649	1023906948-	1660309849
6050000050	2626746049	2881947149	9919547647-	1660202949
6100000050	2632470049	2879410049	9605144247-	1660626549
6150000050	2637847349	2877389949	9304761247-	1661067149
6200000050	2643109949	2871532749	9009538947-	1660925149
6250000050	2648130849	2865866349	8722235647-	1660762349
6300000050	2653151949	2863872249	8439884647-	1661178249
6350000050	2657868449	2862307949	8170596347-	1661647349
6400000050	2662506949	2855418249	7906118647-	1661268649
6450000050	2666979249	2853564549	7646123647-	1661632049
6500000050	2671290149	2850728349	7398459347-	1661851749
6550000050	2675423749	2847637949	7152865647-	1661996949
6600000050	2679406949	2846344549	6919246647-	1662397549
6650000050	2683351549	2840481449	6689618947-	1662110649
6700000050	2686929149	2839103449	6464358647-	1662420949
6750000050	2690481249	2836859749	6250206647-	1662604649
6800000050	2694001049	2834150049	6038114347-	1662733749
6850000050	2697196849	2831799149	5836184947-	1662872249
6900000050	2700311349	2828158749	5636372347-	1662784949
6950000050	2703415349	2828412849	5444500347-	1663318049
7000000050	2706350449	2825298849	5260204347-	1663287649
7050000050	2709250149	2822004049	5078001647-	1663234049
7100000050	2711910749	2822291549	4902877647-	1663707349
7150000050	2714377449	2820422349	4735206647-	1663789149
7200000050	2716957249	2817521849	4570820647-	1663757949
7250000050	2719438549	2814758149	4411639047-	1663734349
7300000050	2721616849	2814000049	4255578647-	1663944149
7350000050	2723800649	2812669249	4108016647-	1664096249
7400000050	2726009549	2810895949	3961913647-	1664163349
7450000050	2727926849	2810423949	3823311647-	1664402549

-37-

R	G++	G--	F+-	G+-
7500000050	2729846849	2807243349	3688017347-	1664198449
7550000050	2731597549	2808799149	3555494047-	1664254449
7600000050	2733423049	2809156849	3429242047-	1664624549
7650000050	2735398449	2807866249	3307600347-	1664770549
7700000050	2736945249	2804856449	3189040247-	1664563849
7750000050	2738585249	2803690449	3072867147-	1664649349
7800000050	2739749349	2803416949	2961978347-	1664797349
7850000050	2741214849	2802463849	2855142047-	1664883149
7900000050	2743028449	2801493349	2751680947-	1665013349
7950000050	2744271849	2800889649	2651314447-	1665116849
8000000050	2745472849	2799465549	2555532347-	1665110149
8050000050	2746999649	2798017549	2461229647-	1665121749
8100000050	2748265849	2798098849	2370721347-	1665343649
8150000050	2749229849	2796542949	2284170747-	1665301149
8200000050	2750151149	2795402049	2198832747-	1665230749
8250000050	2751146649	2795680049	2117991847-	1665453949
8300000050	2752254249	2794964349	2040135747-	1665538149
8350000050	2753091649	2793689849	1964667047-	1665455549
8400000050	2754036149	2792409549	1891542047-	1665466949
8450000050	2755039249	2792284949	1820309147-	1665565049
8500000050	2755999649	2791624949	1752854047-	1665610849
8550000050	2756643349	2791020249	1686347747-	1665634649
8600000050	2757164749	2791013249	1623916047-	1665698149
8650000050	2758057749	2790086949	1563277547-	1665729949
8700000050	2758830149	2788737849	1504464847-	1665646449
8750000050	2759343449	2788684349	1446812847-	1665689149
8800000050	2760443749	2788826249	1393189947-	1665942349
8850000050	2761284549	2787288149	1339758047-	1665842049
8900000050	2761567449	2787043249	1287996747-	1665901449
8950000050	2761999249	2786827849	1235540847-	1665903049
9000000050	2762645849	2786640849	1192125847-	1665983749
9050000050	2763282649	2786413749	1146668947-	1666002849
9100000050	2763805449	2786250549	1103087447-	1666105749
9150000050	2764199649	2785122849	1061152347-	1665965749
9200000050	2764565449	2784648249	1019737247-	1665920349
9250000050	2765125749	2784658049	9809146246-	1666034449
9300000050	2765822749	2784575449	9427805946-	1666153549
9350000050	2766134849	2784175949	9067987246-	1666103349
9400000050	2766424649	2783725049	8714797246-	1666098049
9450000050	2766864249	2783811149	8381080646-	1666185149
9500000050	2767135849	2782939949	8057184646-	1666079249
9550000050	2767578049	2782677649	7742153346-	1666140049
9600000050	2768040849	2782751149	7440615646-	1666232949
9650000050	2768172549	2782805249	7151100346-	1666213749
9700000050	2768817049	2782205149	6878758346-	1666270349
9750000050	2769099349	2781508749	6601190946-	1666236249
9800000050	2769026349	2781661549	6342075346-	1666171749
9850000050	2769351049	2781829449	6095810646-	1666223249
9900000050	2769871549	2781692949	5860969346-	1666349949
9950000050	2770021949	2781406249	5630237346-	1666328049

-38-

R	G++	G--	F+-	G+-
1000000051	2770495649	2781021049	5413264646-	1666336549
1005000051	2770728949	2780724049	5193456946-	1666357349
1010000051	2770667849	2780851649	4991060346-	1666329049
1015000051	2770923849	2780613149	4796423646-	1666326549
1020000051	2771138749	2780396049	4613761046-	1666359149
1025000051	2771683549	2780388949	4429853646-	1666377749
1030000051	2771973049	2779799949	4253810046-	1666396549
1035000051	2771862949	2779930849	4086468046-	1666412249
1040000051	2771722049	2780636249	3924107046-	1666420949
1045000051	2772147649	2779871449	3767789646-	1666442649
1050000051	2772738749	2779353549	3619181646-	1666434449
1055000051	2772821549	2779675849	3475174646-	1666412749
1060000051	2772503049	2779201249	3334747846-	1666435349
1065000051	2772609149	2779057049	3201216446-	1666451149
1070000051	2773142249	2779477749	3074521446-	1666460349
1075000051	2773244449	2779683949	2951351846-	1666489749
1080000051	2773578049	2779203449	2833827246-	1666511349
1085000051	2773503349	2778869349	2721345646-	1666514349
1090000051	2773291649	2779055849	2611672846-	1666486949
1095000051	2773874549	2778724649	2505786646-	1666465049
1100000051	2773801749	2778443349	2405271046-	1666496649
1105000051	2773827349	2778671949	2307420446-	1666533249
1110000051	2774365649	2778843449	2212901646-	1666517049
1115000051	2774344149	2778699349	2124772446-	1666553449
1120000051	2773908349	2778612349	2038725846-	1666581249
1125000051	2774493049	2778684349	1956505046-	1666535849
1130000051	2774665749	2778393749	1878284246-	1666536049
1135000051	2774195849	2778264049	1803025446-	1666567949
1140000051	2774724949	2778552449	1729886446-	1666562249
1145000051	2774782649	2778418049	1660632846-	1666572349
1150000051	2774825249	2778384449	1593419746-	1666613749
1155000051	2775162749	2778337749	1527822046-	1666621749
1160000051	2775202549	2778031349	1465377646-	1666617749
1165000051	2775212749	2778187749	1405207146-	1666588449
1170000051	2775005049	2778190949	1347581246-	1666568349
1175000051	2774829749	2777808149	1291840946-	1666565749
1180000051	2775262949	2777777149	1239573846-	1666555049
1185000051	2775342349	2777995049	1189338546-	1666564949
1190000051	2775284449	2778148849	1141244146-	1666609849
1195000051	2775431349	2778087349	1095034946-	1666632849
1200000051	2775560049	2778136949	1052316346-	1666632749
1205000051	2775604049	2778251949	1009452246-	1666639249
1210000051	2775685649	2777704849	9683129045-	1666638849
1215000051	2775766749	2777607749	9279845445-	1666628449
1220000051	2775743649	2777772049	8894833845-	1666603749
1225000051	2775731249	2777683449	8513486645-	1666603949
1230000051	2775649549	2777586649	8165205045-	1666644549
1235000051	2775822649	2777768749	7825024845-	1666660649
1240000051	2776274049	2778217449	7509967245-	1666669049
1245000051	2776023849	2777922649	7210902445-	1666703449

-39-

R	G++	G--	F+-	G+-
1250000051	2775830849	2777947549	6911527445-	1666690249
1255000051	2776293649	2777593649	6629423645-	1666634849
1260000051	2775956549	2777404049	6364087245-	1666646849
1265000051	2775701949	2777668849	6078561645-	1666656749
1270000051	2776633349	2777483949	5820674445-	1666644949
1275000051	2776429049	2777839149	5591293445-	1666679649
1280000051	2775968849	2778131849	5360199445-	1666708649
1285000051	2776418549	2777796549	5140321245-	1666695849
1290000051	2776282349	2777708349	4943523045-	1666684649
1295000051	2776433649	2777524049	4737066645-	1666685849
1300000051	2776330149	2777349049	4532872845-	1666675249
1305000051	2776324349	2777576449	4343796045-	1666686849
1310000051	2776425649	2777671049	4151076845-	1666694449
1315000051	2776609449	2777694849	3983135645-	1666679849
1320000051	2776581649	2777704749	3806219845-	1666688249
1325000051	2776343349	2777258649	3652845045-	1666707049
1330000051	2776573249	2777638349	3489372845-	1666718049
1335000051	2776717049	2777752749	3342796045-	1666714649
1340000051	2776880049	2777636249	3199794645-	1666719049
1345000051	2776520649	2777732749	3078077845-	1666716649
1350000051	2776317949	2777516549	2951011445-	1666722449
1355000051	2776623349	2777696849	2833324045-	1666706049
1360000051	2776869749	2777602049	2723558445-	1666695249
1365000051	2776706049	2777598749	2600312245-	1666715249
1370000051	2776733649	2777295949	2486234845-	1666719049
1375000051	2776748749	2777406849	2377076045-	1666710649
1380000051	2776619249	2777723349	2278639645-	1666729249
1385000051	2776837149	2777698249	2178340245-	1666744049
1390000051	2777049449	2777857649	2093995445-	1666744049
1395000051	2776835049	2777527549	2004204645-	1666741849
1400000051	2776804349	2777426549	1907123045-	1666735649
1405000051	2776918149	2777320449	1823446845-	1666708849
1410000051	2776858549	2777611649	1739792045-	1666694249
1415000051	2776758249	2777639949	1656978445-	1666726649
1420000051	2776860949	2777199249	1582088945-	1666731449
1425000051	2777152149	2777827149	1523788445-	1666721049
1430000051	2776841949	2777788349	1457186345-	1666728849
1435000051	2776779649	2777489449	1405674045-	1666740449
1440000051	2776861249	2777715849	1359134145-	1666712449
1445000051	2776892949	2777670349	1312624545-	1666714249
1450000051	2776977449	2777515349	1255758745-	1666733849
1455000051	2777072449	2777406249	1213158045-	1666726249
1460000051	2777040649	2777692749	1168931945-	1666735849
1465000051	2776735049	2777722949	1119745345-	1666748849
1470000051	2777129649	2777495149	1063827245-	1666754449
1475000051	2777326749	2777349049	1021375645-	1666765249
1480000051	2777178649	2777636049	9655848844-	1666741049
1485000051	2777274349	2777736149	9253049444-	1666733649
1490000051	2776534949	2777467049	8768826844-	1666759649
1495000051	2777075149	2777522149	8533708444-	1666752249

-40-

R	G++	G--	F+-	G+-
1500000051	2777438249	2777842249	8341083444-	1666753849
1505000051	2776787449	2777955949	8126879044-	1666757449
1510000051	2777349949	2777769449	7700537044-	1666722449
1515000051	2777027849	2777084849	7306994044-	1666727449
1520000051	2777066649	2776806649	6985767044-	1666743449
1525000051	2777496149	2778151749	6587050444-	1666708649
1530000051	2777024649	2778040849	6173242644-	1666759249
1535000051	2777172949	2777116349	5828011444-	1666797649
1540000051	2777547549	2777678849	5780691844-	1666743249
1545000051	2777013749	2777804449	5493829444-	1666727249
1550000051	2776986049	2777578849	5130810644-	1666750449
1555000051	2777400449	2777231749	4993282444-	1666724449
1560000051	2777222849	2777506849	4925385044-	1666735849
1565000051	2776905649	2777850749	4620497444-	1666764849
1570000051	2777395649	2777560949	4445736444-	1666740049
1575000051	2777370249	2777570949	4172319444-	1666779449
1580000051	2777026249	2777162849	4246681444-	1666751849
1585000051	2777371449	2778024449	3864447844-	1666760249
1590000051	2777469049	2777956449	3686745644-	1666737449
1595000051	2777347449	2777057349	3342606244-	1666761049
1600000051	2777245049	2777280749	3187047044-	1666752849
1605000051	2777306649	2777463349	2818775244-	1666733649
1610000051	2777250449	2777688149	2690374844-	1666739049
1615000051	2777204949	2777750949	2589302844-	1666759849
1620000051	2777199749	2777749749	2648429444-	1666763049
1625000051	2777293549	2777856949	2554843044-	1666741449
1630000051	2777367249	2777493849	2400201444-	1666740449
1635000051	2777353049	2777027949	2321070644-	1666746849
1640000051	2777175249	2777754249	2279905044-	1666750449
1645000051	2777171449	2778062249	2075542244-	1666762849
1650000051	2777520949	2777636849	1921045044-	1666783049
1655000051	2777618449	2777356249	2116504844-	1666796649
1660000051	2777180149	2778138749	2031121644-	1666799449
1665000051	2777364649	2778069449	1919220444-	1666771849
1670000051	2777568349	2777387849	1787747844-	1666750649
1675000051	2777304849	2777208649	1757451644-	1666758049
1680000051	2777400049	2777318549	1594583644-	1666742049
1685000051	2777338349	2778126749	1673520044-	1666747449
1690000051	2777072749	2778050349	1561469444-	1666790049
1695000051	2777601349	2777521049	1707564144-	1666770849
1700000051	2777669749	2777805149	1675545444-	1666729849
1705000051	2777156149	2777291549	1563206144-	1666744449
1710000051	2777285649	2777119549	1189199044-	1666717649
1715000051	2777625849	2777598049	1140677844-	1666697249
1720000051	2777312949	2777403949	8572371043-	1666728249
1725000051	2777388649	2777695349	8275803443-	1666759449
1730000051	2777387349	2777606849	8640025243-	1666758649
1735000051	2777210349	2778144849	1107939444-	1666779249
1740000051	2777400049	2778114249	8999818643-	1666798649
1745000051	2777869249	2777113849	9281630243-	1666792449

-41-

R	G++	G--	F+-	G+-
1750000051	2777900449	2777574049	9120440643-	1666790649
1755000051	2777155749	2777889249	8154033643-	1666755849
1760000051	2777399349	2777949149	8030725243-	1666737649
1765000051	2777055349	2777827949	1102667944-	1666753649
1770000051	2777186549	2777638649	1138591344-	1666766249
1775000051	2778045549	2777823549	1085156244-	1666768249
1780000051	2777728549	2777345049	9037028643-	1666803849
1785000051	2777697649	2777496349	6710214443-	1666786249
1790000051	2777687949	2777830749	3043598243-	1666743849
1795000051	2777232949	2777093749	3093668243-	1666736049
1800000051	2777319949	2777807849	3720539643-	1666715249
1805000051	2777183149	2778096449	4475504243-	1666711449
1810000051	2777358449	2777205049	2977659443-	1666728049
1815000051	2777800149	2777281749	5506619243-	1666721049
1820000051	2777285049	2777805049	5182531643-	1666745849
1825000051	2777128449	2777889849	6335892843-	1666781249
1830000051	2777625049	2778189449	5015580043-	1666754049
1835000051	2777958949	2777545749	7375398643-	1666760449
1840000051	2777331049	2777157349	5860099643-	1666788449
1845000051	2777346349	2777827049	5208887243-	1666766049
1850000051	2777849049	2777799149	2646916843-	1666725449
1855000051	2777593349	2777718749	4481527843-	1666724049
1860000051	2777290049	2777610949	6522825643-	1666760649
1865000051	2776938449	2778062949	7427424043-	1666745049
1870000051	2777782249	2777837149	6371586443-	1666745449
1875000051	2778029849	2776929549	6917647843-	1666777249
1880000051	2777590849	2777634049	5892259043-	1666789249
1885000051	2777486049	2777910949	3650755243-	1666741849
1890000051	2777344549	2777665849	2299512643-	1666726849
1895000051	2777432349	2777393249	2642404643-	1666733849
1900000051	2777587949	2777274049	2311456843-	1666735849
1905000051	2777568349	2777934349	2078230443-	1666769249
1910000051	2777623349	2777863649	6788782042-	1666780649
1915000051	2777770849	2777822249	3688646643-	1666781249
1920000051	2777189149	2778207649	2491600243-	1666765449
1925000051	2777598149	2777342349	3160412443-	1666776249
1930000051	2777639449	2777294249	3581615043-	1666725249
1935000051	2777646649	2778371449	3724902643-	1666723649
1940000051	2777439749	2777210749	8244512042-	1666704449
1945000051	2777512949	2777501849	3355458643-	1666720649
1950000051	2777190049	2777726549	8093139442-	1666758449
1955000051	2777868549	2777501749	9646477242-	1666725049
1960000051	2778353349	2777815349	1023924643-	1666705849
1965000051	2776612349	2777215149	6540210842-	1666745049
1970000051	2777127649	2777826349	1033749443-	1666763449
1975000051	2777719349	2778101549	9023478042-	1666689049
1980000051	2778011949	2777630049	9037008642-	1666716849
1985000051	2777533649	2777612449	1497820343-	1666762049
1990000051	2777090249	2777814649	2588796643-	1666756449
1995000051	2777623749	2777888449	3602104343-	1666839649
2000000051	2777298449	2778193649	7421399943-	1666782949

REFERENCES

1. Cohen, Judd, and Riddell, Mu-Mesonic Molecules. I. The Three-Body Problem, Phys. Rev. (to be published).
2. Cohen, Judd, and Riddell, Mu-Mesonic Molecules. II. Molecular Ion Formation and Nuclear Catalysis, Phys. Rev. (to be published).
3. M. Born and J. R. Oppenheimer, Z. Physik 46, 814 (1928); Z. Physik 50, 347 (1928).
4. E. A. Hylleraas, Z. Physik 71, 739 (1931).

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.