KERNFORSCHUNGSZENTRUM

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Zyklotron–Laboratorium

Improved Version of Tamura's Code for Coupled Channel Calculations: „JUPITOR KARLSRUHE VERSION"

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Abstract

T. Tamura's coupled channel code JUPITOR 1 has been modified and improved. The most important modification is an automatic parameter search option for the best fits. The treatment of the rotational model is improved by expanding the deformed optical potential in terms of Legendre polynomials up to the order 8, hence including all terms that contribute to the excitation of the 4^+ rotational state. Coulomb excitation is included in the same manner. In the original version[1] we have found some programming errors which in some cases caused drastic effects for the calculated cross sections. After an adequate correction the results agree with calculations done in the case of the rotational model by A. Hill's coupled channel program CCP1 (Oxford). The differential cross sections published by T. Tamura[2] have been reproduced for the rotational model. Differences have been found in some cases for the vibrational model and when the original treatment of the Coulomb excitation was used. The origin of these differences has not been fully clarified. A Fortran IV listing of the modified code is presented.

Zusammenfassung

T. Tamura's Rechenprogramm[1] JUPITOR 1 zur Berechnung von Streuquerschnitten nach der Methode der gekoppelten Kanäle wurde modifiziert und verbessert. Die wichtigste Ergänzung besteht in der zusätzlichen Möglichkeit einer automatischen Parametervariation zur Anpassung an experimentelle Ergebnisse. Die Behandlung des Rotationsmodells wurde verbessert, indem das deformierte optische Potential bis zur 8. Ordnung in Legendre-Polynome entwickelt wurde, so dass alle Terme, die zur Anregung des 4^+ Niveaus beitragen, berücksichtigt werden. Die Coulombanregung wurde in der gleichen Weise behandelt. In der Originalversion wurden einige Programmierfehler gefunden, die auf manche Wirkungsquerschnitte drastische Auswirkungen hatten. Nach der Korrektur stimmen die Ergebnisse mit Vergleichsrechnungen überein,die mit dem "Coupled Channel"-Code CCP1 (A.Hill, Oxford) durchgeführt wurden. Die von T. Tamura publizierten differentiellen Wirkungsquerschnitte[2] konnten im Falle des Rotationsmodells reproduziert werden. Unterschiede ergaben sich bei der Benutzung der ursprünglichen Behandlung der Coulombanregung und in manchen Fällen des Vibrationsmodells. Die Ursachen für diese Unterschiede sind nicht völlig geklärt. Ein Fortran IV Listing des gesamten, modifizierten Programms ist angefügt.

1. Introduction

T.Tamura has developed a quite comprehensive computer program (JUPITOR-1) for coupled-channel calculations in terms of the collective model[1,2]. We have adapted this code to an IBM 360-65 and 360-91 computer. For this, a number of modifications of the original version was required. Furthermore, we have improved this program in several ways and performed detailed checks and necessary corrections of the most important parts. The code is working now on the IBM 360-65/85 of the Kernforschungszentrum Karlsruhe and the IBM 360-91 of the Institut für Plasmaphysik in München- Garching.

In this report we summarize the modifications and the improvements. In the following text we refer explicitly to the detailed description of the program given by Tamura[1]. References to particular statements will be denoted by the card numbers appearing in the FortranIV listing presented in the appendix. The most important supplement is an automatic search routine[3] according to a χ^2-minimization of the fits. The use of this option will be explained. The treatment of the rotational model (including the Coulomb excitation) has been modified in several respects. The results have been compared to calculations done by A.Hill's coupled channel code CCP1 (Oxford-Atlas Computer Laboratory, Chilton, Didcot, England)and agree.

2. Fortran IV adaption and modifications in the numerical procedures

The compiler that processes the original code is different from the IBM Fortran IV compiler in several respects. Therefore the following modifications were required.

a) DO-Loops with an upper bound less than the lower one are executed once by the IBM compiler in contrary to the CDC compiler used by Tamura, which skipped such DO-Loops. For this reason the statements on the following cards are changed.

   84,86 KA 1957, KA 2351, KA 2352, KA 2480, KA 2599, KA 2600

b) As in single precision mode the IBM compiler takes only 6 significant digits, in various routines double precision is required.

All numerical constants ($\pi\sqrt{2}$ etc.) are redefined. The "COMMON" has been rearranged according to the difference of integer and real variable in double precision representation. The integer variable LMAX is placed between L9(9) and U9. The field EXTRA5(525) in the subroutine CROSPL, CMMMFC, BFCTOR, OUTPUT and PLOTER is enlarged to 530 places.

c) Several library functions were introduced in order to match double precision

DLGAMA=lnΓ(x) (card KA68) and the corresponding complex function CDLGAM for calculating

$$\sigma_L(\eta) = \mathrm{Im}\left[\ln\Gamma(L+1+i\eta)\right] \text{(cards KA282, KA353)}$$

The subroutine[4] W3JS is used to compute the Clebsch-Gordan coefficients. This routine proves to be more precise than Tamura's subroutine CLEB, especially for coefficients of the form $<1j00|k0>$.

The subroutine FLGLCH for calculation of the Coulomb wave functions was modified in cards Ka339 and KA525 in order to reduce occasional convergence difficulties of the numerical method[5]. If the difference of any of the regular Coulomb wave functions obtained in the last two iterations is larger than 10^{-6}, the differences (field T1MEMO) are given in the output; the computation is continued with the last iteration values (see cards 526-KA537). The results of the subroutine FLGLCH have been compared to calculations by a similar routine[6]. For typical values of the Coulomb-Parameter η ($0.5 \leq \eta \leq 2.5$) and $\rho = kr$ ($10 \leq \rho \leq 100$) the differences in the renormalization factor (card 512) are of the order of 10^{-6}. But since for large ρ values the computational method in FLGLCH is more precise than in the comparable routine[7]; there was no reason to replace FLGLCH.

The subroutine DOTEST checks the range of some indices of the variables. It gives an output (the card number) if the tested index lies outside of the allowed range.

d) The range in real number representation needed in the subroutine COUPLE is of the order

$$R = \left(\frac{XMAX}{XMES1}\right)^{2\,LMAX}$$

For LMAX = 70, XMAX = 10fm and XMES1 = 0.01 fm, R is of the order 10^{420}. Therefore it is necessary for an IBM 360 (with a number representation range of 10^{152}) to use a renormalization of the wave functions during the integration procedure. This is done by the statements on cards KA 867, KA 869, KA 1064, Ka 1068, KA 1100 and by the subroutine RANGE. The renormalization procedure is called if KTRL(2) > 0 in the first data card. For IBM 360 machines KTRL(2) = 69 is recommended.

3. Automatic search routine for fitting experimental data

A χ^2 minimizing routine[3] is incorporated into the code. The routine varies some selected parameters in order to minimize the sum

$$S = \sum_{i,n} \left[\frac{\sigma^{(n)}_{exp}(\theta_i) - \sigma^{(n)}_{theor}(\theta_i)}{0.1 \cdot \sigma^{(n)}_{exp}(\theta_i)} \right]^2 +$$

$$+ \sum_{i,m} \left[\frac{P^{(m)}_{exp}(\theta_i) - P^{(m)}_{theor}(\theta_i)}{0.1} \right]^2$$

where n and m stand for the cross section curves and for the polarizations plotted in subroutine PLOTER. Note that the use of real experimental errors is not possible and an overall error of 10 % is assumed.

If a minimum of S as a function of the selected parameters is found, standard errors (see for definition in ref. 3) of the parameters may be computed.
The parameter search option is used with KTRL(5) = 1 and further information on two data cards 20 and 21 (see subroutine ANPASS):
Card 20 gives 4 integer and 1 real value (FORMAT (4I5, E7.1)),

i) The number of experimental points. It has to agree with
NANGLR · (IIXPLT + IIPPLT) ⩽ 600

ii) The number N of variable parameters (N ⩽ 10)

iii) The maximum number MA of complete sets of calculations (cross sections and polarizations) in the search routine. A minus sign must be added if standard errors for the final parameters are desired. The number MA should exceed the number N by at least 4. N additional computations are necessary for the calculation of the standard errors.

iv) A print control number IP

v) A step size paramter ES
IP = -1 and ES = 100 are recommended. For further explanation of IP and ES see ref. 3.

Card 21 gives the reference numbers of the variable parameters and the search accuracies (FORMAT (8(I3, E7.1))).The reference numbers of the parameters are 1 to 29 in the sequence VSX, WSX, WSF, VSD DFN... . WC(6), BETA(1)... . BETA(9) (See subroutine VARIAB). The search accuracies should be c. 0.01 times the corresponding parameter values, but not zero.

During the search procedure the output is that of the search routine VA01A. Then a normal calculation follows using the final values of the parameters. The modifications needed for the search procedure are given as statements on the cards KA 242, KA 2722 and by the subroutines ANPASS, VARIAB, CALFUN, VA01A and VD01A. The search routine requires c. 50 K of additional memory.

4. Rotational model treatment

For the rotational model option (Intype 4) the deformed nuclear (optical) potential is expanded in terms of Legendre polynomials (see ref 2, eqs. 14-16). For the excitation of a I^+ state of the ground state band terms up to the order $\lambda = 2I$ contribute. T. Tamura has included only terms up to $\lambda = 4$. The influence of this truncation is not large (see fig. 1), but detectable,

especially in cases, where a β_4 deformation is included in the calculations [+]. It was desirable to have a further option including terms up to the order $\lambda=8$. This is done with the modifications on cards KA 636, KA 640, KA 681, KA 684, KA 712, KA 714, KA 937, KA 972 and KA 1234 and can be used with INTMAX = 4. In these calculations the fields AMAT1C and AMAT2C are used so that Coulomb excitation cannot be used with KTRL(13) = 1 in this mode. For this mode the Coulomb potential was treated in the body fixed system in the same manner as the optical potential. As for the nuclear part terms up to λ = 8 are included (cf. cards KA 640 and KA 714). In the expansion of the radial Coulomb form factors terms up to second order in the deformation can be taken into account, as an option. For KTRL(6) = 1 only terms linear in β_λ are used, for KTRL(6) = 2 terms of the form $(\beta_{\lambda'} \otimes \beta_{\lambda''})_\lambda$ are included. Note that the term $(\alpha_{\lambda'} \otimes \alpha_{\lambda''})_\lambda$ in eqs. 10,13 and 13.2 of ref. 2 should be replaced by $1/2\ (\alpha_{\lambda'} \otimes \alpha_{\lambda''})_\lambda$

5. Program tests

We quote Tamura's statement in ref. 1 (page 63):"In the past few months, fairly large modifications were made throughout the program in order to bring it in the final shape appropriate for publication. It is believed ..... but some errors might have been committed in this procedure". This statement also holds for our testing procedures.

During our check procedure we found several erros due to misprints on the computer cards: KA 190, KA 348, KA 525, KA 650, KA 684, KA 815, KA 819, KA 912, KA 1184, KA 1219, KA 2059, KA 2174. In card KA 1219 a minus sign was added in order to obtain agreement with table C of ref 2: $C_{22} = -\sqrt{8/49}$. But we have not checked if this sign is correct.

We tried to reproduce the calculated cross sections published by Tamura and shown in figs. 1-5,13 of ref 2. We succeeded in most cases except the following:

[+] An important misprint was detected in card KA 684. The last Legendre polynomial is BR(3) and not BR(4).(See ref. 1)

a. The dotted curves in fig. 1A of ref 2 representing a calculation in the frame of the vibrational model show large deviations for $\Theta > 70^{\circ}$

b. In fig. 3 of ref 2 (Excitation of the octupole 3^- state in ^{114}Cd by 12.16 MeV protons) curve 1 (complex coupling) cannot be reproduced.

c. In fig. 4B of ref 2 the calculated cross sections for the 6^+ state of ^{156}Gd differ from our results.

The origin of these discrepancies is not clear. In fig 1A it is obvious that the dotted and solid curves for the 4^+ state are interchanged .

Furthermore we see differences for large angles ($\Theta > 140^{\circ}$) in fig. 4A and fig. 5C of ref 2. This may be due to numerical effects of a different choice for the step sizes of the integration procedure.

Detailed comparisons with an independent program have been performed for the rotational model description of the scattering of 104 MeV α particles from ^{20}Ne and ^{28}Si. Here we compare calculations for several coupling schemes with results of Alec Hill's Code CCP1(Oxford) running on the Atlas computer, Chilton, Didcot (England). For the final status of the JUPITOR program very good agreement is achieved (see an example in fig. 1). Fig. 2 compares the original version of the Coulomb excitation and our treatment for rotational model calculations of $^{28}Si(\alpha,\alpha')^{28}Si$. We believe that the difference is not only due to the different procedure but we have not studied this program part in detail.

An independent test has been performed for the vibrational model in the special case of the scattering of 104 α particles from ^{58}Ni assuming the coupling 0^+ 2^+ 4^+, including only first order terms IICPLE = 3, INTYPE = 3, $\beta_{02} = \beta_{24} = 0.22$ was taken. The results agree within a few percent with a similar calculation with Hill's codes CCP1 and INCH[+].

[+]The vibrational routine of INCH was written by D. Edens.

We thank Dr.W.J.Thompson for making available to us Tamura's coupled channel code JUPITOR 1. One of us (H.R.) wishes to thank Dr. P.E.Hodgson and his group for their kind hospitality during a short period at Oxford and for the opportunity to use A.Hill's coupled channel programs CCP1 and INCH. The advice of Drs.D.Edens and A.Dudek, the help of Dr.R.Löhken and the excellent service of the Atlas computer laboratory Chilton, Didcot (England), is gratefully acknowledged. Finally it is a pleasure to thank Drs. G.Schatz and J.Specht for stimulating discussions, helpful comments and encouragement.

References:

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3. G.W.Schweimer, Arbeitsbericht Nr. 29 and 35 (1970) des Zyklotron-Laboratoriums Karlsruhe (unpublished)

4. J.Specht, Arbeitsbericht Nr. 22 (1968) unpublished

5. B.Buck, R.N.Madison, and P.E.Hodgson, Phil.Mag. 5(1960)118

6. G.W.Schweimer, Arbeitsbericht Nr. 19 (1967) des Zyklotron-Laboratoriums (unpublished)

7. C.E.Fröberg, Rev.Mod.Phys. 27 (1955) 399

8. A.Hill, unpublished reports, Oxford, 1967

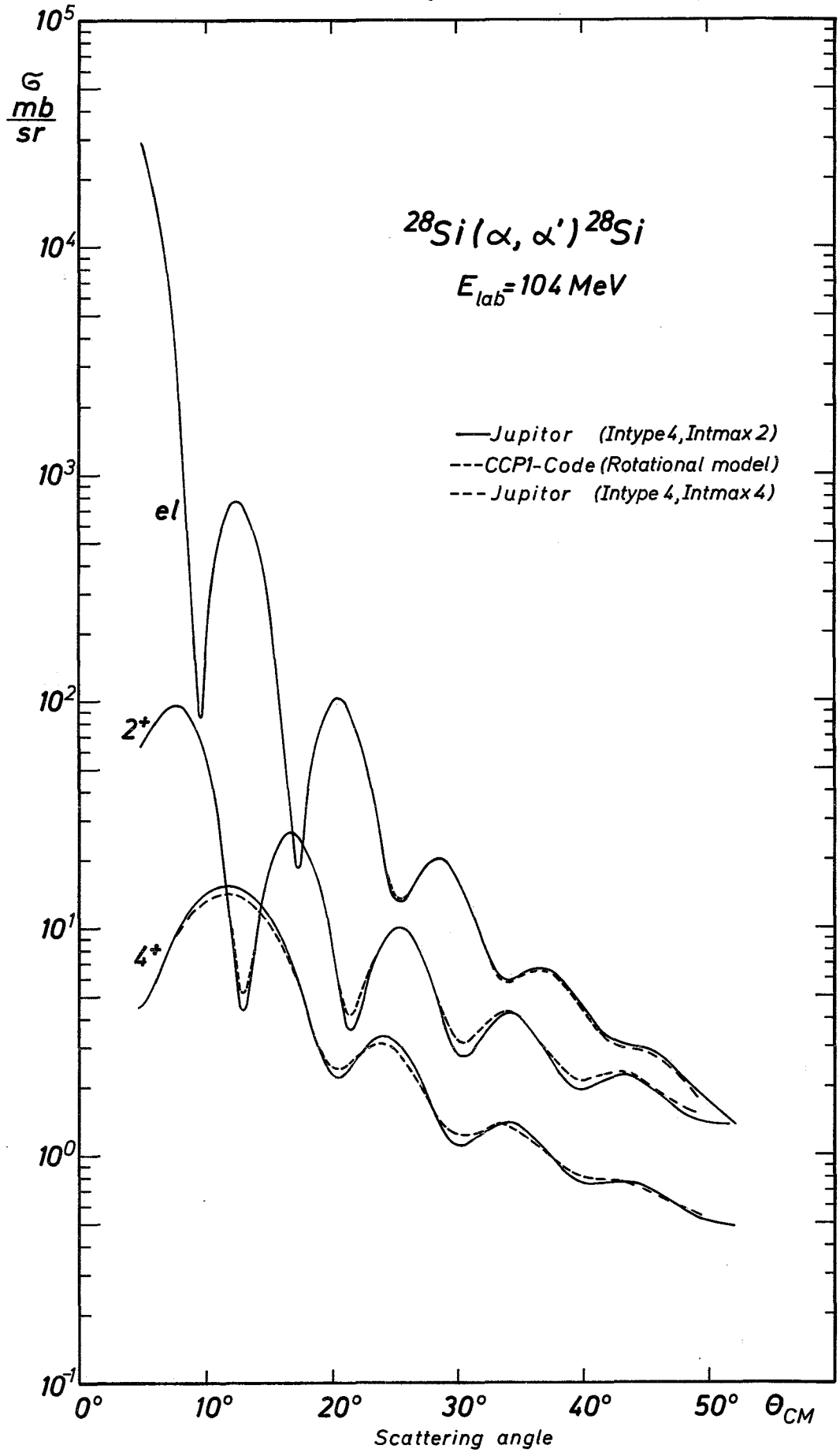


Fig.1 Comparison of cross sections calculated with the codes JUPITOR and CCP 1

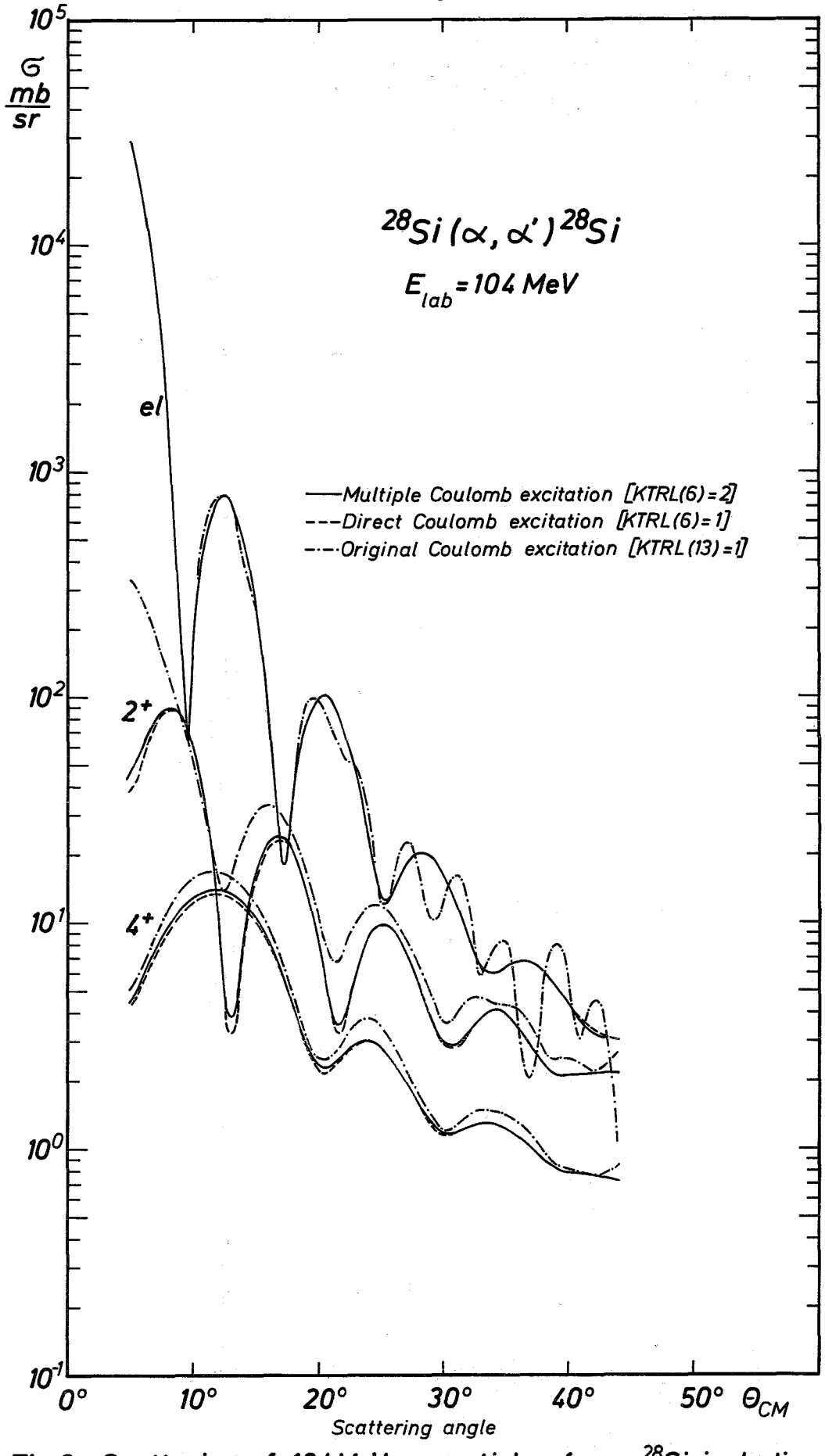


Fig. 2 Scattering of 104 MeV α-particles from ^{28}Si including different modes of Coulomb excitation

JOB CCNTRCL CARDS

```
//ZYK03628 JOB (0036,061,P0S00),SCHWEIMER,REGION=350K,TIME=30,CLASS=J
/*MAIN SYSTEM=M85,LINES=12
// EXEC FHG,LIB=ZYK,NAME=ZYKJP2,REGION=350K,TIME=30
//G.FT06F001 DD SYSOUT=A,DCB=(BLKSIZE=133,RECFM=FBA,LRECL=133)
//G.FT08F001 DD UNIT=SYSDA,SPACE=(2298,(75)),DISP=(NEW,PASS),
// DCB=(BLKSIZE=2298,LRECL=1145,RECFM=VBS)
//G.FT09F001 DD UNIT=SYSDA,SPACE=(2298,(75)),DISP=(NEW,PASS),
// DCB=(BLKSIZE=2298,LRECL=1145,RECFM=VBS)
//G.SYSIN DD *
```

DATA CARDS FOR THE CROSS SECTIONS SHOWN IN FIGURE 1

```
       69    1                                        1     1                28SI   1
                                                                             28SI   2
                                                                          50 28SI   3
                                      1                                      28SI   4
                                                                             28SI   5
                                                                             28SI   6
    3    4    4         80   3                   1                           28SI   7
         1               2   1    1.78      4    1    4.61                   28SI   8
104.    4.      28.     28.     .0125   .1                                   28SI   9
1.      1.                                                                   28SI  10
98.521 25.7                     1.      1.      1.                           28SI  17
.636    .628    .5      .5      1.399   1.508                   1.3          28SI  18
-.322   -.203                                                               128SI  19
       69    1                                        1     1                28SI   1
                                                                             28SI   2
                                                                          50 28SI   3
                                      1                                      28SI   4
                                                                             28SI   5
                                                                             28SI   6
    3    4    2         80   3                   1                           28SI   7
         1               2   1    1.78      4    1    4.61                   28SI   8
104.    4.      28.     28.     .0125   .1                                   28SI   9
1.      1.                                                                   28SI  10
98.521 25.7                     1.      1.      1.                           28SI  17
.636    .628    .5      .5      1.399   1.508                   1.3          28SI  18
-.322   -.203                                                                28SI  19
```

DATA CARDS FOR THE CROSS SECTIONS SHOWN IN FIGURE 2

```
       69    1              2                         1     1                28SI   1
                                                                             28SI   2
     170                                                                  70 28SI   3
                                      1                                      28SI   4
                                                                             28SI   5
                                                                             28SI   6
    3    4    4         80   3                   1                           28SI   7
         1               2   1    1.78      4    1    4.61                   28SI   8
104.    4.      28.     28.     .0125   .1                                   28SI   9
1.      1.                                                                   28SI  10
98.521 25.7                     1.      1.      1.                           28SI  17
.636    .628    .5      .5      1.399   1.508                   1.3          28SI  18
-.322   -.203                                                               128SI  19
       69    1              1                         1     1                28SI   1
                                                                             28SI   2
     170                                                                  70 28SI   3
                                      1                                      28SI   4
                                                                             28SI   5
                                                                             28SI   6
    3    4    4         80   3                   1                           28SI   7
         1               2   1    1.78      4    1    4.61                   28SI   8
104.    4.      28.     28.     .0125   .1                                   28SI   9
1.      1.                                                                   28SI  10
98.521 25.7                     1.      1.      1.                           28SI  17
.636    .628    .5      .5      1.399   1.508                   1.3          28SI  18
-.322   -.203                                                               128SI  19
       69    1                                        1     1     1          28SI   1
                                                                             28SI   2
     170                                                                  70 28SI   3
                                      1                                      28SI   4
                                                                             28SI   5
                                                                             28SI   6
    3    4    2         80   3                   1                           28SI   7
         1               2   1    1.78      4    1    4.61                   28SI   8
104.    4.      28.     28.     .0125   .1                                   28SI   9
1.      1.                                                                   28SI  10
98.521 25.7                     1.      1.      1.                           28SI  17
.636    .628    1.      1.      1.399   1.508                   1.3          28SI  18
-.322   -.203                                                                28SI  19
```

DATA CARDS FOR THE PARAMETER SEARCH MODE

```
       69    1          1   2                         1     1                28SI   1
                                                                             28SI   2
     170                                                                  70 28SI   3
                        1          1                                         28SI   4
                                                                             28SI   5
                                                                             28SI   6
    3    4    4         47   3   3               1                           28SI   7
         1               2   1   1.78       4    1    4.61                   28SI   8
104.    4.      28.     28.     .0125   .1                                   28SI   9
5.      1.                                                                   28SI  10
23500.  11400.  4500.   1300.   210.    168.    465.    605.    578.    465. 28SI 0+1
243.    78.     20.     30.     62.     90.     93.     71.     45.8    24.3 28SI 0+2
12.1    13.6    16.5    19.1    20.1    18.5    13.1    8.9     6.5     5.1  28SI 0+3
5.35    6.2     6.8     6.8     6.15    5.0     4.2     3.65    3.40    3.08 28SI 0+4
2.80    2.80    2.80    2.62    2.40    2.22    2.00                         28SI 0+5
105.    184.    200.    159.    110.    68.     37.8    17.     8.6     11.  28SI 2+1
23.3    37.     38.     29.5    18.8    10.     6.3     8.1     11.6    14.5 28SI 2+2
16.5    15.5    12.     8.5     6.2     5.      5.6     6.35    6.8     6.75 28SI 2+3
6.1     5.15    4.23    3.42    3.03    2.81    2.8     3.00    2.95    2.68 28SI 2+4
2.55    2.38    2.18    2.00    1.88    1.72    1.61                         28SI 2+5
0.57    .8      1.1     1.5     2.09    2.82    3.95    5.      5.      4.05 28SI 4+1
2.7     1.15    .62     1.1     1.54    1.85    2.02    1.99    1.5     .9   28SI 4+2
0.635   .59     .64     .81     1.08    1.11    .86     .51     .438    .43  28SI 4+3
0.5     .6      .71     .79     .81     .78     .69     .56     .43     .35  28SI 4+4
.34     .375    .40     .39     .35     .29     .22                          28SI 4+5
98.521 25.7                     1.      1.      1.                           28SI  17
.636    .628    .5      .5      1.399   1.508                   1.3          28SI  18
-.322   -.203                                                                28SI  19
  141    8  -30   -1  100.                                                   28SI  20
  1 2.     2 1.     5 .01    6 .02    9 .015   10 .015   20 .004   21 .001
```

********** COUPLED CHANNEL CALCULATION **********

(ON PROGRAM JUPITOR, KARLSRUHE VERSION)

ELAB= 104.000, CHARGE= 28.0, TMAS= 28.000, PMAS= 4.000

```
VSX,WSX,WSF,VSO                          =  98.521  25.700   0.0     0.0
DFN,DFNW,DFNS,DFNSP                      =   0.636   0.628   0.500   0.500
RZERO,RZEROW,RZEROS,RZROSP,RZEROC=   1.399   1.508   0.0     0.0     1.300
WC                                       =   1.000   1.000   1.000   0.0     0.0     0.0

PROJECTILE SPIN=0

IIRMAX=3,INTYPE=4,INTMAX=4,BETA=-0.322-0.203 0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0

TARGET STATES,  0  (+) AT  0.0   MEV,  2  (+) AT  1.780 MEV,  4  (+) AT  4.610 MEV,
```

```
KTRL     0  69   1   0   1   2.  0   0   0   0   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
KEXCOM   0 170   0   0   0   0   0   0   0   0   0   0   0  70
KTLOUT   0   0   0   0   1   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
EXTCOM       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
XMES1=0.01250    XMES2=0.10000    UNIT=AMU
```

```
M, N, MA, IP, ES   141    8  -30   -1 1.0E 02
INDEX    1 2.0E 00  2 1.0E 00  5 1.0E-02  6 2.0E-02  9 1.5E-02 10 1.5E-02 20 4.0E-03 21 1.0E-03

ITERATION    0        9 CALLS OF CALFUN     CHISQUARE = 3.94216D 04
VARIABLES
 9.85210E 01  2.57000E 01  6.36000E-01  6.28000E-01  1.39900E 00  1.50800E 00 -3.22000E-01 -2.03000E-01
FUNCTIONS
-2.05996E 00 -2.63479E 00 -3.83535E 00 -4.74377E 00 -8.33927E-01  1.22989E 00 -2.65440E 00 -2.95098E 00 -1.30181E 00  6.39890E-01
-3.46152E-01 -3.53251E 00 -2.15329E 00 -3.98842E 00 -5.29154E 00 -1.27583E 00  1.83909E 00  1.72531E 00 -1.15415E 00 -3.95679E 00
-2.13737E 00 -2.00172E 00 -4.38592E 00  3.99320E-01  4.31586E 00  3.28133E 00 -2.72751E 00 -4.68308E 00  2.68836E-02 -6.04694E 00
-6.87854E 00  2.34942E 00  6.18226E 00  2.65543E 00 -4.14080E 00 -3.31752E 00  1.55634E 00 -3.43802E 00 -2.20552E 00  4.95517E 00
 7.07025E 00 -1.47735E-01 -9.33200E 00 -3.32512E 00  2.76787E 00 -1.54661E 00  1.49069E 00  5.92287E 00  6.74608E 00  5.77348E 00
 3.98753E 00  2.45069E 00  1.82085E 00  2.46564E 00  3.76594E 00  5.42249E 00  3.60684E 00  3.18043E 00  3.54529E 00  3.29529E 00
 2.98106E 00  2.74799E 00  2.22620E 00  2.94094E 00  5.21790E 00  5.08576E 00  4.28157E 00  4.20509E 00  4.22467E 00  3.88462E 00
 3.42738E 00  3.48267E 00  3.91249E 00  4.70295E 00  4.51507E 00  4.30713E 00  4.20271E 00  3.80199E 00  3.20097E 00  2.95453E 00
 2.90251E 00  2.78576E 00  2.33231E 00  2.56171E 00  3.19466E 00  2.67889E 00  1.50914E 00  1.63051E 00  2.20920E 00  2.18250E 00
 1.94280E 00  2.32272E 00  2.28102E 00  1.25531E 00 -6.91088E 01 -5.99469E 01 -5.67988E 01 -5.25345E 01 -4.46083E 01 -3.64479E 01
-2.53454E 01 -1.77061E 01 -1.62410E 01 -1.98028E 01 -2.92678E 01 -6.40518E 01 -8.83255E 01 -2.69493E 01 -8.50319E 00 -2.68686E 00
-1.42776E 00 -2.96119E 00 -9.76106E 00 -2.46382E 01 -3.50418E 01 -3.05092E 01 -2.06032E 01 -9.98762E 00 -2.44000E 00 -7.35312E-01
-4.15598E 00 -1.53999E 01 -1.93998E 01 -1.86131E 01 -1.38876E 01 -9.15224E 00 -4.59212E 00 -1.48431E 00 -4.84334E-01 -5.22173E-01
-1.03005E 00 -2.74639E 00 -6.96103E 00 -1.17263E 01 -1.13019E 01 -7.26982E 00 -5.17628E 00 -4.95611E 00 -5.27310E 00 -6.96034E 00
-1.27784E 01

ITERATION    1       11 CALLS OF CALFUN     CHISQUARE = 4.00763D 03
VARIABLES
 1.02330E 02  3.47126E 01  6.97690E-01  9.51328E-01  1.32840E 00  1.22528E 00 -3.88234E-01 -1.37355E-01

ITERATION    2       23 CALLS OF CALFUN     CHISQUARE = 3.68350D 03
VARIABLES
 1.01141E 02  2.60794E 01  7.08112E-01  7.99372E-01  1.33913E 00  1.41984E 00 -3.57382E-01 -1.18843E-01

ITERATION    3       27 CALLS OF CALFUN     CHISQUARE = 3.39928D 03
VARIABLES
 9.73897E 01  3.16834E 01  6.77360E-01  8.19710E-01  1.37755E 00  1.34281E 00 -3.55265E-01 -1.15793E-01

VA01A    30 CALLS OF CALFUN

VA01A FINAL VALUES OF FUNCTIONS AND VARIABLES

ITERATION    4       30 CALLS OF CALFUN     CHISQUARE = 3.25509D 03
VARIABLES
 8.97487E 01  3.14599E 01  6.27892E-01  7.28745E-01  1.44299E 00  1.42928E 00 -3.29160E-01 -1.07776E-01
FUNCTIONS
-2.37773E 00 -2.84931E 00 -3.09834E 00 -2.03102E 00  1.94891E 00 -2.24589E 00 -2.63764E 00 -2.90271E 00 -1.91168E 00  5.59900E-01
 1.99486E 00  3.64927E 00  3.68816E 00 -3.23656E 00 -2.57598E 00 -5.26648E-01  9.55607E-01  1.85710E 00  3.11095E 00  3.67638E 00
 1.01625E 00 -1.06779E-01 -9.81694E-01 -4.55345E-01  8.99512E-01  2.23561E 00  2.20833E 00  1.78854E 00  6.17733E-01 -2.00696E 00
-2.27070E 00 -8.80122E-01  6.01197E-01  1.75970E 00  2.40646E 00  2.27287E 00  2.08374E 00  1.65985E 00  1.43336E 00  9.00157E-01
 5.95590E-01  1.46681E 00  2.49179E 00  3.06127E 00  3.44318E 00  3.75304E 00  3.74108E 00  4.38839E 00  5.34303E 00  4.21807E 00
 2.17007E 00  5.21135E-01  1.64905E-01  1.81142E 00  4.69541E 00  5.31009E 00 -6.58893E-01 -2.62592E-01  1.30013E 00  1.59031E 00
 1.73190E 00  2.29773E 00  2.96253E 00  3.37550E 00  3.43882E 00  2.73513E 00  2.27148E 00  2.70756E 00  3.14568E 00  3.36995E 00
 3.63491E 00  3.73377E 00  2.95875E 00  2.93923E 00  2.68340E 00  2.50791E 00  2.57718E 00  2.73121E 00  2.89143E 00  2.89583E 00
 2.34594E 00  1.79407E 00  1.02507E 00  6.70909E-01  1.18351E 00  1.35338E 00  1.26104E 00  1.78966E 00  2.11428E 00  2.11640E 00
 1.92884E 00  1.74890E 00  1.20901E 00  8.70178E-01 -1.46313E 01 -1.24955E 01 -1.28397E 01 -1.20370E 01 -8.93889E 00 -5.40572E 00
-1.27289E 00  1.29911E 00  1.75595E 00  5.63411E-01 -2.81959E 00 -1.63479E 01 -3.08016E 01 -8.15864E 00  2.34244E-01  3.90116E 00
 5.42474E 00  5.50081E 00  3.38223E 00 -2.60455E 00 -9.50142E 00 -1.12110E 01 -8.20205E 00 -2.47142E 00  2.22146E 00  3.64835E 00
 2.62654E 00 -2.31102E 00 -5.14618E 00 -6.45763E 00 -4.63761E 00 -2.02188E 00  4.53145E-01  2.20927E 00  3.17964E 00  3.54716E 00
 3.12588E 00  1.73322E 00 -7.20927E-01 -3.11574E 00 -3.24291E 00 -1.52919E 00 -1.83319E-01  2.63374E-01 -1.19546E-01 -1.50628E 00
-4.48966E 00

STANDARD ERRORS OF THE VARIABLES ASSUMING  133 DEGREES OF FREEDOM
 3.95642D 00  1.33461D 01  2.63032D-02  1.45702D-01  2.83036D-02  2.21120D-01  2.52206D-02  1.03922D-02

ERROR ENHANCEMENTS
 9.58656D 00  1.59584D 01  3.18095D 00  1.04321D 01  1.11995D 01  2.46974D 01  2.24404D 00  2.28953D 00
```

********** COUPLED CHANNEL CALCULATION **********

(ON PROGRAM JUPITOR, KARLSRUHE VERSION)

ELAB= 104.000, CHARGE= 28.0, TMAS= 28.000, PMAS= 4.000

VSX,WSX,WSF,VSO =	89.749	31.460	0.0	0.0	
DFN,DFNW,DFNS,DFNSP =	0.628	0.729	0.500	0.500	
RZERO,RZEROW,RZEROS,RZROSP,RZEROC=	1.443	1.429	0.0	0.0	1.300
WC =	1.000	1.000	1.000	0.0	0.0 0.0

PROJECTILE SPIN=0

IIRMAX=3,INTYPE=4,INTMAX=4,BETA=-0.329-0.108 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

TARGET STATES, 0 (+) AT 0.0 MEV, 2 (+) AT 1.780 MEV, 4 (+) AT 4.610 MEV,

KTRL	0	69	1	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KEXCOM	0	170	0	0	0	0	0	0	0	0	0	0	0	70													
KTLOUT	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXTCOM		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0					

XMES1=0.01250 XMES2=0.10000 UNIT=AMU

ECM	0.91000D 02	0.89220D 02	0.86390D 02
WN	0.39032D 01	0.38648D 01	0.38030D 01
WNINI	0.55009D 01	0.54737D 01	0.54303D 01
ETA	0.864620 00	0.87320D 00	0.88739D 00
SIGMO	-0.30703D 00	-0.30714D 00	-0.30718D 00

JJJMAX,KEX14,NXCPLE,NXMAX= 70 70 170 170 XMAX,XBAR= 0.17000000 02 0.4381797D 01

IN FLGLCH, KTRL(15)= 0
ETA,SIGMAZ,RHOMX,RHOMXG,RD= 0.864620D 00 -0.307029D 00 0.6635380 02 0.741601D 02 0.390316D 00
LMAX,NINC,NMAX,ICEC= 70 0 20 40

L	F	G	FD	GD	WRONSK	TIMEMO
0	-8.50274D-01	5.38542D-01	5.31923D-01	8.39185D-01	1.38778D-16	-2.63678D-16
1	-9.68187D-01	-2.76435D-01	-2.72319D-01	9.55106D-01	3.05311D-16	-2.22045D-16
2	-1.61018D-01	-9.94032D-01	-9.80325D-01	1.58531D-01	3.05311D-16	2.22045D-16
3	8.90396D-01	-4.70796D-01	-4.64447D-01	-8.77520D-01	4.16334D-16	-3.60822D-16
4	6.94546D-01	7.30503D-01	7.18961D-01	-6.83608D-01	3.74700D-16	-3.46945D-16
5	-5.38529D-01	8.52326D-01	8.38558D-01	5.29731D-01	3.88578D-16	-4.44089D-16
6	-9.54993D-01	-3.26465D-01	-3.20119D-01	9.37695D-01	5.68989D-16	-2.91434D-16
7	1.00649D-01	-1.00482D 00	-9.85300D-01	-9.88287D-02	7.49401D-16	-1.24900D-15
8	1.00248D 00	-1.30160D-01	-1.27974D-01	-9.80915D-01	7.91034D-16	-4.44089D-16
9	3.58602D-01	9.46399D-01	9.24001D-01	-3.50045D-01	5.27356D-16	-1.24900D-16
10	-8.35833D-01	5.72366D-01	5.58174D-01	8.14182D-01	5.82867D-16	-3.19189D-16
11	-7.60090D-01	-6.72234D-01	-6.52660D-01	7.38412D-01	5.82867D-16	-2.49800D-16
12	4.59242D-01	-9.06071D-01	-8.78203D-01	-4.44831D-01	6.38378D-16	-4.85723D-16
13	9.96520D-01	2.06595D-01	1.98741D-01	-9.62290D-01	1.02696D-15	-4.71845D-16
14	7.29195D-02	1.01670D 00	9.78530D-01	-7.03151D-02	8.88178D-16	8.88178D-16
15	-9.56255D-01	3.58161D-01	3.44332D-01	9.16778D-01	1.05471D-15	-6.52256D-16
16	-6.25678D-01	-8.09877D-01	-7.72969D-01	5.97736D-01	1.04083D-15	-4.71845D-16
17	5.80097D-01	-8.45326D-01	-8.04613D-01	-5.51356D-01	9.02056D-16	-9.85323D-16
18	9.88702D-01	2.81113D-01	2.65066D-01	-9.36062D-01	1.42941D-15	-5.68989D-16
19	6.29703D-02	1.02829D 00	9.68828D-01	-5.98328D-02	1.05471D-15	4.66294D-15
20	-9.46242D-01	4.13840D-01	3.89147D-01	8.86618D-01	9.99201D-16	-8.04912D-16
21	-7.26962D-01	-7.37979D-01	-6.87040D-01	6.78135D-01	8.88178D-16	-2.77556D-16
22	4.17119D-01	-9.51086D-01	-8.82215D-01	-3.85832D-01	9.85323D-16	-1.27676D-15
23	1.04174D 00	2.03923D-02	1.71555D-02	-9.59593D-01	1.24900D-15	-6.52256D-16
24	3.96913D-01	9.67076D-01	8.84558D-01	-3.64223D-01	9.15934D-16	2.22045D-16
25	-7.20856D-01	7.61578D-01	6.93677D-01	6.54377D-01	8.32667D-16	-7.77156D-16
26	-9.99556D-01	-3.30452D-01	-2.96350D-01	9.02472D-01	1.08247D-15	-3.46945D-16
27	-1.42315D-01	-1.04698D 00	-9.37601D-01	1.28933D-01	9.15934D-16	1.77636D-15
28	8.72736D-01	-6.02781D-01	-5.37611D-01	-7.74505D-01	1.02696D-15	-6.24500D-16
29	9.44642D-01	4.92868D-01	4.32103D-01	-8.33152D-01	1.44329D-15	-2.49800D-16
30	2.22059D-02	1.06975D 00	9.34354D-01	-2.14159D-02	1.15186D-15	1.50990D-14
31	-9.23001D-01	5.50817D-01	4.79178D-01	7.97465D-01	1.05471D-15	-5.68989D-16
32	-9.48900D-01	-5.16754D-01	-4.40080D-01	8.14192D-01	1.04083D-15	-1.66533D-16
33	-5.66833D-02	-1.08436D 00	-9.19550D-01	5.07682D-02	1.01308D-15	6.43929D-15
34	8.88776D-01	-6.33770D-01	-5.34717D-01	-7.43846D-01	1.37390D-15	-6.66134D-16
35	1.02517D 00	3.93772D-01	3.22971D-01	-8.51395D-01	1.69309D-15	-4.44089D-16
36	2.57777D-01	1.07418D 00	8.79416D-01	-2.14708D-01	1.31839D-15	8.88178D-16
37	-7.29452D-01	8.38563D-01	6.81649D-01	5.87283D-01	1.48492D-15	-8.04912D-16
38	-1.11571D 00	-8.79453D-02	-6.53039D-02	8.91146D-01	1.74860D-15	-4.02456D-16
39	-6.15046D-01	-9.44554D-01	-7.40846D-01	4.88144D-01	1.37390D-15	0.0
40	3.56701D-01	-1.07771D 00	-8.37929D-01	-2.71802D-01	1.59595D-15	-1.59595D-15
41	1.06562D 00	-4.16752D-01	-3.24139D-01	-8.11654D-01	1.70697D-15	-8.46545D-16
42	1.02037D 00	5.39168D-01	3.98978D-01	-7.69218D-01	1.95677D-15	-6.66134D-16
43	2.82721D-01	1.12923D 00	8.31672D-01	-2.15220D-01	1.54043D-15	8.88178D-16
44	-6.38517D-01	9.86029D-01	7.18732D-01	4.56229D-01	1.74860D-15	-1.67921D-15
45	-1.16382D 00	2.31382D-01	1.73007D-01	8.24845D-01	1.81799D-15	-9.57567D-16
46	-1.00153D 00	-6.59973D-01	-4.50886D-01	7.01357D-01	2.06779D-15	-6.66134D-16
47	-2.76897D-01	-1.18077D 00	-8.00469D-01	1.98008D-01	1.72085D-15	1.11022D-15
48	5.95078D-01	-1.07327D 00	-7.18138D-01	-3.85235D-01	2.05391D-15	-2.01228D-15
49	1.16790D 00	-4.26210D-01	-2.87893D-01	-7.51174D-01	2.02616D-15	-1.15186D-15
50	1.18797D 00	4.22576D-01	2.52356D-01	-7.52007D-01	2.28983D-15	-7.49401D-16
51	6.80768D-01	1.08381D 00	6.53355D-01	-4.28762D-01	1.85962D-15	0.0
52	-1.08517D-01	1.29596D 00	7.67709D-01	4.67939D-02	1.98452D-15	-8.96505D-15
53	-8.56043D-01	1.00936D 00	5.89197D-01	4.73442D-01	1.70697D-15	-1.99840D-15
54	-1.29940D 00	3.64112D-01	2.22131D-01	7.07340D-01	1.58207D-15	-1.54043D-15
55	-1.31946D 00	-3.99757D-01	-1.85135D-01	7.01797D-01	1.95677D-15	-1.17961D-15
56	-9.48695D-01	-1.04522D 00	-5.04305D-01	4.98462D-01	2.01228D-15	-1.31839D-15
57	-3.25007D-01	-1.41203D 00	-6.64683D-01	1.89057D-01	1.95677D-15	-2.22045D-15
58	3.75706D-01	-1.44421D 00	-6.59050D-01	-1.28275D-01	2.01228D-15	-3.33067D-16
59	9.98516D-01	-1.17692D 00	-5.26741D-01	-3.80635D-01	2.02616D-15	-8.88178D-16
60	1.44388D 00	-7.00472D-01	-3.27809D-01	-5.33547D-01	2.41474D-15	-9.29812D-16
61	1.67549D 00	-1.20324D-01	-1.20023D-01	-5.88221D-01	2.27596D-15	-1.06859D-15
62	1.70878D 00	4.74069D-01	5.51671D-02	-5.69909D-01	2.77556D-15	-9.15934D-16
63	1.59054D 00	1.02643D 00	1.76957D-01	-5.14521D-01	3.20577D-15	-9.85323D-16
64	1.37853D 00	1.51827D 00	2.42438D-01	-4.58399D-01	3.19189D-15	-6.52256D-16
65	1.12620D 00	1.96571D 00	2.60444D-01	-4.33353D-01	2.66454D-15	-4.02456D-16
66	8.74431D-01	2.41413D 00	2.45073D-01	-4.67004D-01	2.49800D-15	-2.35922D-16
67	6.49104D-01	2.93555D 00	2.10701D-01	-5.87697D-01	1.90126D-15	-9.71445D-17
68	4.62724D-01	3.63311D 00	1.69069D-01	-8.33656D-01	1.49880D-15	-1.80411D-16
69	3.17882D-01	4.65682D 00	1.28218D-01	-1.26749D 00	1.88738D-15	-4.44089D-16
70	2.11042D-01	6.23726D 00				

```
IN FLGLCH, KTRL(15)= 0
ETA,SIGMAZ,RHOMX,RHOMXG,RD=  0.873202D 00 -0.307136D 00  0.657016D 02  0.734312D 02  0.386480D 00
LMAX,NINC,NMAX,IDEC=   70    0   20   40
```

L	F	G	FD	GD	WRONSK	TIMEMO
0	-9.99499D-01	-1.21381D-01	-1.19322D-01	9.86010D-01	1.52656D-16	0.0
1	-5.78988D-01	-8.23938D-01	-8.12535D-01	5.70862D-01	1.38778D-16	4.44089D-16
2	4.96834D-01	-8.75837D-01	-8.63808D-01	-4.89992D-01	2.22045D-16	-2.63678D-16
3	9.90021D-01	1.87300D-01	1.84084D-01	-9.75253D-01	4.16334D-17	2.22045D-16
4	9.01875D-02	1.00390D 00	9.88158D-01	-8.85602D-02	1.52656D-16	3.99680D-15
5	-9.51148D-01	3.35207D-01	3.30045D-01	9.35045D-01	4.16334D-17	0.0
6	-5.49541D-01	-8.46730D-01	-8.31006D-01	5.39291D-01	2.77556D-17	6.66134D-16
7	6.98492D-01	-7.29474D-01	-7.15351D-01	-6.84576D-01	8.32667D-17	-1.80411D-16
8	8.71466D-01	5.13083D-01	5.01408D-01	-8.52284D-01	9.71445D-17	2.22045D-16
9	-2.96089D-01	9.67803D-01	9.44845D-01	2.89021D-01	1.52656D-16	-1.22125D-15
10	-1.01191D 00	-5.69929D-02	-5.48389D-02	9.85137D-01	1.38778D-17	0.0
11	-1.94296D-01	-9.96070D-01	-9.67144D-01	1.88664D-01	1.80411D-16	2.22045D-15
12	9.15100D-01	-4.41902D-01	-4.28536D-01	-8.85837D-01	1.52656D-16	-5.55112D-17
13	6.69559D-01	7.66990D-01	7.39706D-01	-6.46176D-01	1.80411D-16	4.44089D-16
14	-5.54195D-01	8.55785D-01	8.23517D-01	5.32749D-01	3.33067D-16	-3.33067D-16
15	-9.80644D-01	-2.87065D-01	-2.74160D-01	9.39483D-01	2.35922D-16	4.44089D-16
16	-1.81429D-02	-1.02353D 00	-9.76694D-01	1.76240D-02	2.49800D-16	1.39888D-14
17	9.69790D-01	-3.34592D-01	-3.18909D-01	-9.21123D-01	4.16334D-17	2.22045D-16
18	6.30902D-01	8.12270D-01	7.67479D-01	-5.96923D-01	8.32667D-17	6.66134D-16
19	-5.55449D-01	8.68235D-01	8.17723D-01	5.22143D-01	1.24900D-16	2.22045D-16
20	-1.01009D 00	-2.19731D-01	-2.04398D-01	9.45543D-01	3.33067D-16	6.66134D-16
21	-1.60317D-01	-1.02403D 00	-9.53059D-01	1.49966D-01	4.16334D-17	8.88178D-16
22	8.92312D-01	-5.33083D-01	-4.94649D-01	-8.25172D-01	0.0	6.66134D-16
23	8.40290D-01	6.17873D-01	5.66895D-01	-7.73223D-01	8.32667D-17	6.66134D-16
24	-2.29223D-01	1.02073D 00	9.32918D-01	2.08285D-01	3.74700D-16	1.33227D-15
25	-1.02752D 00	2.15632D-01	1.97506D-01	9.31770D-01	2.35922D-16	6.66134D-16
26	-6.38273D-01	-8.38724D-01	-7.54079D-01	5.75829D-01	8.32667D-17	6.66134D-16
27	4.70892D-01	-9.47131D-01	-8.47349D-01	-4.19309D-01	3.19189D-16	8.88178D-16
28	1.06220D 00	-1.38595D-02	-1.46800D-02	-9.41253D-01	3.33067D-16	6.66134D-16
29	5.15273D-01	9.34295D-01	8.19728D-01	-4.54386D-01	9.71445D-17	8.88178D-16
30	-5.69210D-01	9.07804D-01	7.91966D-01	4.93755D-01	1.80411D-16	6.66134D-16
31	-1.07614D 00	-3.98391D-02	-3.13668D-02	9.28083D-01	4.02456D-16	6.66134D-16
32	-5.21940D-01	-9.48221D-01	-8.08090D-01	4.47852D-01	1.24900D-16	1.11022D-15
33	5.31937D-01	-9.48875D-01	-8.03375D-01	-4.46853D-01	2.91434D-16	2.22045D-16
34	1.09195D 00	-6.85279D-02	-6.10053D-02	-9.11965D-01	3.46945D-16	6.66134D-16
35	6.69734D-01	8.73478D-01	7.18805D-01	-5.55653D-01	1.80411D-16	6.66134D-16
36	-3.35494D-01	1.05514D 00	8.61896D-01	2.69999D-01	2.77556D-16	4.44089D-16
37	-1.05845D 00	3.49007D-01	2.85462D-01	8.50649D-01	3.19189D-16	6.66134D-16
38	-9.21721D-01	-6.40604D-01	-5.04454D-01	7.34327D-01	3.19189D-16	6.66134D-16
39	-6.32948D-02	-1.12865D 00	-8.82964D-01	5.44613D-02	2.35922D-16	4.44089D-15
40	8.42846D-01	-7.66051D-01	-5.94845D-01	-6.45809D-01	3.74700D-16	4.44089D-16
41	1.13850D 00	1.51418D-01	1.08327D-01	-8.63940D-01	4.44089D-16	6.66134D-16
42	6.42996D-01	9.63674D-01	7.14342D-01	-4.84617D-01	3.05311D-16	4.44089D-16
43	-2.80403D-01	1.13465D 00	8.32339D-01	1.98231D-01	3.60822D-16	1.11022D-15
44	-1.02549D 00	5.84042D-01	4.26656D-01	7.32155D-01	4.71845D-16	6.66134D-16
45	-1.14871D 00	-3.20743D-01	-2.16621D-01	8.10057D-01	5.41234D-16	6.66134D-16
46	-6.09327D-01	-1.04052D 00	-7.10739D-01	4.27457D-01	1.66533D-16	0.0
47	2.63487D-01	-1.19093D 00	-8.02814D-01	-1.66640D-01	1.11022D-16	3.33067D-15
48	9.99940D-01	-7.24967D-01	-4.85191D-01	-6.48291D-01	5.55112D-17	1.55431D-15
49	1.24856D 00	9.46792D-02	4.66746D-02	-7.97381D-01	1.94289D-16	1.11022D-15
50	9.25167D-01	8.70954D-01	5.28530D-01	-5.83327D-01	6.93889D-17	6.66134D-16
51	2.05429D-01	1.27412D 00	7.62324D-01	-1.39751D-01	9.71445D-17	-2.77556D-15
52	-5.96201D-01	1.16939D 00	6.87338D-01	3.29138D-01	6.93889D-17	2.66454D-15
53	-1.17794D 00	6.33365D-01	3.73345D-01	6.48195D-01	9.71445D-17	1.33227D-15
54	-1.36036D 00	-1.17376D-01	-3.80196D-02	7.31817D-01	1.94289D-16	1.11022D-15
55	-1.12222D 00	-8.31834D-01	-4.03286D-01	5.92159D-01	3.60822D-16	4.44089D-16
56	-5.70656D-01	-1.31397D 00	-6.27068D-01	3.08504D-01	9.71445D-17	-5.13478D-16
57	1.23234D-01	-1.46841D 00	-6.79523D-01	-1.77005D-02	1.24900D-16	1.33227D-14
58	7.90077D-01	-1.30054D 00	-5.86111D-01	-3.00906D-01	4.99600D-16	3.10862D-15
59	1.30715D 00	-8.86130D-01	-4.03002D-01	-4.91824D-01	4.30211D-16	2.44249D-15
60	1.61557D 00	-3.30268D-01	-1.91593D-01	-5.79810D-01	4.02456D-16	1.77636D-15
61	1.71450D 00	2.68420D-01	-6.21922D-04	-5.83357D-01	3.05311D-16	1.55431D-15
62	1.64251D 00	8.40351D-01	1.41564D-01	-5.36395D-01	2.77556D-17	1.55431D-15
63	1.45604D 00	1.35371D 00	2.26325D-01	-4.76376D-01	3.88578D-16	1.77636D-15
64	1.21176D 00	1.81333D 00	2.59267D-01	-4.37269D-01	3.88578D-16	1.99840D-15
65	9.55742D-01	2.25539D 00	2.53491D-01	-4.48113D-01	3.74700D-16	1.99840D-15
66	7.19174D-01	2.74334D 00	2.23870D-01	-5.36513D-01	9.29812D-16	2.22045D-15
67	5.18844D-01	3.36954D 00	1.83375D-01	-7.36466D-01	1.31839D-15	2.44249D-15
68	3.60253D-01	4.26680D 00	1.41406D-01	-1.10103D 00	1.69309D-15	2.66454D-15
69	2.41472D-01	5.63558D 00	1.03631D-01	-1.72268D 00	1.80411D-15	2.44249D-15
70	1.56639D-01	7.79665D 00				

IN FLGLCH, KTRL(15)= 0
ETA,SIGMAZ,RHOMX,RHOMXG,RD= 0.887389D 00 -0.307178D 00 0.646512D 02 0.722572D 02 0.380301D 00
LMAX,NINC,NMAX,IDEC= 70 0 20 40

L	F	G	FD	GD	WRONSK	T1MEMO
0	-3.40775D-01	-9.47641D-01	-9.34479D-01	3.35849D-01	2.77556D-17	0.0
1	4.68831D-01	-8.91152D-01	-8.78889D-01	-4.62375D-01	2.77556D-17	-3.88578D-16
2	1.00676D 00	3.60218D-02	3.50686D-02	-9.92029D-01	8.32667D-17	-2.22045D-16
3	2.96735D-01	9.63105D-01	9.48340D-01	-2.92009D-01	0.0	-3.74700D-16
4	-8.43639D-01	5.51842D-01	5.43305D-01	8.29953D-01	1.38778D-16	-3.88578D-16
5	-7.46610D-01	-6.78728D-01	-6.66575D-01	7.33417D-01	2.35922D-16	-3.74700D-16
6	4.81624D-01	-8.87139D-01	-8.70661D-01	-4.72574D-01	5.55112D-17	-6.66134D-16
7	9.76051D-01	2.61961D-01	2.56064D-01	-9.55812D-01	1.24900D-16	-3.88578D-16
8	-2.68549D-02	1.01108D 00	9.88340D-01	2.63022D-02	8.32667D-17	-5.85643D-15
9	-9.89926D-01	2.13107D-01	2.08426D-01	9.65308D-01	1.24900D-16	-4.57967D-16
10	-4.47630D-01	-9.09859D-01	-8.84856D-01	4.35418D-01	5.55112D-17	-1.94289D-16
11	7.70081D-01	-6.61476D-01	-6.42233D-01	-7.46906D-01	1.38778D-16	-5.68989D-16
12	8.39822D-01	5.73647D-01	5.54199D-01	-8.12178D-01	1.52656D-16	-4.02456D-16
13	-3.27240D-01	9.64440D-01	9.29916D-01	3.15220D-01	1.52656D-16	-1.02696D-15
14	-1.01947D 00	-4.51521D-02	-4.25139D-02	9.79015D-01	2.63678D-16	-6.66134D-16
15	-2.53886D-01	-9.90430D-01	-9.47332D-01	2.43156D-01	1.38778D-16	-2.22045D-16
16	8.69083D-01	-5.42367D-01	-5.17560D-01	-8.27645D-01	3.60822D-16	-8.18789D-16
17	7.90374D-01	6.55826D-01	6.21181D-01	-7.49788D-01	4.71845D-16	-6.52256D-16
18	-3.61723D-01	9.63543D-01	9.09877D-01	3.40854D-01	5.68989D-16	-1.34615D-15
19	-1.03195D 00	-1.26673D-02	-1.06457D-02	9.68908D-01	7.91034D-16	-1.08247D-15
20	-3.54029D-01	-9.72432D-01	-9.07738D-01	3.31291D-01	6.38378D-16	-5.55112D-16
21	7.77089D-01	-6.87634D-01	-6.39596D-01	-7.20885D-01	6.52256D-16	-1.17961D-15
22	9.34615D-01	4.58783D-01	4.21984D-01	-8.62817D-01	9.15934D-16	-9.43690D-16
23	-5.33912D-02	1.04296D 00	9.56364D-01	4.78477D-02	9.57567D-16	-6.41154D-15
24	-9.77490D-01	3.77626D-01	3.45581D-01	8.89522D-01	9.99201D-16	-1.26288D-15
25	-7.57787D-01	-7.29634D-01	-6.58179D-01	6.85905D-01	1.05471D-15	-9.02056D-16
26	3.27375D-01	-1.00365D 00	-9.01058D-01	-2.92178D-01	1.15186D-15	-1.70697D-15
27	1.04797D 00	-1.59873D-01	-1.44551D-01	-9.32172D-01	1.13798D-15	-8.60423D-16
28	6.31317D-01	8.57435D-01	7.55071D-01	-5.58477D-01	1.11022D-15	-7.35523D-16
29	-4.52357D-01	9.68873D-01	8.48364D-01	3.93591D-01	1.09635D-15	-1.44329D-15
30	-1.07118D 00	8.46156D-02	7.61895D-02	9.27529D-01	1.20737D-15	-1.04083D-15
31	-6.20226D-01	-8.84172D-01	-7.56471D-01	5.33917D-01	9.85323D-16	-6.38378D-16
32	4.32116D-01	-9.95687D-01	-8.46329D-01	-3.64072D-01	1.31839D-15	-1.16573D-15
33	1.07812D 00	-1.70870D-01	-1.47028D-01	-9.04234D-01	1.19349D-15	-8.32667D-16
34	7.41899D-01	8.09638D-01	6.68965D-01	-6.17848D-01	1.06859D-15	-7.35523D-16
35	-2.48435D-01	1.07634D 00	8.82931D-01	1.99914D-01	1.20737D-15	-1.56819D-15
36	-1.02708D 00	4.25831D-01	3.48720D-01	8.29053D-01	1.17961D-15	-1.08247D-15
37	-9.60876D-01	-5.74971D-01	-4.54419D-01	7.68801D-01	1.16573D-15	-6.93889D-16
38	-1.32757D-01	-1.11987D 00	-8.80007D-01	1.09251D-01	9.15934D-16	0.0
39	7.96696D-01	-8.10071D-01	-6.31516D-01	-6.13066D-01	1.05471D-15	-8.74301D-16
40	1.14183D 00	9.38766D-02	6.51060D-02	-8.70435D-01	1.15186D-15	-7.91034D-16
41	6.83564D-01	9.31782D-01	6.93805D-01	-5.17179D-01	9.99201D-16	-3.46945D-16
42	-2.35239D-01	1.14193D 00	8.41507D-01	1.66017D-01	1.22125D-15	-1.95677D-15
43	-1.00261D 00	6.16927D-01	4.52244D-01	7.19123D-01	1.17961D-15	-8.88178D-16
44	-1.15458D 00	-2.86758D-01	-1.93748D-01	8.17996D-01	1.52656D-15	-7.77156D-16
45	-6.32533D-01	-1.02305D 00	-7.02060D-01	4.45445D-01	1.27676D-15	-1.80411D-16
46	2.39759D-01	-1.19287D 00	-8.07868D-01	-1.51488D-01	1.45717D-15	-2.73392D-15
47	9.86518D-01	-7.38091D-01	-4.96001D-01	-6.42569D-01	1.58207D-15	-1.15186D-15
48	1.24646D 00	8.09168D-02	3.82125D-02	-7.99790D-01	1.67921D-15	-7.21645D-16
49	9.28919D-01	8.62442D-01	5.25804D-01	-5.88345D-01	1.73472D-15	-2.63678D-16
50	2.09057D-01	1.27045D 00	7.63674D-01	-1.42510D-01	1.48492D-15	2.66454D-15
51	-5.95032D-01	1.16663D 00	6.88832D-01	3.30047D-01	1.41553D-15	-1.91513D-15
52	-1.17741D 00	6.28109D-01	3.71983D-01	6.50882D-01	1.65146D-15	-1.13798D-15
53	-1.35673D 00	-1.25435D-01	-4.26349D-02	7.33126D-01	1.73472D-15	-6.66134D-16
54	-1.11272D 00	-8.39843D-01	-4.09225D-01	5.89830D-01	2.47025D-15	-2.08167D-16
55	-5.55266D-01	-1.31768D 00	-6.31529D-01	3.02282D-01	2.17881D-15	1.33227D-15
56	1.41748D-01	-1.46434D 00	-6.80362D-01	-2.62535D-02	2.12330D-15	-1.09773D-14
57	8.07445D-01	-1.28742D 00	-5.82692D-01	-3.09406D-01	2.22045D-15	-2.60902D-15
58	1.31927D 00	-8.65167D-01	-3.96189D-01	-4.98178D-01	2.10942D-15	-1.69309D-15
59	1.61980D 00	-3.04342D-01	-1.83156D-01	-5.82948D-01	2.20657D-15	-1.23512D-15
60	1.71019D 00	2.95968D-01	7.52717D-03	-5.83428D-01	2.63678D-15	-1.04083D-15
61	1.63079D 00	8.66895D-01	1.47961D-01	-5.34548D-01	2.58127D-15	-8.18789D-16
62	1.43914D 00	1.37816D 00	2.30227D-01	-4.74387D-01	3.41394D-15	-7.77156D-16
63	1.19231D 00	1.83658D 00	2.60630D-01	-4.37244D-01	3.63598D-15	-9.43690D-16
64	9.36116D-01	2.28057D 00	2.52762D-01	-4.52465D-01	3.76088D-15	-1.13798D-15
65	7.01119D-01	2.77621D 00	2.21729D-01	-5.48312D-01	3.66374D-15	-1.34615D-15
66	5.03398D-01	3.41946D 00	1.80514D-01	-7.60313D-01	3.52496D-15	-1.36002D-15
67	3.47810D-01	4.34892D 00	1.38390D-01	-1.14475D 00	3.69149D-15	-1.40166D-15
68	2.31955D-01	5.77519D 00	1.00842D-01	-1.80041D 00	3.80251D-15	-1.20737D-15
69	1.49686D-01	8.03768D 00	7.02945D-02	-2.90605D 00	3.62210D-15	-9.29812D-16
70	9.36656D-02	1.17097D 01				

POTENTIALS

X	VCENTR	VCENTI	VSPIN	VCOULM	VCPL1R	VCPL1I	VCPL2R	VCPL2I
1.25000D-02	-8.96332D 01	-3.13575D 01	0.0	1.53193D 01	3.56793D-01	2.62484D-01	2.20743D-01	1.51159D-01
2.50000D-02	-8.96309D 01	-3.13557D 01	0.0	1.53192D 01	3.63866D-01	2.66972D-01	2.25163D-01	1.53736D-01
3.75000D-02	-8.96285D 01	-3.13540D 01	0.0	1.53189D 01	3.71037D-01	2.71537D-01	2.29670D-01	1.56356D-01
5.00000D-02	-8.96261D 01	-3.13521D 01	0.0	1.53186D 01	3.78311D-01	2.76178D-01	2.34266D-01	1.59020D-01
6.25000D-02	-8.96237D 01	-3.13503D 01	0.0	1.53181D 01	3.85690D-01	2.80897D-01	2.38954D-01	1.61729D-01
7.50000D-02	-8.96211D 01	-3.13484D 01	0.0	1.53176D 01	3.93176D-01	2.85697D-01	2.43734D-01	1.64482D-01
8.75000D-02	-8.96186D 01	-3.13465D 01	0.0	1.53169D 01	4.00773D-01	2.90577D-01	2.48609D-01	1.67282D-01
1.00000D-01	-8.96160D 01	-3.13445D 01	0.0	1.53161D 01	4.08484D-01	2.95539D-01	2.53580D-01	1.70128D-01
1.25000D-01	-8.96106D 01	-3.13405D 01	0.0	1.53143D 01	4.24258D-01	3.05716D-01	2.63819D-01	1.75964D-01
1.50000D-01	-8.96050D 01	-3.13364D 01	0.0	1.53120D 01	4.40525D-01	3.16239D-01	2.74466D-01	1.81996D-01
1.75000D-01	-8.95992D 01	-3.13321D 01	0.0	1.53094D 01	4.57311D-01	3.27119D-01	2.85537D-01	1.88230D-01
2.00000D-01	-8.95931D 01	-3.13277D 01	0.0	1.53063D 01	4.74643D-01	3.38367D-01	2.97049D-01	1.94673D-01
2.50000D-01	-8.95802D 01	-3.13183D 01	0.0	1.52989D 01	5.11058D-01	3.62019D-01	3.21464D-01	2.08212D-01
3.00000D-01	-8.95663D 01	-3.13084D 01	0.0	1.52899D 01	5.50010D-01	3.87295D-01	3.47855D-01	2.22669D-01
3.50000D-01	-8.95512D 01	-3.12977D 01	0.0	1.52793D 01	5.91759D-01	4.14304D-01	3.76376D-01	2.38102D-01
4.00000D-01	-8.95349D 01	-3.12863D 01	0.0	1.52670D 01	6.36582D-01	4.43159D-01	4.07192D-01	2.54574D-01
5.00000D-01	-8.94982D 01	-3.12610D 01	0.0	1.52375D 01	7.36674D-01	5.06900D-01	4.76440D-01	2.90902D-01
6.00000D-01	-8.94551D 01	-3.12321D 01	0.0	1.52014D 01	8.52967D-01	5.79572D-01	5.57183D-01	3.32220D-01
7.00000D-01	-8.94048D 01	-3.11990D 01	0.0	1.51588D 01	9.88559D-01	6.62355D-01	6.51240D-01	3.79156D-01
8.00000D-01	-8.93460D 01	-3.11613D 01	0.0	1.51097D 01	1.14702D 00	7.56561D-01	7.60688D-01	4.32399D-01
9.00000D-01	-8.92771D 01	-3.11182D 01	0.0	1.50540D 01	1.33246D 00	8.63644D-01	8.87895D-01	4.92700D-01
1.00000D 00	-8.91967D 01	-3.10689D 01	0.0	1.49917D 01	1.54957D 00	9.85208D-01	1.03554D 00	5.60870D-01
1.10000D 00	-8.91028D 01	-3.10128D 01	0.0	1.49229D 01	1.80370D 00	1.12301D 00	1.20664D 00	6.37776D-01
1.20000D 00	-8.89932D 01	-3.09488D 01	0.0	1.48475D 01	2.10094D 00	1.27895D 00	1.40457D 00	7.24332D-01
1.30000D 00	-8.88653D 01	-3.08760D 01	0.0	1.47656D 01	2.44815D 00	1.45509D 00	1.63305D 00	8.21487D-01
1.40000D 00	-8.87164D 01	-3.07931D 01	0.0	1.46771D 01	2.85298D 00	1.65363D 00	1.89615D 00	9.30204D-01
1.50000D 00	-8.85430D 01	-3.06990D 01	0.0	1.45821D 01	3.32396D 00	1.87685D 00	2.19827D 00	1.05144D 00
1.60000D 00	-8.83414D 01	-3.05921D 01	0.0	1.44805D 01	3.87044D 00	2.12715D 00	2.54404D 00	1.18610D 00
1.70000D 00	-8.81074D 01	-3.04711D 01	0.0	1.43724D 01	4.50259D 00	2.40695D 00	2.93826D 00	1.33500D 00
1.80000D 00	-8.78361D 01	-3.03341D 01	0.0	1.42577D 01	5.23125D 00	2.71865D 00	3.38572D 00	1.49883D 00
1.90000D 00	-8.75221D 01	-3.01794D 01	0.0	1.41364D 01	6.06779D 00	3.06452D 00	3.89099D 00	1.67804D 00
2.00000D 00	-8.71595D 01	-3.00050D 01	0.0	1.40086D 01	7.02387D 00	3.44665D 00	4.45814D 00	1.87282D 00
2.10000D 00	-8.67416D 01	-2.98088D 01	0.0	1.38743D 01	8.11100D 00	3.86679D 00	5.09039D 00	2.08298D 00
2.20000D 00	-8.62612D 01	-2.95886D 01	0.0	1.37334D 01	9.34010D 00	4.32621D 00	5.78964D 00	2.30788D 00
2.30000D 00	-8.57105D 01	-2.93420D 01	0.0	1.35859D 01	1.07209D 01	4.82557D 00	6.55599D 00	2.54630D 00
2.40000D 00	-8.50810D 01	-2.90667D 01	0.0	1.34319D 01	1.22610D 01	5.36470D 00	7.38713D 00	2.79642D 00
2.50000D 00	-8.43638D 01	-2.87602D 01	0.0	1.32713D 01	1.39652D 01	5.94247D 00	8.27778D 00	3.05569D 00
2.60000D 00	-8.35497D 01	-2.84201D 01	0.0	1.31042D 01	1.58344D 01	6.55655D 00	9.21912D 00	3.32079D 00
2.70000D 00	-8.26291D 01	-2.80438D 01	0.0	1.29305D 01	1.78646D 01	7.20331D 00	1.01983D 01	3.58765D 00
2.80000D 00	-8.15923D 01	-2.76291D 01	0.0	1.27503D 01	2.00457D 01	7.87761D 00	1.11983D 01	3.85145D 00
2.90000D 00	-8.04296D 01	-2.71738D 01	0.0	1.25635D 01	2.23608D 01	8.57278D 00	1.21975D 01	4.10672D 00
3.00000D 00	-7.91319D 01	-2.66758D 01	0.0	1.23702D 01	2.47854D 01	9.28053D 00	1.31707D 01	4.34747D 00
3.10000D 00	-7.76903D 01	-2.61334D 01	0.0	1.21703D 01	2.72868D 01	9.99102D 00	1.40890D 01	4.56743D 00
3.20000D 00	-7.60968D 01	-2.55454D 01	0.0	1.19639D 01	2.98245D 01	1.06930D 01	1.49216D 01	4.76028D 00
3.30000D 00	-7.43447D 01	-2.49107D 01	0.0	1.17509D 01	3.23502D 01	1.13739D 01	1.56371D 01	4.91998D 00
3.40000D 00	-7.24285D 01	-2.42291D 01	0.0	1.15313D 01	3.48091D 01	1.20205D 01	1.62051D 01	5.04107D 00
3.50000D 00	-7.03449D 01	-2.35008D 01	0.0	1.13052D 01	3.71411D 01	1.26189D 01	1.65986D 01	5.11903D 00
3.60000D 00	-6.80925D 01	-2.27268D 01	0.0	1.10726D 01	3.92835D 01	1.31552D 01	1.67958D 01	5.15056D 00
3.70000D 00	-6.56729D 01	-2.19088D 01	0.0	1.08333D 01	4.11729D 01	1.36163D 01	1.67820D 01	5.13384D 00
3.80000D 00	-6.30909D 01	-2.10494D 01	0.0	1.05876D 01	4.27485D 01	1.39900D 01	1.65509D 01	5.06867D 00
3.90000D 00	-6.03546D 01	-2.01522D 01	0.0	1.03353D 01	4.39551D 01	1.42659D 01	1.61054D 01	4.95656D 00
4.00000D 00	-5.74765D 01	-1.92215D 01	0.0	1.00791D 01	4.54544D 01	1.44360D 01	1.60902D 01	4.80064D 00
4.10000D 00	-5.44732D 01	-1.82627D 01	0.0	9.83322D 00	4.60126D 01	1.44948D 01	1.53199D 01	4.60554D 00
4.20000D 00	-5.13656D 01	-1.72819D 01	0.0	9.59910D 00	4.60936D 01	1.44400D 01	1.44023D 01	4.37708D 00
4.30000D 00	-4.81786D 01	-1.62859D 01	0.0	9.37587D 00	4.56943D 01	1.42726D 01	1.33710D 01	4.12198D 00
4.40000D 00	-4.49408D 01	-1.52822D 01	0.0	9.16278D 00	4.48284D 01	1.39967D 01	1.22627D 01	3.84743D 00
4.50000D 00	-4.16836D 01	-1.42785D 01	0.0	8.95916D 00	4.35260D 01	1.36196D 01	1.11147D 01	3.56072D 00
4.60000D 00	-3.84401D 01	-1.32828D 01	0.0	8.76440D 00	4.18321D 01	1.31512D 01	9.96199D 00	3.26885D 00
4.70000D 00	-3.52436D 01	-1.23028D 01	0.0	8.57792D 00	3.98038D 01	1.26037D 01	8.83561D 00	2.97824D 00
4.80000D 00	-3.21267D 01	-1.13462D 01	0.0	8.39921D 00	3.75072D 01	1.19909D 01	7.76118D 00	2.69445D 00
4.90000D 00	-2.91193D 01	-1.04196D 01	0.0	8.22780D 00	3.50129D 01	1.13273D 01	6.75804D 00	2.42206D 00
5.00000D 00	-2.62477D 01	-9.52931D 00	0.0	8.06324D 00	3.23922D 01	1.06281D 01	5.83913D 00	2.16457D 00
5.10000D 00	-2.35335D 01	-8.68034D 00	0.0	7.90514D 00	2.97135D 01	9.90758D 00	5.01146D 00	1.92446D 00
5.20000D 00	-2.09934D 01	-7.87681D 00	0.0	7.75312D 00	2.70386D 01	9.17945D 00	4.27690D 00	1.70322D 00

5.300000D 00	-1.863820D 01	-7.121700D 00	0.0	7.606830D 00	2.442100D 01	8.455900D 00	3.633240D 00	1.501520D 00
5.400000D 00	-1.647390D 01	-6.416890D 00	0.0	7.465970D 00	2.190420D 01	7.747490D 00	3.075330D 00	1.319290D 00
5.500000D 00	-1.450120D 01	-5.763250D 00	0.0	7.330220D 00	1.952170D 01	7.062960D 00	2.596090D 00	1.155970D 00
5.600000D 00	-1.271690D 01	-5.160710D 00	0.0	7.199330D 00	1.729680D 01	6.409190D 00	2.187460D 00	1.010580D 00
5.700000D 00	-1.111430D 01	-4.608380D 00	0.0	7.073020D 00	1.524380D 01	5.791270D 00	1.841030D 00	8.818790D-01
5.800000D 00	-9.683770D 00	-4.104700D 00	0.0	6.951070D 00	1.336960D 01	5.212660D 00	1.548630D 00	7.684910D-01
5.900000D 00	-8.414260D 00	-3.647570D 00	0.0	6.833260D 00	1.167430D 01	4.675330D 00	1.302600D 00	6.689760D-01
6.000000D 00	-7.293340D 00	-3.234500D 00	0.0	6.719370D 00	1.015340D 01	4.180010D 00	1.096030D 00	5.819050D-01
6.100000D 00	-6.308100D 00	-2.862710D 00	0.0	6.609220D 00	8.798590D 00	3.726420D 00	9.227790D-01	5.059060D-01
6.200000D 00	-5.445590D 00	-2.529280D 00	0.0	6.502620D 00	7.599340D 00	3.313460D 00	7.775510D-01	4.396930D-01
6.300000D 00	-4.693180D 00	-2.231230D 00	0.0	6.399400D 00	6.543570D 00	2.939460D 00	6.557970D-01	3.820840D-01
6.400000D 00	-4.038840D 00	-1.965560D 00	0.0	6.299410D 00	5.618540D 00	2.602280D 00	5.536680D-01	3.320090D-01
6.500000D 00	-3.471330D 00	-1.729380D 00	0.0	6.202500D 00	4.811440D 00	2.299540D 00	4.679260D-01	2.885110D-01
6.600000D 00	-2.980290D 00	-1.519910D 00	0.0	6.108520D 00	4.109810D 00	2.028710D 00	3.958670D-01	2.507410D-01
6.700000D 00	-2.556270D 00	-1.334490D 00	0.0	6.017350D 00	3.501810D 00	1.787180D 00	3.352350D-01	2.179490D-01
6.800000D 00	-2.190770D 00	-1.170690D 00	0.0	5.928860D 00	2.976430D 00	1.572400D 00	2.841550D-01	1.894820D-01
6.900000D 00	-1.876200D 00	-1.026200D 00	0.0	5.842930D 00	2.523560D 00	1.381860D 00	2.410700D-01	1.647660D-01
7.000000D 00	-1.605820D 00	-8.989350D-01	0.0	5.759460D 00	2.134060D 00	1.213210D 00	2.046840D-01	1.433040D-01
7.100000D 00	-1.373680D 00	-7.869850D-01	0.0	5.678340D 00	1.799720D 00	1.064200D 00	1.739210D-01	1.246630D-01
7.200000D 00	-1.174570D 00	-6.886150D-01	0.0	5.599480D 00	1.513240D 00	9.327780D-01	1.478830D-01	1.084690D-01
7.300000D 00	-1.003930D 00	-6.022630D-01	0.0	5.522770D 00	1.268160D 00	8.170310D-01	1.258230D-01	9.439600D-02
7.400000D 00	-8.578000D-01	-5.265270D-01	0.0	5.448140D 00	1.058830D 00	7.152220D-01	1.071160D-01	8.216400D-02
7.500000D 00	-7.327300D-01	-4.601500D-01	0.0	5.375500D 00	8.802790D-01	6.257730D-01	9.124000D-02	7.152890D-02
7.600000D 00	-6.257430D-01	-4.020170D-01	0.0	5.304770D 00	7.281960D-01	5.472620D-01	7.775620D-02	6.227990D-02
7.700000D 00	-5.342660D-01	-3.511320D-01	0.0	5.235870D 00	5.988330D-01	4.784090D-01	6.629660D-02	5.423430D-02
7.800000D 00	-4.560810D-01	-3.066140D-01	0.0	5.168750D 00	4.889450D-01	4.180730D-01	5.655140D-02	4.723410D-02
7.900000D 00	-3.892780D-01	-2.676840D-01	0.0	5.103320D 00	3.957300D-01	3.652340D-01	4.825980D-02	4.114200D-02
8.000000D 00	-3.322170D-01	-2.336550D-01	0.0	5.039530D 00	3.167730D-01	3.189890D-01	4.120160D-02	3.583930D-02
8.100000D 00	-2.834880D-01	-2.039190D-01	0.0	4.977310D 00	2.499980D-01	2.785330D-01	3.519060D-02	3.122300D-02
8.200000D 00	-2.418840D-01	-1.779420D-01	0.0	4.916610D 00	1.936210D-01	2.431590D-01	3.006950D-02	2.720340D-02
8.300000D 00	-2.063690D-01	-1.552560D-01	0.0	4.857380D 00	1.461090D-01	2.122400D-01	2.570490D-02	2.370300D-02
8.400000D 00	-1.760560D-01	-1.354470D-01	0.0	4.799550D 00	1.061530D-01	1.852230D-01	2.198380D-02	2.065430D-02
8.500000D 00	-1.501870D-01	-1.181550D-01	0.0	4.743080D 00	7.262900D-02	1.616230D-01	1.881040D-02	1.799880D-02
8.600000D 00	-1.281130D-01	-1.030620D-01	0.0	4.687930D 00	4.457670D-02	1.410140D-01	1.610320D-02	1.568540D-02
8.700000D 00	-1.092780D-01	-8.989070D-02	0.0	4.634050D 00	2.117560D-02	1.230200D-01	1.379310D-02	1.367000D-02
8.800000D 00	-9.320930D-02	-7.839780D-02	0.0	4.581390D 00	1.724630D-03	1.073120D-01	1.182130D-02	1.191400D-02
8.900000D 00	-7.950070D-02	-6.837060D-02	0.0	4.529910D 00	-1.437440D-02	9.360240D-02	1.013770D-02	1.038390D-02
9.000000D 00	-6.780640D-02	-5.962310D-02	0.0	4.479580D 00	-2.763170D-02	8.163880D-02	8.699910D-03	9.050590D-03
9.100000D 00	-5.783100D-02	-5.199260D-02	0.0	4.430350D 00	-3.848240D-02	7.119990D-02	7.471580D-03	7.888680D-03
9.200000D 00	-4.932220D-02	-4.533710D-02	0.0	4.382200D 00	-4.729730D-02	6.209260D-02	6.421910D-03	6.876090D-03
9.300000D 00	-4.206460D-02	-3.953230D-02	0.0	4.335080D 00	-5.439200D-02	5.414780D-02	5.524640D-03	5.993600D-03
9.400000D 00	-3.587440D-02	-3.446970D-02	0.0	4.288960D 00	-6.003520D-02	4.721760D-02	4.757370D-03	5.224460D-03
9.500000D 00	-3.059480D-02	-3.005480D-02	0.0	4.243810D 00	-6.445570D-02	4.117300D-02	4.101050D-03	4.554090D-03
9.600000D 00	-2.609200D-02	-2.620480D-02	0.0	4.199610D 00	-6.784780D-02	3.590110D-02	3.539400D-03	3.969790D-03
9.700000D 00	-2.225160D-02	-2.284760D-02	0.0	4.156310D 00	-7.037670D-02	3.130340D-02	3.058580D-03	3.460500D-03
9.800000D 00	-1.897640D-02	-1.992010D-02	0.0	4.113900D 00	-7.218300D-02	2.729380D-02	2.646770D-03	3.016570D-03
9.900000D 00	-1.618310D-02	-1.736750D-02	0.0	4.072350D 00	-7.338560D-02	2.379740D-02	2.293880D-03	2.629620D-03
1.000000D 01	-1.380090D-02	-1.514190D-02	0.0	4.031620D 00	-7.408560D-02	2.074850D-02	1.991330D-03	2.292320D-03
1.010000D 01	-1.176940D-02	-1.320130D-02	0.0	3.991700D 00	-7.436880D-02	1.809000D-02	1.731780D-03	1.998300D-03
1.020000D 01	-1.003680D-02	-1.150930D-02	0.0	3.952570D 00	-7.430770D-02	1.577180D-02	1.508980D-03	1.742000D-03
1.030000D 01	-8.559260D-03	-1.003410D-02	0.0	3.914200D 00	-7.396360D-02	1.375060D-02	1.317580D-03	1.518590D-03
1.040000D 01	-7.299220D-03	-8.747890D-03	0.0	3.876560D 00	-7.338850D-02	1.198830D-02	1.153040D-03	1.323830D-03
1.050000D 01	-6.224650D-03	-7.626530D-03	0.0	3.839640D 00	-7.262620D-02	1.045180D-02	1.011470D-03	1.154050D-03
1.060000D 01	-5.308270D-03	-6.648870D-03	0.0	3.803420D 00	-7.171370D-02	9.112080D-03	8.895380D-04	1.006050D-03
1.070000D 01	-4.526790D-03	-5.796520D-03	0.0	3.767870D 00	-7.068210D-02	7.944070D-03	7.844230D-04	8.770370D-04
1.080000D 01	-3.860350D-03	-5.053410D-03	0.0	3.732980D 00	-6.955750D-02	6.925740D-03	6.937010D-04	7.645670D-04
1.090000D 01	-3.292020D-03	-4.405550D-03	0.0	3.698740D 00	-6.836200D-02	6.037910D-03	6.153080D-04	6.665220D-04
1.100000D 01	-2.807360D-03	-3.840740D-03	0.0	3.665110D 00	-6.711380D-02	5.263870D-03	5.474770D-04	5.810510D-04
1.110000D 01	-2.394050D-03	-3.348330D-03	0.0	3.632090D 00	-6.582830D-02	4.589040D-03	4.887010D-04	5.065410D-04
1.120000D 01	-2.041590D-03	-2.919040D-03	0.0	3.599660D 00	-6.451830D-02	4.000720D-03	4.376930D-04	4.415870D-04

1.13000D 01	-1.74102D-03	-2.54479D-03	0.0	3.56781D 00	-6.31945D-02	3.48780D-03	3.93350D-04	3.84962D-04
1.14000D 01	-1.48469D-03	-2.21852D-03	0.0	3.53651D 00	-6.18654D-02	3.04064D-03	3.54731D-04	3.35598D-04
1.15000D 01	-1.26611D-03	-1.93407D-03	0.0	3.50576D 00	-6.05385D-02	2.65080D-03	3.21033D-04	2.92565D-04
1.16000D 01	-1.07970D-03	-1.68610D-03	0.0	3.47554D 00	-5.92195D-02	2.31094D-03	2.91566D-04	2.55050D-04
1.17000D 01	-9.20743D-04	-1.46991D-03	0.0	3.44583D 00	-5.79131D-02	2.01465D-03	2.65741D-04	2.22346D-04
1.18000D 01	-7.85185D-04	-1.28145D-03	0.0	3.41663D 00	-5.66234D-02	1.75634D-03	2.43054D-04	1.93835D-04
1.19000D 01	-6.69584D-04	-1.11714D-03	0.0	3.38792D 00	-5.53532D-02	1.53115D-03	2.23074D-04	1.68980D-04
1.20000D 01	-5.71003D-04	-9.73904D-04	0.0	3.35969D 00	-5.41051D-02	1.33483D-03	2.05431D-04	1.47313D-04
1.21000D 01	-4.86936D-04	-8.49031D-04	0.0	3.33192D 00	-5.28808D-02	1.16369D-03	1.89809D-04	1.28423D-04
1.22000D 01	-4.15245D-04	-7.40169D-04	0.0	3.30461D 00	-5.16816D-02	1.01448D-03	1.75936D-04	1.11956D-04
1.23000D 01	-3.54110D-04	-6.45265D-04	0.0	3.27774D 00	-5.05087D-02	8.84406D-04	1.63578D-04	9.76008D-05
1.24000D 01	-3.01975D-04	-5.62529D-04	0.0	3.25131D 00	-4.93627D-02	7.71009D-04	1.52537D-04	8.50860D-05
1.25000D 01	-2.57516D-04	-4.90401D-04	0.0	3.22530D 00	-4.82439D-02	6.72150D-04	1.42640D-04	7.41759D-05
1.26000D 01	-2.19602D-04	-4.27522D-04	0.0	3.19970D 00	-4.71525D-02	5.85967D-04	1.33740D-04	6.46648D-05
1.27000D 01	-1.87271D-04	-3.72705D-04	0.0	3.17451D 00	-4.60886D-02	5.10835D-04	1.25710D-04	5.63732D-05
1.28000D 01	-1.59699D-04	-3.24916D-04	0.0	3.14970D 00	-4.50520D-02	4.45335D-04	1.18442D-04	4.91448D-05
1.29000D 01	-1.36187D-04	-2.83255D-04	0.0	3.12529D 00	-4.40424D-02	3.88234D-04	1.11840D-04	4.28433D-05
1.30000D 01	-1.16136D-04	-2.46935D-04	0.0	3.10125D 00	-4.30595D-02	3.38454D-04	1.05825D-04	3.73498D-05
1.31000D 01	-9.90378D-05	-2.15273D-04	0.0	3.07757D 00	-4.21028D-02	2.95057D-04	1.00325D-04	3.25607D-05
1.32000D 01	-8.44566D-05	-1.87670D-04	0.0	3.05426D 00	-4.11718D-02	2.57225D-04	9.52814D-05	2.83856D-05
1.33000D 01	-7.20222D-05	-1.63607D-04	0.0	3.03129D 00	-4.02661D-02	2.24243D-04	9.06407D-05	2.47459D-05
1.34000D 01	-6.14185D-05	-1.42629D-04	0.0	3.00867D 00	-3.93849D-02	1.95490D-04	8.63580D-05	2.15729D-05
1.35000D 01	-5.23760D-05	-1.24341D-04	0.0	2.98639D 00	-3.85278D-02	1.70424D-04	8.23939D-05	1.88068D-05
1.36000D 01	-4.46647D-05	-1.08397D-04	0.0	2.96443D 00	-3.76941D-02	1.48572D-04	7.87142D-05	1.63953D-05
1.37000D 01	-3.80888D-05	-9.44984D-05	0.0	2.94279D 00	-3.68832D-02	1.29522D-04	7.52892D-05	1.42931D-05
1.38000D 01	-3.24811D-05	-8.23816D-05	0.0	2.92147D 00	-3.60944D-02	1.12914D-04	7.20930D-05	1.24604D-05
1.39000D 01	-2.76989D-05	-7.18185D-05	0.0	2.90045D 00	-3.53272D-02	9.84360D-05	6.91030D-05	1.08627D-05
1.40000D 01	-2.36209D-05	-6.26097D-05	0.0	2.87973D 00	-3.45809D-02	8.58143D-05	6.62992D-05	9.46983D-06
1.41000D 01	-2.01432D-05	-5.45818D-05	0.0	2.85931D 00	-3.38548D-02	7.48110D-05	6.36644D-05	8.25558D-06
1.42000D 01	-1.71776D-05	-4.75832D-05	0.0	2.83917D 00	-3.31485D-02	6.52186D-05	6.11833D-05	7.19702D-06
1.43000D 01	-1.46485D-05	-4.14819D-05	0.0	2.81932D 00	-3.24612D-02	5.68561D-05	5.88423D-05	6.27420D-06
1.44000D 01	-1.24918D-05	-3.61630D-05	0.0	2.79974D 00	-3.17924D-02	4.95659D-05	5.66296D-05	5.46971D-06
1.45000D 01	-1.06527D-05	-3.15261D-05	0.0	2.78043D 00	-3.11416D-02	4.32104D-05	5.45346D-05	4.76836D-06
1.46000D 01	-9.08431D-06	-2.74837D-05	0.0	2.76138D 00	-3.05081D-02	3.76699D-05	5.25479D-05	4.15695D-06
1.47000D 01	-7.74684D-06	-2.39597D-05	0.0	2.74260D 00	-2.98914D-02	3.28397D-05	5.06613D-05	3.62394D-06
1.48000D 01	-6.60629D-06	-2.08875D-05	0.0	2.72407D 00	-2.92911D-02	2.86289D-05	4.88673D-05	3.15926D-06
1.49000D 01	-5.63366D-06	-1.82093D-05	0.0	2.70579D 00	-2.87066D-02	2.49581D-05	4.71593D-05	2.75418D-06
1.50000D 01	-4.80422D-06	-1.58744D-05	0.0	2.68775D 00	-2.81373D-02	2.17579D-05	4.55312D-05	2.40103D-06
1.51000D 01	-4.09690D-06	-1.38390D-05	0.0	2.66995D 00	-2.75829D-02	1.89680D-05	4.39776D-05	2.09316D-06
1.52000D 01	-3.49372D-06	-1.20645D-05	0.0	2.65238D 00	-2.70429D-02	1.65359D-05	4.24937D-05	1.82477D-06
1.53000D 01	-2.97935D-06	-1.05176D-05	0.0	2.63505D 00	-2.65168D-02	1.44156D-05	4.10750D-05	1.59079D-06
1.54000D 01	-2.54070D-06	-9.16897D-06	0.0	2.61794D 00	-2.60042D-02	1.25672D-05	3.97176D-05	1.38682D-06
1.55000D 01	-2.16664D-06	-7.99330D-06	0.0	2.60105D 00	-2.55046D-02	1.09558D-05	3.84178D-05	1.20900D-06
1.56000D 01	-1.84765D-06	-6.96838D-06	0.0	2.58437D 00	-2.50177D-02	9.55103D-06	3.71722D-05	1.05398D-06
1.57000D 01	-1.57562D-06	-6.07487D-06	0.0	2.56791D 00	-2.45430D-02	8.32637D-06	3.59778D-05	9.18832D-07
1.58000D 01	-1.34365D-06	-5.29594D-06	0.0	2.55166D 00	-2.40803D-02	7.25874D-06	3.48318D-05	8.01016D-07
1.59000D 01	-1.14582D-06	-4.61688D-06	0.0	2.53561D 00	-2.36290D-02	6.32800D-06	3.37315D-05	6.98308D-07
1.60000D 01	-9.77125D-07	-4.02489D-06	0.0	2.51976D 00	-2.31890D-02	5.51661D-06	3.26745D-05	6.08769D-07
1.61000D 01	-8.33264D-07	-3.50881D-06	0.0	2.50411D 00	-2.27598D-02	4.80926D-06	3.16587D-05	5.30711D-07
1.62000D 01	-7.10584D-07	-3.05890D-06	0.0	2.48866D 00	-2.23410D-02	4.19260D-06	3.06819D-05	4.62662D-07
1.63000D 01	-6.05966D-07	-2.66668D-06	0.0	2.47339D 00	-2.19325D-02	3.65501D-06	2.97423D-05	4.03338D-07
1.64000D 01	-5.16751D-07	-2.32475D-06	0.0	2.45831D 00	-2.15339D-02	3.18636D-06	2.88381D-05	3.51621D-07
1.65000D 01	-4.40670D-07	-2.02666D-06	0.0	2.44341D 00	-2.11448D-02	2.77779D-06	2.79675D-05	3.06535D-07
1.66000D 01	-3.75791D-07	-1.76680D-06	0.0	2.42869D 00	-2.07651D-02	2.42162D-06	2.71290D-05	2.67230D-07
1.67000D 01	-3.20464D-07	-1.54026D-06	0.0	2.41414D 00	-2.03943D-02	2.11111D-06	2.63211D-05	2.32965D-07
1.68000D 01	-2.73283D-07	-1.34276D-06	0.0	2.39978D 00	-2.00324D-02	1.84042D-06	2.55425D-05	2.03094D-07
1.69000D 01	-2.33048D-07	-1.17059D-06	0.0	2.38558D 00	-1.96789D-02	1.60444D-06	2.47918D-05	1.77053D-07
1.70000D 01	-1.98736D-07	-1.02049D-06	0.0	2.37154D 00	-1.93337D-02	1.39871D-06	2.40679D-05	1.54351D-07
1.71000D 01	-1.69477D-07	-8.89642D-07	0.0	2.35767D 00	-1.89966D-02	1.21936D-06	2.33695D-05	1.34559D-07
1.72000D 01	-1.44525D-07	-7.75570D-07	0.0	2.34397D 00	-1.86672D-02	1.06301D-06	2.26957D-05	1.17306D-07

X	VCPL3R	VCPL3I	VCPL4R	VCPL4I
1.25000D-02	8.31747D-02	5.28336D-02	-2.49123D-02	-1.12561D-03
2.50000D-02	8.50245D-02	5.37822D-02	-2.41788D-02	-7.82500D-04
3.75000D-02	8.69107D-02	5.47464D-02	-2.34310D-02	-4.33919D-04
5.00000D-02	8.88338D-02	5.57263D-02	-2.26686D-02	-7.97868D-05
6.25000D-02	9.07947D-02	5.67223D-02	-2.18915D-02	2.79976D-04
7.50000D-02	9.27940D-02	5.77345D-02	-2.10994D-02	6.45452D-04
8.75000D-02	9.48326D-02	5.87633D-02	-2.02919D-02	1.01672D-03
1.00000D-01	9.69110D-02	5.98088D-02	-1.94688D-02	1.39386D-03
1.25000D-01	1.01191D-01	6.19511D-02	-1.77747D-02	2.16611D-03
1.50000D-01	1.05639D-01	6.41637D-02	-1.60145D-02	2.96287D-03
1.75000D-01	1.10264D-01	6.64485D-02	-1.41859D-02	3.78484D-03
2.00000D-01	1.15070D-01	6.88078D-02	-1.22864D-02	4.63270D-03
2.50000D-01	1.25257D-01	7.37588D-02	-8.26383D-03	6.40902D-03
3.00000D-01	1.36259D-01	7.90354D-02	-3.92494D-03	8.29768D-03
3.50000D-01	1.48139D-01	8.46568D-02	7.53626D-04	1.03047D-02
4.00000D-01	1.60964D-01	9.06435D-02	5.79667D-03	1.24364D-02
5.00000D-01	1.89738D-01	1.03798D-01	1.70829D-02	1.70991D-02
6.00000D-01	2.23213D-01	1.18678D-01	3.01627D-02	2.23378D-02
7.00000D-01	2.62103D-01	1.35474D-01	4.52899D-02	2.82051D-02
8.00000D-01	3.07211D-01	1.54390D-01	6.27424D-02	3.47527D-02
9.00000D-01	3.59431D-01	1.75635D-01	8.28204D-02	4.20284D-02
1.00000D 00	4.19752D-01	1.99419D-01	1.05841D-01	5.00735D-02
1.10000D 00	4.89246D-01	2.25952D-01	1.32130D-01	5.89182D-02
1.20000D 00	5.69067D-01	2.55426D-01	1.62010D-01	6.85768D-02
1.30000D 00	6.60419D-01	2.88012D-01	1.95781D-01	7.90406D-02
1.40000D 00	7.64529D-01	3.23838D-01	2.33696D-01	9.02707D-02
1.50000D 00	8.82595D-01	3.62974D-01	2.75924D-01	1.02188D-01
1.60000D 00	1.01571D 00	4.05405D-01	3.22508D-01	1.14665D-01
1.70000D 00	1.16477D 00	4.51010D-01	3.73301D-01	1.27511D-01
1.80000D 00	1.33035D 00	4.99524D-01	4.27904D-01	1.40465D-01
1.90000D 00	1.51251D 00	5.50510D-01	4.85579D-01	1.53184D-01
2.00000D 00	1.71065D 00	6.03323D-01	5.45162D-01	1.65234D-01
2.10000D 00	1.92326D 00	6.57076D-01	6.04977D-01	1.76087D-01
2.20000D 00	2.14765D 00	7.10613D-01	6.62749D-01	1.85126D-01
2.30000D 00	2.37975D 00	7.62487D-01	7.15556D-01	1.91652D-01
2.40000D 00	2.61381D 00	8.10961D-01	7.59819D-01	1.94911D-01
2.50000D 00	2.84231D 00	8.54023D-01	7.91366D-01	1.94129D-01
2.60000D 00	3.05583D 00	8.89423D-01	8.05588D-01	1.88557D-01
2.70000D 00	3.24320D 00	9.14756D-01	7.97711D-01	1.77539D-01
2.80000D 00	3.39175D 00	9.27560D-01	7.63190D-01	1.60583D-01
2.90000D 00	3.48791D 00	9.25459D-01	6.98213D-01	1.37435D-01
3.00000D 00	3.51798D 00	9.06325D-01	6.00278D-01	1.08150D-01
3.10000D 00	3.46919D 00	8.68461D-01	4.68778D-01	7.31566D-02
3.20000D 00	3.33091D 00	8.10781D-01	3.05510D-01	3.32808D-02
3.30000D 00	3.09589D 00	7.32976D-01	1.14991D-01	-1.02493D-02
3.40000D 00	2.76150D 00	6.35644D-01	-9.54912D-02	-5.58496D-02
3.50000D 00	2.33055D 00	5.20354D-01	-3.16191D-01	-1.01666D-01
3.60000D 00	1.81184D 00	3.89653D-01	-5.35578D-01	-1.45697D-01
3.70000D 00	1.22007D 00	2.46977D-01	-7.41329D-01	-1.85953D-01
3.80000D 00	5.75168D-01	9.64889D-02	-9.21536D-01	-2.20608D-01
3.90000D 00	-9.89501D-02	-5.71517D-02	-1.06596D 00	-2.48167D-01
4.00000D 00	-4.97953D-01	-2.09074D-01	-1.12624D 00	-2.67581D-01
4.10000D 00	-1.15831D 00	-3.54501D-01	-1.18042D 00	-2.78334D-01
4.20000D 00	-1.76397D 00	-4.89049D-01	-1.18570D 00	-2.80465D-01
4.30000D 00	-2.29483D 00	-6.08988D-01	-1.14589D 00	-2.74538D-01
4.40000D 00	-2.73581D 00	-7.11443D-01	-1.06787D 00	-2.61558D-01
4.50000D 00	-3.07770D 00	-7.94513D-01	-9.60625D-01	-2.42851D-01
4.60000D 00	-3.31746D 00	-8.57304D-01	-8.34137D-01	-2.19926D-01
4.70000D 00	-3.45779D 00	-8.99884D-01	-6.98306D-01	-1.94333D-01
4.80000D 00	-3.50624D 00	-9.23170D-01	-5.62018D-01	-1.67541D-01
4.90000D 00	-3.47400D 00	-9.28764D-01	-4.32511D-01	-1.40842D-01
5.00000D 00	-3.37450D 00	-9.18760D-01	-3.15049D-01	-1.15286D-01
5.10000D 00	-3.22210D 00	-8.95560D-01	-2.12891D-01	-9.16570D-02

5.20000D 00	-3.03099D 00	-8.61682D-01	-1.27492D-01	-7.04737D-02
5.30000D 00	-2.81427D 00	-8.19620D-01	-5.88447D-02	-5.20121D-02
5.40000D 00	-2.58342D 00	-7.71712D-01	-5.87626D-03	-3.63466D-02
5.50000D 00	-2.34799D 00	-7.20067D-01	3.31589D-02	-2.33949D-02
5.60000D 00	-2.11552D 00	-6.66505D-01	6.03431D-02	-1.29642D-02
5.70000D 00	-1.89166D 00	-6.12548D-01	7.78352D-02	-4.79279D-03
5.80000D 00	-1.68036D 00	-5.59412D-01	8.76882D-02	1.41519D-03
5.90000D 00	-1.48412D 00	-5.08032D-01	9.17400D-02	5.96289D-03
6.00000D 00	-1.30429D 00	-4.59091D-01	9.15591D-02	9.14155D-03
6.10000D 00	-1.14133D 00	-4.13050D-01	8.84331D-02	1.12182D-02
6.20000D 00	-9.95011D-01	-3.70193D-01	8.33824D-02	1.24288D-02
6.30000D 00	-8.64668D-01	-3.30652D-01	7.71903D-02	1.29759D-02
6.40000D 00	-7.49317D-01	-2.94450D-01	7.04386D-02	1.30285D-02
6.50000D 00	-6.47804D-01	-2.61519D-01	6.35448D-02	1.27248D-02
6.60000D 00	-5.58890D-01	-2.31732D-01	5.67965D-02	1.21752D-02
6.70000D 00	-4.81324D-01	-2.04919D-01	5.03813D-02	1.14662D-02
6.80000D 00	-4.13889D-01	-1.80885D-01	4.44123D-02	1.06641D-02
6.90000D 00	-3.55432D-01	-1.59420D-01	3.89480D-02	9.81840D-03
7.00000D 00	-3.04884D-01	-1.40308D-01	3.40087D-02	8.96543D-03
7.10000D 00	-2.61266D-01	-1.23340D-01	2.95886D-02	8.13084D-03
7.20000D 00	-2.23698D-01	-1.08309D-01	2.56650D-02	7.33202D-03
7.30000D 00	-1.91388D-01	-9.50222D-02	2.22049D-02	6.58006D-03
7.40000D 00	-1.63639D-01	-8.32984D-02	1.91699D-02	5.88133D-03
7.50000D 00	-1.39833D-01	-7.29696D-02	1.65198D-02	5.23872D-03
7.60000D 00	-1.19430D-01	-6.38823D-02	1.42142D-02	4.65264D-03
7.70000D 00	-1.01958D-01	-5.58965D-02	1.22145D-02	4.12175D-03
7.80000D 00	-8.70072D-02	-4.88861D-02	1.04846D-02	3.64356D-03
7.90000D 00	-7.42211D-02	-4.27374D-02	8.99138D-03	3.21488D-03
8.00000D 00	-6.32924D-02	-3.73487D-02	7.70477D-03	2.83210D-03
8.10000D 00	-5.39557D-02	-3.26293D-02	6.59788D-03	2.49145D-03
8.20000D 00	-4.59825D-02	-2.84984D-02	5.64685D-03	2.18917D-03
8.30000D 00	-3.91761D-02	-2.48846D-02	4.83063D-03	1.92157D-03
8.40000D 00	-3.33676D-02	-2.17246D-02	4.13075D-03	1.68517D-03
8.50000D 00	-2.84122D-02	-1.89624D-02	3.53110D-03	1.47671D-03
8.60000D 00	-2.41857D-02	-1.65488D-02	3.01767D-03	1.29317D-03
8.70000D 00	-2.05817D-02	-1.44404D-02	2.57830D-03	1.13178D-03
8.80000D 00	-1.75094D-02	-1.25991D-02	2.20248D-03	9.90028D-04
8.90000D 00	-1.48908D-02	-1.09914D-02	1.88116D-03	8.65648D-04
9.00000D 00	-1.26594D-02	-9.58805D-03	1.60652D-03	7.56604D-04
9.10000D 00	-1.07583D-02	-8.36317D-03	1.37185D-03	6.61075D-04
9.20000D 00	-9.13899D-03	-7.29427D-03	1.17137D-03	5.77440D-04
9.30000D 00	-7.75995D-03	-6.36160D-03	1.00014D-03	5.04259D-04
9.40000D 00	-6.58580D-03	-5.54790D-03	8.53918D-04	4.40256D-04
9.50000D 00	-5.58630D-03	-4.83805D-03	7.29061D-04	3.84302D-04
9.60000D 00	-4.73568D-03	-4.21885D-03	6.22462D-04	3.35404D-04
9.70000D 00	-4.01193D-03	-3.67877D-03	5.31457D-04	2.92685D-04
9.80000D 00	-3.39630D-03	-3.20774D-03	4.53771D-04	2.55375D-04
9.90000D 00	-2.87277D-03	-2.79694D-03	3.87458D-04	2.22797D-04
1.00000D 01	-2.42770D-03	-2.43869D-03	3.30855D-04	1.94356D-04
1.01000D 01	-2.04946D-03	-2.12629D-03	2.82540D-04	1.69531D-04
1.02000D 01	-1.72813D-03	-1.85387D-03	2.41300D-04	1.47866D-04
1.03000D 01	-1.45526D-03	-1.61633D-03	2.06100D-04	1.28962D-04
1.04000D 01	-1.22363D-03	-1.40921D-03	1.76053D-04	1.12468D-04
1.05000D 01	-1.02712D-03	-1.22862D-03	1.50405D-04	9.80795D-05
1.06000D 01	-8.60480D-04	-1.07115D-03	1.28512D-04	8.55279D-05
1.07000D 01	-7.19258D-04	-9.33864D-04	1.09821D-04	7.45798D-05
1.08000D 01	-5.99657D-04	-8.14164D-04	9.38654D-05	6.50311D-05
1.09000D 01	-4.98439D-04	-7.09803D-04	8.02425D-05	5.67033D-05
1.10000D 01	-4.12851D-04	-6.18815D-04	6.86108D-05	4.94408D-05
1.11000D 01	-3.40546D-04	-5.39487D-04	5.86784D-05	4.31076D-05
1.12000D 01	-2.79525D-04	-4.70327D-04	5.01962D-05	3.75849D-05
1.13000D 01	-2.28088D-04	-4.10031D-04	4.29518D-05	3.27692D-05
1.14000D 01	-1.84786D-04	-3.57464D-04	3.67638D-05	2.85702D-05

1.15000D 01	-1.48387D-04	-3.11636D-04	3.14775D-05	2.49089D-05
1.16000D 01	-1.17844D-04	-2.71682D-04	2.69608D-05	2.17166D-05
1.17000D 01	-9.22629D-05	-2.36849D-04	2.31012D-05	1.89332D-05
1.18000D 01	-7.08861D-05	-2.06483D-04	1.98024D-05	1.65065D-05
1.19000D 01	-5.30683D-05	-1.80009D-04	1.69825D-05	1.43907D-05
1.20000D 01	-3.82610D-05	-1.56929D-04	1.45715D-05	1.25460D-05
1.21000D 01	-2.59982D-05	-1.36809D-04	1.25096D-05	1.09377D-05
1.22000D 01	-1.58838D-05	-1.19268D-04	1.07458D-05	9.53553D-06
1.23000D 01	-7.58159D-06	-1.03976D-04	9.23662D-06	8.31309D-06
1.24000D 01	-8.06064D-07	-9.06440D-05	7.94497D-06	7.24734D-06
1.25000D 01	4.68505D-06	-7.90218D-05	6.83914D-06	6.31820D-06
1.26000D 01	9.09725D-06	-6.88897D-05	5.89207D-06	5.50816D-06
1.27000D 01	1.26047D-05	-6.00567D-05	5.08067D-06	4.80197D-06
1.28000D 01	1.53550D-05	-5.23563D-05	4.38522D-06	4.18630D-06
1.29000D 01	1.74732D-05	-4.56432D-05	3.78889D-06	3.64957D-06
1.30000D 01	1.90648D-05	-3.97908D-05	3.27731D-06	3.18165D-06
1.31000D 01	2.02194D-05	-3.46888D-05	2.83822D-06	2.77371D-06
1.32000D 01	2.10124D-05	-3.02409D-05	2.46112D-06	2.41808D-06
1.33000D 01	2.15075D-05	-2.63634D-05	2.13707D-06	2.10804D-06
1.34000D 01	2.17583D-05	-2.29831D-05	1.85843D-06	1.83775D-06
1.35000D 01	2.18102D-05	-2.00361D-05	1.61865D-06	1.60212D-06
1.36000D 01	2.17010D-05	-1.74671D-05	1.41217D-06	1.39670D-06
1.37000D 01	2.14626D-05	-1.52274D-05	1.23420D-06	1.21762D-06
1.38000D 01	2.11218D-05	-1.32749D-05	1.08067D-06	1.06149D-06
1.39000D 01	2.07008D-05	-1.15728D-05	9.48103D-07	9.25388D-07
1.40000D 01	2.02182D-05	-1.00889D-05	8.33511D-07	8.06735D-07
1.41000D 01	1.96896D-05	-8.79527D-06	7.34348D-07	7.03295D-07
1.42000D 01	1.91278D-05	-7.66752D-06	6.48433D-07	6.13118D-07
1.43000D 01	1.85433D-05	-6.68438D-06	5.73901D-07	5.34503D-07
1.44000D 01	1.79448D-05	-5.82729D-06	5.09155D-07	4.65968D-07
1.45000D 01	1.73396D-05	-5.08010D-06	4.52829D-07	4.06221D-07
1.46000D 01	1.67333D-05	-4.42872D-06	4.03751D-07	3.54135D-07
1.47000D 01	1.61306D-05	-3.86086D-06	3.60919D-07	3.08727D-07
1.48000D 01	1.55352D-05	-3.36581D-06	3.23473D-07	2.69141D-07
1.49000D 01	1.49502D-05	-2.93424D-06	2.90676D-07	2.34632D-07
1.50000D 01	1.43778D-05	-2.55800D-06	2.61896D-07	2.04547D-07
1.51000D 01	1.38196D-05	-2.23001D-06	2.36590D-07	1.78319D-07
1.52000D 01	1.32771D-05	-1.94407D-06	2.14293D-07	1.55455D-07
1.53000D 01	1.27512D-05	-1.69480D-06	1.94604D-07	1.35522D-07
1.54000D 01	1.22423D-05	-1.47748D-06	1.77180D-07	1.18145D-07
1.55000D 01	1.17510D-05	-1.28804D-06	1.61723D-07	1.02996D-07
1.56000D 01	1.12773D-05	-1.12288D-06	1.47979D-07	8.97897D-08
1.57000D 01	1.08213D-05	-9.78903D-07	1.35730D-07	7.82767D-08
1.58000D 01	1.03827D-05	-8.53386D-07	1.24784D-07	6.82398D-08
1.59000D 01	9.96142D-06	-7.43962D-07	1.14980D-07	5.94900D-08
1.60000D 01	9.55698D-06	-6.48570D-07	1.06177D-07	5.18620D-08
1.61000D 01	9.16903D-06	-5.65408D-07	9.82507D-08	4.52121D-08
1.62000D 01	8.79712D-06	-4.92910D-07	9.10973D-08	3.94149D-08
1.63000D 01	8.44077D-06	-4.29708D-07	8.46249D-08	3.43610D-08
1.64000D 01	8.09945D-06	-3.74610D-07	7.87540D-08	2.99552D-08
1.65000D 01	7.77265D-06	-3.26576D-07	7.34158D-08	2.61142D-08
1.66000D 01	7.45984D-06	-2.84702D-07	6.85501D-08	2.27658D-08
1.67000D 01	7.16049D-06	-2.48196D-07	6.41046D-08	1.98467D-08
1.68000D 01	6.87405D-06	-2.16372D-07	6.00338D-08	1.73019D-08
1.69000D 01	6.60000D-06	-1.88628D-07	5.62978D-08	1.50834D-08
1.70000D 01	6.33783D-06	-1.64442D-07	5.28616D-08	1.31494D-08
1.71000D 01	6.08704D-06	-1.43357D-07	4.96946D-08	1.14633D-08
1.72000D 01	5.84714D-06	-1.24975D-07	4.67699D-08	9.99347D-09

SGTOTL = 0.242746D 04 REACCR = 0.130940D 04 STRGFS = 0.156063D 00 STRGFP = 0.156596D 00 FOR NPS = 1

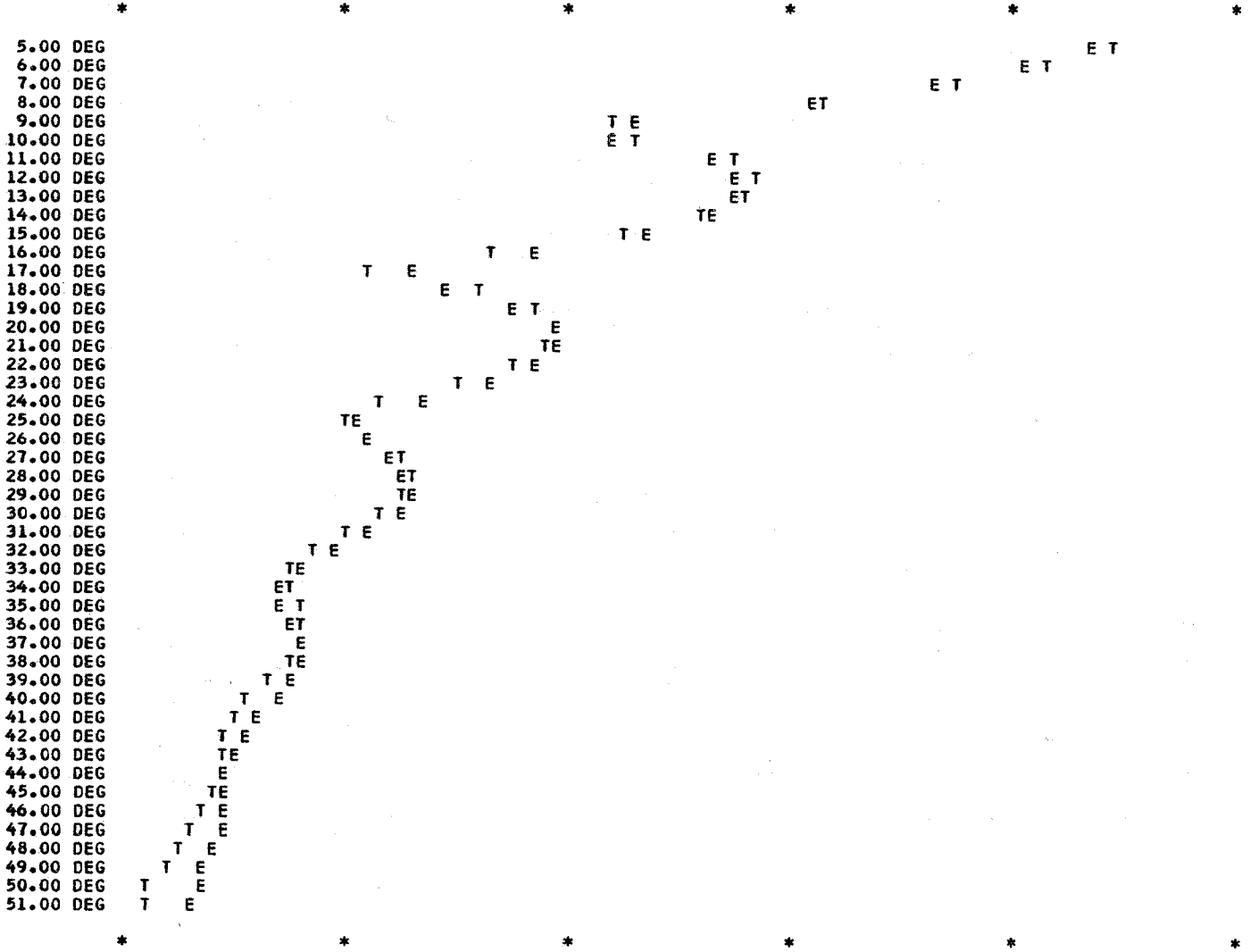
***** SCATTERING TO 0 (+) STATE AT 0.0 MEV ***** (FAI= 0.0 DEGREE) NPS=1

ANGLE	SGMTH	POLTH	ANGLE	SGMTH	POLTH	ANGLE	SGMTH	POLTH
5.0	0.29088D 05	0.0	6.0	0.14648D 05	0.0	7.0	0.58941D 04	0.0
8.0	0.15640D 04	0.0	9.0	0.16907D 03	0.0	10.0	0.20576D 03	0.0
11.0	0.58769D 03	0.0	12.0	0.78063D 03	0.0	13.0	0.68849D 03	0.0
14.0	0.43895D 03	0.0	15.0	0.19451D 03	0.0	16.0	0.49525D 02	0.0
17.0	0.12622D 02	0.0	18.0	0.39713D 02	0.0	19.0	0.77974D 02	0.0
20.0	0.94740D 02	0.0	21.0	0.84110D 02	0.0	22.0	0.57810D 02	0.0
23.0	0.31548D 02	0.0	24.0	0.15364D 02	0.0	25.0	0.10869D 02	0.0
26.0	0.13745D 02	0.0	27.0	0.18120D 02	0.0	28.0	0.19969D 02	0.0
29.0	0.18291D 02	0.0	30.0	0.14363D 02	0.0	31.0	0.10206D 02	0.0
32.0	0.73071D 01	0.0	33.0	0.60977D 01	0.0	34.0	0.61230D 01	0.0
35.0	0.65644D 01	0.0	36.0	0.67452D 01	0.0	37.0	0.63906D 01	0.0
38.0	0.56027D 01	0.0	39.0	0.46694D 01	0.0	40.0	0.38630D 01	0.0
41.0	0.33244D 01	0.0	42.0	0.30438D 01	0.0	43.0	0.29123D 01	0.0
44.0	0.28025D 01	0.0	45.0	0.26330D 01	0.0	46.0	0.23890D 01	0.0
47.0	0.21020D 01	0.0	48.0	0.18177D 01	0.0	49.0	0.15734D 01	0.0
50.0	0.13866D 01	0.0	51.0	0.12516D 01	0.0			

RUTHERFORD CROSS SECTION

5.0	0.33887D 05	6.0	0.16351D 05	7.0	0.88319D 04
8.0	0.51811D 04	9.0	0.32373D 04	10.0	0.21260D 04
11.0	0.14537D 04	12.0	0.10276D 04	13.0	0.74700D 03
14.0	0.55613D 03	15.0	0.42264D 03	16.0	0.32699D 03
17.0	0.25701D 03	18.0	0.20485D 03	19.0	0.16532D 03
20.0	0.13492D 03	21.0	0.11123D 03	22.0	0.92547D 02
23.0	0.77649D 02	24.0	0.65651D 02	25.0	0.55900D 02
26.0	0.47908D 02	27.0	0.41306D 02	28.0	0.35814D 02
29.0	0.31215D 02	30.0	0.27338D 02	31.0	0.24053D 02
32.0	0.21252D 02	33.0	0.18853D 02	34.0	0.16789D 02
35.0	0.15003D 02	36.0	0.13453D 02	37.0	0.12102D 02
38.0	0.10919D 02	39.0	0.98804D 01	40.0	0.89650D 01
41.0	0.81556D 01	42.0	0.74377D 01	43.0	0.67992D 01
44.0	0.62295D 01	45.0	0.57200D 01	46.0	0.52631D 01
47.0	0.48524D 01	48.0	0.44823D 01	49.0	0.41481D 01
50.0	0.38456D 01	51.0	0.35712D 01		

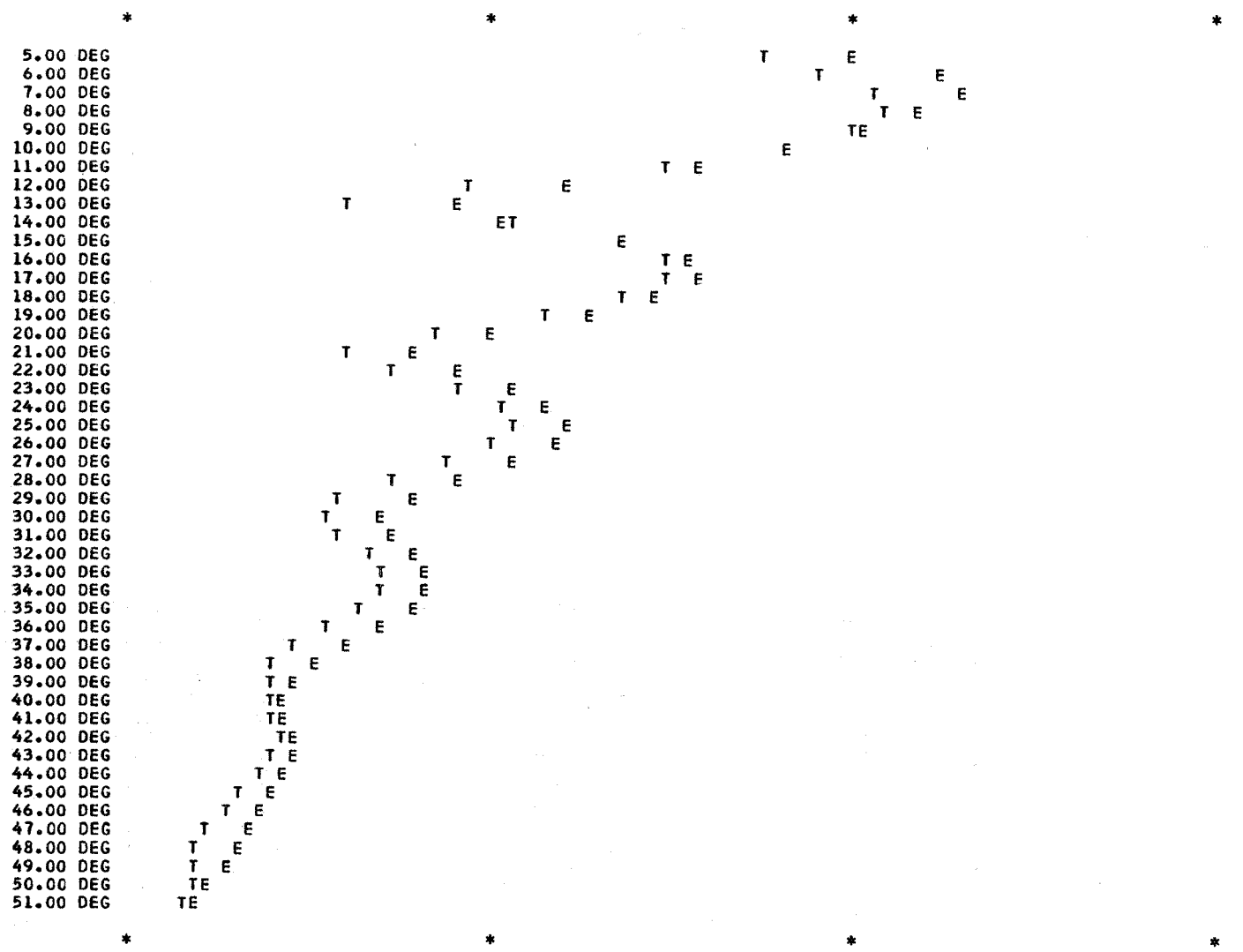
PLOT OF XSEC. LOWEST AND HIGHEST * ARE FOR 10E 0 AND 10E 5
A= 28 P= 4 ZZ= 28 ELAB=104.00 2S=0 II=1 IR=0 K=1
VSX ETC 89.749 31.460 0.0 0.0 0.628 0.729 0.500 0.500 1.443 1.429 0.0 0.0 1.300
WC= 1.000 1.000 1.000 0.0 0.0 0.0 VCOUPL=-0.329-0.108 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0



***** SCATTERING TO 2 (+) STATE AT 1.780 MEV ***** (FAI= 0.0 DEGREE) NPS=1

ANGLE	SGMTH	POLTH	ANGLE	SGMTH	POLTH	ANGLE	SGMTH	POLTH
5.0	0.58923D 02	0.0	6.0	0.85690D 02	0.0	7.0	0.11564D 03	0.0
8.0	0.12450D 03	0.0	9.0	0.10427D 03	0.0	10.0	0.66877D 02	0.0
11.0	0.30951D 02	0.0	12.0	0.90167D 01	0.0	13.0	0.40332D 01	0.0
14.0	0.11725D 02	0.0	15.0	0.23913D 02	0.0	16.0	0.32190D 02	0.0
17.0	0.31956D 02	0.0	18.0	0.24390D 02	0.0	19.0	0.14479D 02	0.0
20.0	0.70364D 01	0.0	21.0	0.41729D 01	0.0	22.0	0.53144D 01	0.0
23.0	0.84273D 01	0.0	24.0	0.11206D 02	0.0	25.0	0.12032D 02	0.0
26.0	0.10624D 02	0.0	27.0	0.79553D 01	0.0	28.0	0.54096D 01	0.0
29.0	0.38845D 01	0.0	30.0	0.35203D 01	0.0	31.0	0.39538D 01	0.0
32.0	0.46459D 01	0.0	33.0	0.50944D 01	0.0	34.0	0.50101D 01	0.0
35.0	0.44335D 01	0.0	36.0	0.36605D 01	0.0	37.0	0.30047D 01	0.0
38.0	0.26174D 01	0.0	39.0	0.24861D 01	0.0	40.0	0.25217D 01	0.0
41.0	0.26119D 01	0.0	42.0	0.26447D 01	0.0	43.0	0.25505D 01	0.0
44.0	0.23418D 01	0.0	45.0	0.20934D 01	0.0	46.0	0.18766D 01	0.0
47.0	0.17184D 01	0.0	48.0	0.16140D 01	0.0	49.0	0.15510D 01	0.0
50.0	0.15119D 01	0.0	51.0	0.14697D 01	0.0			

PLOT OF XSEC. LOWEST AND HIGHEST * ARE FOR 10E 0 AND 10E 3
A= 28 P= 4 ZZ= 28 ELAB=104.00 2S=0 II=2 IR=2 K=1
VSX ETC 89.749 31.460 0.0 0.0 0.628 0.729 0.500 0.500 1.443 1.429 0.0 0.0 1.300
WC= 1.000 1.000 1.000 0.0 0.0 0.0 VCOUPL=-0.329-0.108 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0



***** SCATTERING TO 4 (+) STATE AT 4.610 MEV ***** (FAI= 0.0 DEGREE) NPS=1

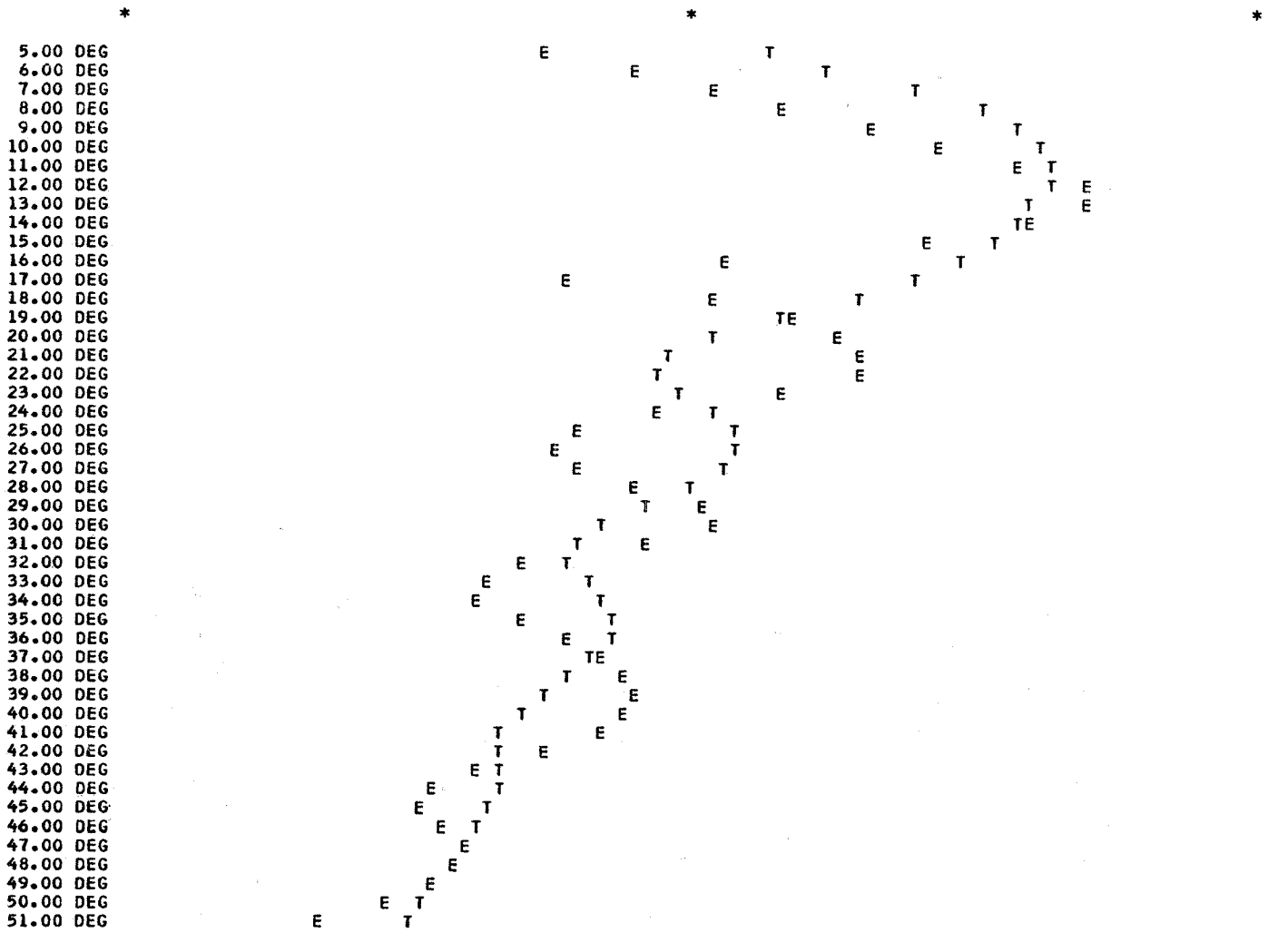
ANGLE	SGMTH	POLTH	ANGLE	SGMTH	POLTH	ANGLE	SGMTH	POLTH
5.0	0.14041D 01	0.0	6.0	0.17998D 01	0.0	7.0	0.25126D 01	0.0
8.0	0.33058D 01	0.0	9.0	0.39585D 01	0.0	10.0	0.43447D 01	0.0
11.0	0.44531D 01	0.0	12.0	0.43507D 01	0.0	13.0	0.41223D 01	0.0
14.0	0.38220D 01	0.0	15.0	0.34614D 01	0.0	16.0	0.30301D 01	0.0
17.0	0.25297D 01	0.0	18.0	0.19974D 01	0.0	19.0	0.15039D 01	0.0
20.0	0.11283D 01	0.0	21.0	0.92419D 00	0.0	22.0	0.89535D 00	0.0
23.0	0.99270D 00	0.0	24.0	0.11344D 01	0.0	25.0	0.12384D 01	0.0
26.0	0.12514D 01	0.0	27.0	0.11649D 01	0.0	28.0	0.10101D 01	0.0
29.0	0.84002D 00	0.0	30.0	0.70498D 00	0.0	31.0	0.63408D 00	0.0
32.0	0.62784D 00	0.0	33.0	0.66339D 00	0.0	34.0	0.70766D 00	0.0
35.0	0.73186D 00	0.0	36.0	0.72128D 00	0.0	37.0	0.67778D 00	0.0
38.0	0.61542D 00	0.0	39.0	0.55240D 00	0.0	40.0	0.50328D 00	0.0
41.0	0.47428D 00	0.0	42.0	0.46291D 00	0.0	43.0	0.46097D 00	0.0
44.0	0.45902D 00	0.0	45.0	0.45023D 00	0.0	46.0	0.43231D 00	0.0
47.0	0.40730D 00	0.0	48.0	0.37969D 00	0.0	49.0	0.35415D 00	0.0
50.0	0.33365D 00	0.0	51.0	0.31877D 00	0.0			

PLOT OF XSEC. LOWEST AND HIGHEST * ARE FOR 10E-1 AND 10E 1

A= 28 P= 4 ZZ= 28 ELAB=104.00 2S=0 II=3 IR=4 K=1

VSX ETC 89.749 31.460 0.0 0.0 0.628 0.729 0.500 0.500 1.443 1.429 0.0 0.0 1.300

WC= 1.000 1.000 1.000 0.0 0.0 0.0 VCOUPL=-0.329-0.108 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0



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C     PROGRAM ON LIBRARY LOAD.ZYK, NAME ZYKJP2
C      C O U P L E D  C H A N N E L S  C O D E  J U P I T O R
C      BY TARO TAMURA, ORNL REPORT 4152 AUGUST 1967
C      KARLSRUHE SEARCH VERSION OCTOBER 1970
C      KARLSRUHE MODIFICATIONS ARE ON CARDS LABELED KA
C      KARLSRUHE LIBRARY FUNCTIONS: DLGAMA, CDLGAM, VA01A, VD01A, W3JS
C      COMMON MODIFICATIONS DUE TO DIFFERENT LENGTH OF INTEGERS AND REALS
C      RANGE OF REALS: EXPONENT < 75 FOR THE IBM 360 AND < 1024 FOR THE CDC 1604
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                          KA    1
      COMPLEX*16 TTR,TTI,ZERO                                            KA    2
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9       KA    3
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)                    4
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD         KA    5
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),       6
C     DR(10) IS A DUMMY FIELD
     1             ECM(10),                                                     7
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),        8
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),       9
     4             WN(10),WNINI(10),WC(10)                                     10
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,           11
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,             12
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,       13
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,                14
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,         15
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                             16
      DATA N11/2H  /,N12/2H/2/,N13/3H(+)/,N14/3H(-)/,N15/3HAMU/,         KA    17
     1N16/3HPMU/                                                         KA    18
CCCCCC      ******       COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES   *****
      COMMON       EXTRA4(12190)                                               19
      COMMON       AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),           20
     1             NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,          21
     2             NPOLST                                                      22
CCCCCC      ******       DIMENSION FIELDS USED ONLY IN THIS ROUTINE      ********
      DIMENSION    MENSBT(20,3),OCCUPA(20,3),EULER(3,3)                        24
      EQUIVALENCE (EXTRA4(   1),MENSBT(1)),(EXTRA4( 61),OCCUPA(1)),      KA    25
     1            (EXTRA4( 121),EULER(1))                                 KA    26
      DIMENSION    IIOT(6),IIBB(6),KPBB(6)                                     27
      INTEGER AMPMWR                                                     KA    28
      EQUIVALENCE (AR(1),ISBB   ),(AR(2),IIBB(1)),(AR(8),KPBB(1)),       KA    29
     1            (AR(14),IIOT(1))                                        KA    29
CCCCCC      IF KTRL(1)=0 TARGET IS OF EVEN A, IF=1 TARGET IS OF ODD A.           30
CCCCCC      IF KTRL(2).GT.0 RANGE OF REALS IS LIMITED TO EXP(KTRL(2)) IN COUPLE.
CCCCCC      IF KTRL(3)=0 ONLY DIFFERENTIAL CROSS SECTIONS ARE COMPUTED.          31
CCCCCC      IF KTRL(3)=1 REACTION AND TOTAL CROSS SECTIONS ARE COMPUTED.         31
CCCCCC      IF KTRL(3)=2 DIFFERENTIAL CROSS SECTIONS ARE NOT COMPUTED.           32
CCCCCC      IF KTRL(4)=1 DIAGONAL ELEMENTS OF ALPHA*ALPHA TERM ARE ADDED.        33
CCCCCC      IF KTRL(5)=1 PARAMETER SEARCH IS PERFORMED WITH ADDITIONAL DATA KA33
CCCCCC      IF KTRL(6)=1 DIRECT COULOMB EXCITATION IS ADDED IF KTRL(11)=1   KA33
CCCCCC      IF KTRL(6)=2 DIRECT AND MULTIPLE COULOMB EXCITATION IS ADDED    KA33
CCCCCC      IF KTRL(7)=1 ADIABATIC APPROXIMATION IS MADE.                        34
CCCCCC      IF KTRL(8)=1 BOTH PROJECTILE AND TARGET ARE INITIALLY POLARIZED.     35
CCCCCC      IF KTRL(8)=2 ONLY THE PROJECTILE IS INITIALLY POLARIZED.             36
CCCCCC      IF KTRL(8)=3 ONLY THE TARGET IS INITIALLY POLARIZED.                 37
CCCCCC      IF KTRL(9)=1 RANGES OF JJJ AND K ARE RESTRICTED BY KEXCOM(5,6,7).    38
CCCCCC      IF KTRL(9)=2 RANGES OF JJJ AND K ARE RESTRICTED BY KEXCOM(5,6).      39
CCCCCC      IF KTRL(11)=1 EXPANSION OF V IN LEGENDRE POLINOMIAL IS MADE.         40
CCCCCC      IF KTRL(12)=1 COMPLEX COUPLING IS TAKEN.                             41
CCCCCC      IF KTRL(13)=1 COULOMB EXCITATION IS ADDED.                           42
CCCCCC      IF KTRL(17)=1 ELASTIC XSEC IS DIVIDED BY RUTHERFORD XSEC.            43
CCCCCC      IF KTRL(19)=1 SPIN-SPIN INTERACTION IS CONSIDERED.                   44
CCCCCC      IF KTRL(27)=1 IT IS ASSUMED THAT C-MARICES WERE ALREADY COMPUTED.    45
CCCCCC      KEXCOM(2)=NXMAX=NXCPLE IF NON-ZERO (CCCTRL,SN-181)                   46
CCCCCC      KEXCOM(4)=INCREMENT OF NXMAX. (CCCTRL).                              47
CCCCCC      KEXCOM(5,6,7)=JMIN,JMAX,KPARITY USED WHEN KTRL(9) IS NON-ZERO.       48
CCCCCC      KEXCOM(12)=SPIN OF TWO-PHONON CORE STATE (INTYPE=5).                 49
CCCCCC      KEXCOM(13)=NUMBER OF THREE-PHONON STATES (INTYPE=3).                 50
CCCCCC      KEXCOM(14)=LLMAX IN NLJJJK.                                          51
CCCCCC      KEXCOM(21-27) GIVE NUMBER OF STATES IN THE GROUND BAND,AND           52
CCCCCC      K=0+,0-,2+,1-,2-,3- BANDS.                                           53
CCCCCC      KEXCOM(28)=KIREPT (BMATRX,AMATRX)                                    54
CCCCCC      KEXCOM(41)=KBOUND  (C.F.COUPLE)                                      55
CCCCCC      KEXCOM(42)=NBOUND  (C.F.COUPLE)                                      56
CCCCCC      KEXCOM(43)=MXROWI  (C.F.COUPLE)                                      57
CCCCCC      KEXCOM(45,46)=JJ,K IN NLJJJK.                                        58
      PI=3.141592653589793                                               KA    59
      TTR=(1.0D0,0.0D0)                                                        59
      TTI=(0.0D0,1.0D0)                                                        59
      ZERO=(0.0D0,0.0D0)                                                       59
  701 FORMAT(14I5)                                                             60
  702 FORMAT(10F7.2)                                                           61
  703 FORMAT(3(2I5,F10.3))                                                     62
  704 FORMAT(I5,4F7.2)                                                         63
  705 FORMAT(10F7.3,I2)                                                        64
 4000 FORMAT(1H1)                                                              65
 4100 FORMAT(1H0)                                                              66
      DO 10 N=1,500                                                      KA    67
   10 FACLOG(N)=DLGAMA(DFLOAT(N))                                        KA    68
  100 READ(5,701) (KTRL(N),N=1,28),(KEXCOM(N),N=1,14),(KTLOUT(N),N=1,28)CARD 1-5
      READ(5,702) (EXTCOM(N),N=1,10)                                     CARD   6
      READ(5,701) IICPLE,INTYPE,INTMAX,ISTRTW,NANGLR,IIXCAL,IIXPLT,      CARD   7
     1            IIPCAL,IIPPLT,KANGRD                                          73
      IF(INTYPE-6) 103,102,103                                                 74
  102 READ(5,701) (KEXCOM(N),N=21,27)                                    CARD 7.1
  103 IIRMAX=IICPLE*(1-KTRL(7))+IIXCAL*KTRL(7)                                 76
      READ(5,703) (IIREAD(N),KPRITR(N),QVALUE(N),N=1,IIRMAX)             CARD   8
  105 READ(5,702) ELAB,PMAS,TMAS,CHARGE,XMES1,XMES2,AMUPMU               CARD   9
      IF(KANGRD) 112,111,112                                                   79
  111 READ(5,702) (ANGLER(N),N=1,NANGLR)                                 CARD  10
        GO TO 115                                                        CARD  10
  112 READ(5,702) ANGMIN,ANGDEL                                          CARD  10
        ANG=ANGMIN                                                       CARD  10
      DO 113 N=1,NANGLR                                                        82
        ANGLER(N)=ANG                                                          82
  113 ANG=ANG+ANGDEL                                                           83
  115 IF(IIXPLT) 114,114,116                                                   84
  116 DO 117 I1=1,IIXPLT                                                       85
  117 READ(5,702) (SGMEXP(N,I1),N=1,NANGLR)                              CARD10.1
  114 IF(IIPPLT) 128,128,121                                                   86
  121 DO 119 I1=1,IIPPLT                                                       87
  119 READ(5,702) (POLEXP(N,I1),N=1,NANGLR)                              CARD10.1
  128 IF(KTRL(8)) 132,131,132                                                  88
  131 NFAI=1                                                                   89
        FAI(1)=0.0D0                                                           89
        GO TO 137                                                              89
  132 READ(5,704) NFAI,(FAI(N),N=1,NFAI)                                 CARD  11
```

```
      DO 135 N=1,NFAI                                                    KA91
  135 FAI(N)=FAI(N)*PI/18.D1                                               92
  137 DO 138 N=1,NANGLR                                                    93
  138 THETA(N)=ANGLER(N)*PI/18.D1                                          94
      NPOLST=1                                                             95
      MULSPN=ISTRTW+1                                                      96
        FMLSPN=MULSPN                                                      96
      SQRTSP=1.0D0/DSQRT(FMLSPN)                                           96
      MULT1Z=IIREAD(1)+IIREAD(1)+1-KTRL(1)                                 97
      FSQ=1.0D0/DFLOAT(MULT1Z)                                      KA     98
      FSQINV=DSQRT(FSQ)                                                    98
      DO 155 N1=1,3                                                        99
        DO 155 M1=1,3                                                      99
        DO 145 M2=1,3                                                      99
  145 AMS(M1,M2,N1)=0.0D0                                                 100
  155 AMS(M1,M1,N1)=SQRTSP                                                101
      DO 160 N1=1,3                                                       102
        DO 160 M1=1,MULT1Z                                                102
        DO 157 M2=1,MULT1Z                                                102
      BMTI(M1,M2,N1)=0.0D0                                                102
  157 BMTR(M1,M2,N1)=0.0D0                                                103
  160 BMTR (M1,M1,N1)=FSQINV                                              104
      DO 180 N=1,3                                                        105
        NENSBP(N)=MULSPN                                                  105
        NENSBT(N)=MULT1Z                                                  105
      DO 180 NE2R=1,MULT1Z                                                106
      MENSBT(NE2R,N)=2*(-IIREAD(1)+NE2R)-1                                107
  180 OCCUPA(NE2R,N)=FSQ                                                  108
      IF(KTRL(8)) 190,400,190                                             109
  190 READ(5,701) NPOLST,(NENSBP(N1),NENSBT(N1),N1=1,3)             CARD   12
      IF(KTRL(8)-3) 195,210,195                                           111
  195 DO 197 N3=1,NPOLST                                                  112
      READ(5,702) ((AMS(N1,N2,N3),N2=1,MULSPN),N1=1,MULSPN)             CARD   13
  197 CONTINUE                                                            114
  210 IF(KTRL(8)-2) 215,400,215                                           115
  215 DO 290 NPS=1,NPOLST                                                 116
      N1MAX=NENSBT(NPS)                                                   117
        N2MAX=MULT1Z                                                      117
      READ(5,701) (MENSBT(N1,NPS),N1=1,N1MAX)                           CARD   14
      READ(5,702) (OCCUPA(N1,NPS),N1=1,N1MAX)                           CARD   15
      READ(5,702) (EULER (N1,NPS),N1=1,3)                               CARD   16
      DO 225 N1=1,N1MAX                                                   121
  225 OCCUPA(N1,NPS)=DSQRT( OCCUPA(N1,NPS))                               122
      J1=IIREAD(1)                                                        123
      DO 260 NE2R=1,N1MAX                                                 124
        M1=MENSBT(NE2R,NPS)                                               124
      EUL1=EULER(1,NPS)*PI/36.D1                                          125
      EUL2=EULER(2,NPS)*PI/36.D1                                          126
      EUL3=EULER(3,NPS)*PI/36.D1                                          127
      COBETA=DCOS(EUL2)                                                   128
        SIBETA=DSIN(EUL2)                                                 128
      DO 255 N1D=1,MULT1Z                                                 129
      N1=-IIREAD(1)+N1D                                                   130
        FN1=N1                                                            130
        FM1=M1                                                            130
      ARG13A=EUL1*(FM1-0.5D0)+EUL3*(FN1-0.5D0)                            131
      COS13A=DCOS( ARG13A)                                                132
       SIN13A=DSIN( -ARG13A)                                              132
       JPM=J1+M1                                                          132
       JPN=J1+N1                                                          132
      JMM=J1-M1+1                                                         133
        JMN=J1-N1+1                                                       133
        MMN=M1-N1+1                                                       133
       NTMIN=MAXO(  1,MMN)                                                133
      NTMAX= MINO (JPM,JMN)                                               134
        BMTFC=0.0D0                                                       134
        IF(NTMIN-NTMAX)230,230,247                                        134
  230 NCOPOW=J1+J1+MMN                                                    135
        NSIPOW=MMN+1                                                      135
      DCOMFC=DEXP( 0.5D0*(FACLOG(JPM)+FACLOG(JPN)+FACLOG(JMM)+FACLOG(JMN  136
     1)))                                                                 136
      SUM=0.0D0                                                           137
      DO 245 NT=NTMIN,NTMAX                                               138
      NTTRUE=NT-1                                                         139
       NTTW=NT+NT                                                         139
       K1=JPM-NTTRUE                                                      139
       K2=JMN-NTTRUE                                                      139
      K3=NT                                                               140
        K4=NT-MMN+1                                                       140
      NCPW=NCOPOW-NTTW                                                    141
        NSPW=NTTW-NSIPOW                                                  141
      IF(COBETA) 234,232,234                                              143
  232 IF(NCPW)233,233,234                                                 144
  233 COFC=1.D0                                                           145
      GO TO 235                                                           145
  234 COFC=COBETA**NCPW                                                   146
  235 IF(SIBETA) 238,236,238                                              147
  236 IF(NSPW) 237,237,238                                                147
  237 SIFC=1.D0                                                           148
      GO TO 239                                                           148
  238 SIFC=SIBETA**NSPW                                                   148
  239 TERM=(-1.D0)**MOD(NTTRUE,2)*COFC*SIFC/                        KA    149
     1          DEXP( FACLOG(K1)+FACLOG(K2)+FACLOG(K3)+FACLOG(K4))       150
  245 SUM=SUM+TERM                                                        151
      BMTFC=DCOMFC*SUM*OCCUPA(NE2R,NPS)                                   152
  247 BMTR(NE2R,N1D,NPS)=BMTFC*COS13A                                     153
      BMTI(NE2R,N1D,NPS)=BMTFC*SIN13A                                     154
  255 CONTINUE                                                            155
  260 CONTINUE                                                            156
      DO 262 N1=1,N1MAX                                                   157
      OCCUPA(N1,NPS)=OCCUPA(N1,NPS)**2                                    158
  262 MENSBT(N1,NPS)=MENSBT(N1,NPS)*2-1                                   159
  290 CONTINUE                                                            160
  400 READ(5,702) VSX,WSX,WSF,VSO,(WC(N),N=1,6)                     CARD   17
      READ(5,702) DFN,DFNW,DFNS,DFNSP,RZERO,RZEROW,RZEROS,RZROSP,RZEROC CARD   18
      READ(5,705) (VCOUPL(N),N=1,10),KREAD1                         CARD   19
      IF(INTYPE-3) 500,410,500                                            164
  410 IF(KEXCOM(13)) 420,500,420                                          165
  420 READ(5,702) (VCOUPL(N),N=11,20)                               CARD19.1
  500 WRITE(6,502)                                                        167
  502 FORMAT(1H1,//////////)                                              168
      WRITE(6,503)                                                        169
  503 FORMAT(31X,    10H**********,6X,27HCOUPLED CHANNEL CALCULATION,6X,  170
     110H**********)                                                      171
      WRITE(6,505)                                                        172
  505 FORMAT(1HO,40X,39H(ON PROGRAM JUPITOR, KARLSRUHE VERSION))    KA   173
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      WRITE(6,510) ELAB,CHARGE,TMAS,PMAS                                174
  510 FORMAT(////21X,5HELAB=F8.3,10H,  CHARGE=F6.1,8H,  TMAS=F8.3,8H,  P  175
     1MAS=F6.3)                                                         176
      WRITE(6,513) VSX,WSX,WSF,VSO,DFN,DFNW,DFNS,DFNSP,                 177
     1             RZERO,RZEROW,RZEROS,RZROSP,RZEROC,(WC(N),N=1,6)      178
  513 FORMAT(/// 21X,15HVSX,WSX,WSF,VSO,18X,1H=,4F8.3/21X,19HDFN,DFNW,DF  179
     1NS,DFNSP,14X,1H=4F8.3/21X,34HRZERO,RZEROW,RZEROS,RZROSP,RZEROC=5F8  180
     2.3/21X,2HWC,31X,1H=6F8.3)                                         181
      ISOE=MOD(ISTRTW,2)                                               KA182
        IF(ISOE) 516,514,516                                           182
  514 ISTROT=ISTRTW/2                                                  183
      ISBB=N11                                                         183
        GO TO 517                                                      183
  516 ISTROT=ISTRTW                                                    184
      ISBB=N12                                                         184
  517 WRITE(6,518) ISTROT,ISBB                                         185
  518 FORMAT(1HO,20X,16HPROJECTILE SPIN=I1,A2)                         186
      WRITE(6,520) IIRMAX,INTYPE,INTMAX,(VCOUPL(N),N=1,10)             187
  520 FORMAT(/21X,7HIIRMAX=I1,8H,INTYPE=I1,8H,INTMAX=I1,6H,BETA=10F6.3) 188
      IF(INTYPE-3) 530,523,530                                         KA190
  523 IF(KEXCOM(13)) 524,530,524                                       191
  524 WRITE(6,527) (VCOUPL(N),N=11,20)                                 192
  527 FORMAT(48X,5HBETA=10F6.3)                                        193
  530 DO 538 I1=1,IIRMAX                                               194
        IF(KTRL(1)) 533,532,533                                        194
  532 IIOT(I1)=IIREAD(I1)                                              195
      IIBB(I1)=N11                                                     195
        GO TO 534                                                      195
  533 IIOT(I1)=IIREAD(I1)*2-1                                          196
      IIBB(I1)=N12                                                     196
  534 IF(KPRITR(I1)-1) 536,535,536                                     197
  535 KPBB(I1)=N13                                                     198
        GO TO 538                                                      198
  536 KPBB(I1)=N14                                                     199
  538 CONTINUE                                                         200
      WRITE(6,540) (IIOT(I),IIBB(I),KPBB(I),QVALUE(I),I=1,IIRMAX)      201
  540 FORMAT(1HO,20X,14HTARGET STATES,3(I3,A2,A3,4H AT F6.3,5H MEV,))  KA202
      IF(INTYPE-6) 555,550,555                                         203
  550 WRITE(6,561) (KEXCOM(N),N=21,27)                                 204
  555 WRITE(6,4100)                                                    205
        WRITE(6,562) (KTRL(N),N=1,28)                                  205
      WRITE(6,563) (KEXCOM(N),N=1,14)                                  206
       WRITE(6,564) (KTLOUT(N),N=1,28)                                 206
      WRITE(6,565) (EXTCOM(N),N=1,10)                                  207
      AMPMWR=N15                                                       207
        IF(AMUPMU) 557,558,557                                         208
  557 AMPMWR=N16                                                       209
  558 WRITE(6,566) XMES1,XMES2,AMPMWR                                  210
  561 FORMAT(/21X,31HNO. OF STATES IN VARIOUS BANDS=7I5)               211
  562 FORMAT(///7H KTRL  ,28I4)                                        212
  563 FORMAT(7H KEXCOM,28I4)                                           213
  564 FORMAT(7H KTLOUT,28I4)                                           214
  565 FORMAT(7H EXTCOM,10F10.2)                                        215
  566 FORMAT(7H XMES1=F7.5,3X,7H XMES2=F7.5,3X,6H UNIT=A3)             216
      IF(KTRL(8)) 605,601,605                                          217
  601 IF(KTLOUT(1)) 605,690,605                                        218
  605 WRITE(6,610)                                                     219
  610 FORMAT(1H1,20X,5H*****,5X,21H INITIAL POLARIZATION,5X,5H*****)   220
      DO 680 NPS=1,NPOLST                                              221
      WRITE(6,620) NPS                                                 222
  620 FORMAT(///20X,9H AMS FOR I1,22H-TH POLARIZATION STATE//)         223
      NAMAX=NENSBP(NPS)                                                224
        N1MAX=NENSBT(NPS)                                              224
      DO 640 N1=1,NAMAX                                                225
      WRITE(6,635) N1,(AMS(N1,N2,NPS),N2=1,MULSPN)                     226
  635 FORMAT(10X,5H NE1=I1,5X,3F10.5)                                  227
  640 CONTINUE                                                         228
  645 WRITE(6,650) (EULER (N1,NPS),N1=1,3)                             229
  650 FORMAT(///12X,2HMN,3X,6HWEIGHT,10X,3HBMT,5X,3H***,2X,15H EULER ANG  230
     1LES =3F7.2//)                                                    231
      DO 670 N1=1,N1MAX                                                232
      DO 663 N2=1,MULT1Z                                               233
      BR(N2)=BMTR(N1,N2,NPS)                                           234
  663 BI(N2)=BMTI(N1,N2,NPS)                                           235
      WRITE(6,665) N1,MENSBT(N1,NPS),OCCUPA(N1,NPS),(BR(N2),N2=1,MULT1Z)  236
  665 FORMAT(5H NE2=I2,2X,I3,2H/2,F9.4,2X,10F9.4)                      237
      WRITE(6,667) (BI(N2),N2=1,MULT1Z)                                238
  667 FORMAT(25X,10F9.4)                                               239
  670 CONTINUE                                                         240
  680 CONTINUE                                                         241
  690 WRITE(6,4000)                                                    242
      IF(KTRL(5)) 692,695,692                                        KA 242
  692 CALL ANPASS                                                    KA 242
      GO TO 500                                                      KA 242
  695 CALL CCCTRL                                                    KA 242
      IF(KREAD1*(KREAD1-4)) 700,1000,1000                             KA243
  700 GO TO (100,105,400),KREAD1                                       244
 1000 STOP                                                             245
      END                                                              245
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C      PROGRAM ON LIB=LOAD.ZYK,NAME=S036JB
C      COUPLED CHANNELS CONTROL SUBROUTINE
       SUBROUTINE CCCTRL                                                  246
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
       IMPLICIT REAL*8 (A-H,O-Z)                                        KA247
       COMPLEX*16 TTR,TTI,ZERO,CDLGAM                                   KA247
       COMMON      FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      KA248
       COMMON      KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)              249
       COMMON      F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA250
       COMMON      ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  251
      1            ECM(10),                                               252
      2            IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  253
      3            NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  254
      4            WN(10),WNINI(10),WC(10)                                255
       COMMON      ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,      256
      1            IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,        257
      2            AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  258
      3            PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,           259
      4            RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,    260
      5            XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                        261
CCCCCC     *****      COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES  *******
       COMPLEX*16 EXSGRI                                                KA  264
       COMMON     EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)      265
       DIMENSION  FCRA(14,5,6),FDCRA(14,5,6),GCRA(14,5,6),GDCRA(14,5,6)   266
       EQUIVALENCE (FC(1),FCRA(1)),(FDC(1),FDCRA(1)),(GC(1),GCRA(1)),     267
      1            (GDC(1),GDCRA(1))                                      267
       DX=XMES2                                                           268
       DO 130 I1=1,IIXCAL                                                 269
  130  IIMULT(I1)=2*IIREAD(I1)+1-KTRL(1)                                  270
       RMAS=PMAS*TMAS/(PMAS+TMAS)                                         271
         ECM(1)=ELAB*RMAS/PMAS                                            271
       ETUNIT=0.15745400D0*(1.0D0-AMUPMU)+0.15805086D0*AMUPMU             272
       WNUNIT=0.21870660D0*(1.0D0-AMUPMU)+0.21953760D0*AMUPMU             273
       CFUNIT=1.0D0/(RMAS*WNUNIT*WNUNIT)                                  274
       DO 150 I1=1,IICPLE                                                 275
       ECM(I1)=ECM(1)-QVALUE(I1)                                          276
         E1=DABS( ECM(I1))                                                276
       CE   (I1)=ETUNIT*CHARGE*DSQRT( RMAS/E1)                            277
       WN   (I1)=WNUNIT*DSQRT( RMAS*E1)                                   278
       WNINI(I1)=WNUNIT*DSQRT( RMAS*(ECM(I1)+VSX))                        279
       ETA=CE(I1)                                                         280
       PI=3.14159265358979 3*2.D0                                      KA 281
       SIGMAO=-TTI*CDLGAM(DCMPLX (1.D0,ETA))                           KA282
       SGMAZZ(I1)=DMOD(SIGMAO,PI)                                      KA 283
  150  CONTINUE                                                           296
       NDFMES=1                                                           297
         TX=2.0D0*XMES2                                                   297
       DO 165 N=1,10                                                      298
       TX=0.5D0*TX                                                        299
       IF(TX-1.D-5     -XMES1) 167,167,165                                300
  165  NDFMES=NDFMES+1                                                    301
  167  XMES1=TX                                                           302
       A1=DCBRT(TMAS)                                                  KA 302
         XBAR=RZERO*A1                                                    303
       XCPLR =XBAR+10.D0*DFN                                              304
         XCPLW=RZEROW*A1+10.D0*DFNW                                       304
       XCPLS =RZEROS*A1+10.D0*DFNS                                        305
         XCPLSP=RZROSP*A1+10.D0*DFNSP                                     305
       XCPLE=DMAX1(XCPLR,XCPLW,XCPLS,XCPLSP)                              306
       NXMAX=XCPLE/DX                                                     307
       IF(KEXCOM(2)) 181,182,181                                          308
  181  NXMAX=KEXCOM(2)                                                    309
  182  NXCPLE=NXMAX                                                       310
       IF(KTRL(13)) 183,185,183                                           311
  183  NXMAX=NXMAX+KEXCOM(4)                                              312
  185  FNXMAX=NXMAX                                                       313
         XMAX=DX*FNXMAX                                                   313
         KEX14=KEXCOM(14)                                                 313
       JJJMAX=(1-KTRL(7))*(KEX14+(ISTRTW+2*IIREAD(1)-KTRL(1))/2)          314
      1      +KTRL(7)*(KEX14+(ISTRTW/2))                                  315
       IF(KTRL(5).NE.0) GO TO 275                                     KA 315
       WRITE(6,263) (ECM(I1),I1=1,IICPLE)                                 316
       WRITE(6,265) (WN(I1),I1=1,IICPLE)                                  317
       WRITE(6,267) (WNINI(I1),I1=1,IICPLE)                               318
       WRITE(6,269) (CE(I1),I1=1,IICPLE)                                  319
       WRITE(6,271) (SGMAZZ(I1),I1=1,IICPLE)                              320
       WRITE(6,273) JJJMAX,KEXCOM(14),NXCPLE,NXMAX,XMAX,XBAR              321
  263  FORMAT(7H ECM    6E15.5)                                           322
  265  FORMAT(7H WN     6E15.5)                                           323
  267  FORMAT(7H WNINI  6E15.5)                                           324
  269  FORMAT(7H ETA    6E15.5)                                           325
  271  FORMAT(7H SIGMO  6E15.5)                                           326
  273  FORMAT(27HOJJJMAX,KEX14,NXCPLE,NXMAX=4I5,11H XMAX,XBAR=2E15.7)    327
  275  LMAX =KEXCOM(14)                                                   328
       KEX14=KEXCOM(14)                                                   328
       KBOUND=0                                                           329
       DO 290 I1=1,IICPLE                                                 330
       IF(ECM(I1)) 282,290,290                                            331
  282  KBOUND=1                                                           332
  290  CONTINUE                                                           333
       NFGMX=4*KBOUND+1                                                   334
       X=XMAX+XMES2*DFLOAT(2*KBOUND)                                      334
       DO 390 NFG=1,NFGMX                                                 335
       DO 380 I1=1,IICPLE                                                 336
       ETA=CE(I1)                                                         337
         SIGMAZ=SGMAZZ(I1)                                                337
       RHOMX=X*WN(I1)                                                     338
         RD=DX*WN(I1)                                                     338
         IF(ECM(I1)) 343,341,341                                          338
  341  CALL FLGLCH                                                        339
       IF(KTRL(15)) 342,345,342                                        KA339
  342  IF(KTRL(15)-4) 1000,1000,345                                    KA339
  343  CALL FLGLNG                                                        340
  345  IF(KBOUND) 361,351,361                                             341
  351  DO 355 L=1,LMAX                                                    342
       FC(L,I1)=F(L)                                                      343
         GC(L,I1)=G(L)                                                    343
         FDC(L,I1)=FD(L)                                                  343
  355  GDC(L,I1)=GD(L)                                                    344
       GO TO 380                                                          345
  361  CALL DOTEST (346,LMAX,14)
       DO 365 L=1,LMAX                                                 KA346
       GCRA(L,NFG,I1)=G(L)                                                347
         GDCRA(L,NFG,I1)=GD(L)                                            347
```

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      FCRA(L,NFG,I1)=F(L)
        FDCRA(L,NFG,I1)=FD(L)
  365 CONTINUE
  380 CONTINUE
      X=X-XMES2
  390 CONTINUE
      DO 510 I1=1,IICPLE
        ETA=CE(I1)
      DO 509 L=1,LMAX
      SG=-TTI*CDLGAM(DCMPLX(DFLOAT(L),ETA))
  509 EXSGRI(L,I1)=CDEXP(TTI*SG)
  510 CONTINUE
 4060 FORMAT((4(2H (,E14.7,1H,,E14.7,1H))))
      IF(KTLOUT(6)) 4110,4190,4110
 4110 DO 4120 I1=1,IICPLE
        WRITE(6,4115) I1
 4115 FORMAT(15HOEXSGRI FOR I1=I1)
      WRITE(6,4060) (EXSGRI(L,I1),L=1,LMAX)
 4120 CONTINUE
 4190 CONTINUE
      IF(KTRL(27)) 560,580,560
  560 REWIND 9
      REWIND 8
      GOTO 900
  580 CALL POTENT
      REWIND 9
        JMIN=1
        JMAX=JJJMAX
        IF(KTRL(9)) 601,605,601
  601 JMIN=KEXCOM(5)
        JMAX=KEXCOM(6)
  605 DO 800 JJ=JMIN,JMAX
      KEXCOM(45)=JJ
      DO 790 K=1,2
        IF(KTRL(9)-1) 608,606,608
  606 IF(K-KEXCOM(7)) 790,608,790
  608 KEXCOM(46)=K
        CALL NLJJJK
        IF(MXROW) 790,790,720
  720 REWIND 8
      CALL COUPLE
      IF(KTLOUT(3)) 725,790,725
  725 J1CHEK=MOD(JJROW(1),2)
        J1CKDV=2-J1CHEK
      DO 750 N=1,MXROW
        LLROW(N)=LLROW(N)/2
  750 JJROW(N)=JJROW(N)/J1CKDV
      WRITE(6,761) (NNROW(N),N=1,MXROW)
      WRITE(6,762) (LLROW(N),N=1,MXROW)
      IF(J1CHEK) 756,754,756
  754 WRITE(6,763) (JJROW(N),N=1,MXROW)
        GO TO 770
  756 WRITE(6,765) (JJROW(N),N=1,MXROW)
  761 FORMAT(3HON=,23I5)
  762 FORMAT(3H L=,23I5)
  763 FORMAT(3H J=,23I5)
  765 FORMAT(4H J= ,23(I3,2H/2))
  770 DO 775 N=1,MXROW
        LLROW(N)=LLROW(N)*2
  775 JJROW(N)=JJROW(N)*J1CKDV
  790 CONTINUE
  800 CONTINUE
      IF(KTRL(9)) 1000,900,1000
  900 CALL XSEC
 1000 RETURN
      END
```

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  348 C     PROGRAM ON LIB=LCAD.ZYK,NAME=SC36JC
  348       SUBROUTINE NLJJJK                                                   398
KA348 CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES  ***
  349       IMPLICIT REAL*8 (A-H,O-Z)                                          KA399
  350       COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9       KA400
  351       COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)              401
  352       COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD          KA402
  352       COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10), 403
KA352      1             ECM(10),                                               404
KA353      2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  405
KA354      3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20), KA406
KA355      4             WN(10),WNINI(10),WC(10)                                407
KA358       COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,      408
  359      1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES         409
  360       KTRL1T=KTRL(1)*(1-KTRL(7))                                           415
  360         JJ=KEXCOM(45)                                                      415
  361         K=KEXCOM(46)                                                       415
  362       KT1PIS=KTRL1T+ISTRTW                                                 416
  363       KTISCK=MOD(KT1PIS,2)                                                KA416
  364       JJTRTW=2*JJ-2+KTISCK                                                 417
  365         NROW=0                                                             417
KA366       DO 600 I1=1,IICPLE                                                   418
  366         IF(KTRL(7)) 210,230,210                                            418
  366   210 K1=K+1                                                               419
  367         J1TWMI=JJTRTW+2                                                    419
KA368         J1TWMX=2*JJJMAX+2-KTISCK                                         419
  368       GO TO 250                                                          419
  368   230 K1=K+KPRITR(I1)                                                      420
  369         IITRTW=2*IIREAD(I1)-KTRL(1)                                      420
  369       J1TWMI=IABS( IITRTW-JJTRTW)+2                                      421
  370         J1TWMX=IITRTW+JJTRTW+2                                           421
  371   250 KPCHEK=MOD(K1,2)                                                    KA422
  372       DO 600 J1TW=J1TWMI,J1TWMX,2                                          423
  372        J1TRTW=J1TWMI+J1TWMX-J1TW-2                                       423
  373       L1TWMI=IABS( J1TRTW-ISTRTW)+2                                      424
  374         L1TWMX=J1TRTW+ISTRTW+2                                           424
  374       DO 500 L1TW=L1TWMI,L1TWMX,2                                          425
  374       L1TRTW=L1TWMI+L1TWMX-L1TW-2                                        426
  375         L1TR=L1TRTW/2                                                    426
  376       L1PRCK=MOD(L1TR,2)                                                  KA427
  377         IF(L1PRCK-KPCHEK) 500,410,500                                    427
KA378   410 IF(L1TR-(KEXCOM(14)-1)) 420,420,500                                428
  378   420 NROW=NROW+1                                                        429
  379        NNROW(NROW)=I1                                                    429
  379        LLROW(NROW)=L1TRTW                                                429
  380       JJROW(NROW)=J1TRTW                                                 430
  381   500 CONTINUE                                                           431
  382   600 CONTINUE                                                           432
  383       MXROW=NROW                                                         433
  384       IF(NNROW(1)-1) 610,620,610                                         434
  384   610 MXROW=0                                                            435
  385   620 RETURN                                                             436
  386       END                                                                437
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C      PROGRAM ON LIB=LOAD.ZYK,NAME=S036JD
C      COULCMB FUNCTIONS
       SUBROUTINE FLGLCH                                                  438
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
       IMPLICIT REAL*8 (A-H,O-Z)                                        KA439
       COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9     KA440
       COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)             441
       COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA442
CCCCCC      ******      DIMENSION FIELD USED ONLY IN THIS ROUTINE      *********
       COMMON EXTRA3(6070),FBAR(200),GT(75,2),T1MEMO(100),WRONSK(75)        444
CCCCCC      ******       CALCULATION OF G       ******                      445
       ETATW=ETA+ETA                                                        446
         ETASQ=ETA*ETA                                                      446
         LMAX1=LMAX+1                                                       446
         KTRL(15)=0                                                         446
       DO 200 L=1,LMAX                                                  KA447
  200  WRONSK(L)=0.0D0                                                      448
       EEPS1=1.D-6                                                          449
       EEPS2=1.D-6                                                          449
       EEPS3=2.D-5                                                          449
       COREC1=1.D-10                                                        450
       SQ=DSQRT(1.0D0+ETASQ)                                                451
       M=1                                                                  451
         RHOMXG=RHOMX+20.0D0*RD                                             451
         NINC=0                                                             451
  250  SL1=1.0D0                                                            452
        TL1=0.0D0                                                           452
        SC1=0.0D0                                                           452
        TC1=1.0D0-ETA/RHOMXG                                                452
       SL=SL1                                                               453
         TL=TL1                                                             453
         SC=SC1                                                             453
         TC=TC1                                                             453
       IF(DABS( ETA)-EEPS1) 263,263,255                                     454
  255  DO 260 N=1,25                                                        455
        T1=N                                                                455
        T2=2.0D0*T1-1.D0                                                    455
        T3=T1*(T1-1.0D0)                                                    455
       DENOM=2.0D0*RHOMXG*T1                                                456
        C1=(ETA*T2)/DENOM                                                   456
        C2=(ETASQ-T3)/DENOM                                                 456
       SL2=C1*SL1-C2*TL1                                                    457
         TL2=C1*TL1+C2*SL1                                                  457
       SC2=C1*SC1-C2*TC1-SL2/RHOMXG                                         458
         TC2=C1*TC1+C2*SC1-TL2/RHOMXG                                       458
       SL=SL+SL2                                                            459
         TL=TL+TL2                                                          459
         SC=SC+SC2                                                          459
         TC=TC+TC2                                                          459
       SL1=SL2                                                              460
         TL1=TL2                                                            460
         SC1=SC2                                                            460
         TC1=TC2                                                            460
  260  CONTINUE                                                             461
  263  IF(M-1) 265,265,310                                                  462
  265  IF(DABS( SL*TC-SC*TL-1.0D0)-EEPS1)310,270,270                        463
  270  NINC=NINC+1                                                          464
         IF(NINC-50)  275,280,280                                           464
  275  RHOMXG=RHOMXG+20.0D0*RD                                              465
         GO TO 250                                                          465
  280  KTRL(15)=1                                                           466
         GO TO 900                                                          466
  310  ARG=SIGMAZ+RHOMXG-ETA*DLOG(2.0D0*RHOMXG)                             467
       SINE=DSIN( ARG)                                                      468
         COSI=DCOS( ARG)                                                    468
       GT(1,M)=SL*COSI-TL*SINE                                              469
        GDT=SC*COSI-TC*SINE                                                 469
        T1=SQ                                                               469
       GT(2,M)=((ETA+1.CD0/RHOMXG)*GT(1,M)-GDT)/T1                          470
       IF(M-1) 320,320,330                                                  471
  320  M=M+1                                                                472
         RHOMXG=RHOMXG+RD                                                   472
         GO TO 250                                                          472
CCCCCC      ******       INWARD SOLUTION OF DIFFERENTIAL EQUATION      ****** 473
  330  RHOMXG=RHOMXG-RD                                                     474
       IF(DABS(RHOMXG-RHOMX)-1.D-4) 335,335,340                             475
  335  G(1)=GT(1,1)                                                         476
         G(2)=GT(2,1)                                                       476
         GO TO 360                                                          476
  340  RDSQ=RD*RD                                                           477
        RDSQ56=0.8333333333333333*RDSQ                                      477
        RDSQ12=0.1D0*RDSQ56                                                 477
       NMAX=(RHOMXG-RHOMX)/RD+0.1D0                                         478
       DO 350 L=1,2                                                         479
       RHOTM=RHOMXG                                                         480
         FL=L*(L-1)                                                         480
         PSI1=GT(L,2)                                                       480
         PSI2=GT(L,1)                                                       480
       R1=RHOTM+RD                                                          481
         R2=RHOTM                                                           481
         R3=RHOTM-RD                                                        481
       DO 345 N=1,NMAX                                                      482
       DENOM=1.0D0-RDSQ12*(FL/(R3*R3)+ETATW/R3-1.0D0)                       483
       FAC1=(1.0D0-RDSQ12*(FL/(R1*R1)+ETATW/R1-1.0D0))/DENOM                484
       FAC2=(2.0D0+RDSQ56*(FL/(R2*R2)+ETATW/R2-1.0D0))/DENOM                485
       PSI3=FAC2*PSI2-FAC1*PSI1                                             486
         PSI1=PSI2                                                          486
         PSI2=PSI3                                                          486
       R1=R2                                                                487
         R2=R3                                                              487
         R3=R3-RD                                                           487
  345  CONTINUE                                                             488
       G(L)=PSI3                                                            489
  350  CONTINUE                                                             490
  360  T1=SQ                                                                491
       DO 370 L=1,LMAX1                                                     492
         FL=L                                                               492
         FL1=FL+1.0D0                                                       492
       T2=DSQRT( ETASQ+FL1*FL1)                                             493
         FAC1=1.0D0/(FL*T2)                                                 493
        FAC2=(FL+FL1)*ETA                                                   493
       FAC3=(FL+FL1)*FL*FL1                                                 494
         FAC4=FL1*T1                                                        494
       G(L+2)=FAC1*((FAC2+(FAC3/RHOMX))*G(L+1)-FAC4*G(L))                   495
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        T1=T2                                                          495
  370 CONTINUE                                                         496
CCCCCC      ******       CALCULATION OF F       ******                 497
      IDEC=31                                                          498
  420 I=LMAX+IDEC                                                      499
      FBAR(I)=1.D-25                                                   499
        FBAR(I+1)=0.0D0                                                499
      IMAX=I-1                                                         500
        FL=I                                                           500
        FLSQ=FL*FL                                                     500
        T1=DSQRT( FLSQ+ETASQ)                                          500
      DO 500 I=1,IMAX                                                 KA 501
        L=IMAX+1-I                                                     501
        FL=L                                                           501
        FL1=FL+1.0D0                                                   501
      FLSQ=FL*FL                                                       502
        T2=DSQRT( FLSQ+ETASQ)                                          502
      FBAR(L)=((FL+FL1)*(ETA+FL*FL1/RHOMX)*FBAR(L+1)-FL*T1*FBAR(L+2))  503
     1        /(FL1*T2)                                                504
      FBARC1=FBAR(L)                                                   505
       FBARC2=DABS( FBARC1)                                            505
       IF(L-LMAX) 460,440,435                                          505
  435 IF(FBARC2-1.D15      ) 460,445,445                               506
  440 IF(FBARC2-COREC1) 460,445,445                                    507
  445 COREC2=COREC1/FBARC1                                             508
        FBAR(L)=COREC2*FBAR(L)                                         508
      FBAR(L+1)=COREC2*FBAR(L+1)                                       509
  460 T1=T2                                                            510
  500 CONTINUE                                                         511
      ALPHAI=(FBAR(1)*G(2)-FBAR(2)*G(1))*SQ                            512
      IF(ALPHAI) 520,510,520                                           513
  510 KTRL(15)=4                                                       514
        GO TO 900                                                      514
  520 ALPHA=1.0D0/ALPHAI                                               515
      DO 530 L=1,LMAX1                                                 516
  530 FBAR(L)=ALPHA*FBAR(L)                                            517
        IF(IDEC-31) 535,540,535                                        517
  535 IF(FBAR(1)) 538,536,538                                          518
  536 IF(DABS(F(1))-1.D-6) 560,560,540                                 519
  538 T1=DABS(F(1)/FBAR(1))-1.D0                                      KA520
      IF(DABS(T1)-EEPS2) 560,560,540                                  KA520
  540 DO 545 L=1,LMAX1                                                 521
  545 F(L)=FBAR(L)                                                     522
  550 IDEC=IDEC+9                                                      524
      IF(IDEC+LMAX1-200) 420,420,555                                  KA 525
  555 KTRL(15)=5                                                       526
  560 T1=0.D0                                                         KA529
      DO 570 L=1,LMAX1                                                 529
        IF(FBAR(L)) 565,562,565                                        529
  562 T1MEMO(L)=F(L)                                                  KA530
      GO TO 566                                                       KA531
  565 T1MEMO(L)=DABS(F(L)/FBAR(L))-1.D0                               KA532
  566 T1=DMAX1(T1,DABS(T1MEMO(L)))                                    KA533
  570 CONTINUE                                                         535
      IF(KTRL(15)) 572,572,574                                        KA536
  572 IF(T1-EEPS2) 574,574,550                                        KA537
  574 T1=SQ                                                            539
      DO 590 L=1,LMAX                                                  540
        FL=L                                                           540
        FL1=FL+1.0D0                                                   540
       T2=DSQRT( FL1*FL1+ETASQ)                                        540
      TS=FL/T1                                                         541
      TEST=DABS( F(L)*G(L+1)-F(L+1)*G(L)-TS)                           542
      WRONSK(L)=TEST                                                   543
        IF(TEST-EEPS3) 580,580,577                                     543
  577 KTRL(15)=6                                                      KA544
  580 T1=T2                                                            545
  590 CONTINUE                                                         546
      DO 600 L=1,LMAX                                                  547
        FL=L                                                           547
        FLSQ=FL*FL                                                     547
      FAC1=ETA/FL+FL/RHOMX                                             548
        FAC2=DSQRT( ETASQ+FLSQ)/FL                                     548
      FD(L)=FAC1*F(L)-FAC2*F(L+1)                                      549
        GD(L)=FAC1*G(L)-FAC2*G(L+1)                                    549
  600 CONTINUE                                                         550
      IF(KTRL(5).NE.0) GO TO 1000                                     KA 550
      IF(KTRL(15)-4) 750,750,760                                      KA550
  750 IF(KTLOUT(5)) 760,1000,760                                      KA551
  760 WRITE(6,765) KTRL(15)                                           KA552
  765 FORMAT(21HOIN FLGLCH, KTRL(15)=I2)                              KA553
      WRITE(6,770) ETA,SIGMAZ,RHOMX,RHOMXG,RD,LMAX,NINC,NMAX,IDEC     KA554
  770 FORMAT(28H ETA,SIGMAZ,RHOMX,RHOMXG,RD=5E14.6/21H LMAX,NINC,NMAX,ID  KA555
     1EC=4I5)                                                         KA556
      L=0                                                             KA 557
      L1=LMAX-1                                                       KA 558
      WRITE(6,781) L,F(1),G(1),FD(1),GD(1),WRONSK(1),T1MEMO(1)        KA 559
  781 FORMAT(4HO  L,16X,1HF,19X,1HG,18X,2HFD,18X,2HGD,14X,6HWRONSK14X,6H  KA 560
     1T1MEMO/I4,1P6D20.5)                                             KA561
      WRITE(6,782) (L,F(L+1),G(L+1),FD(L+1),GD(L+1),WRONSK(L+1),T1MEMO(L  KA 562
     1+1),L=1,L1)                                                     KA562
  782 FORMAT(I4,1P6D20.5)                                             KA 563
      WRITE(6,782) LMAX,F(LMAX1),G(LMAX1)                             KA 564
      GO TO 1000                                                       565
  900 WRITE(6,920) KTRL(15)                                            566
  920 FORMAT(18HOIN FLGL KTRL(15)=I2)                                  567
 1000 RETURN                                                           568
      END                                                              569
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C      PROGRAM ON LIB=LOAD.ZYK,NAME=S036JE
C      SPHERICAL HANKEL FUNCTIONS
       SUBROUTINE FLGLNG                                                  570
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES  ***
       IMPLICIT REAL*8 (A-H,O-Z)                                        KA571
       COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9     KA572
       COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)            573
       COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA574
       LMX=LMAX+2                                                       575
       R=RHOMX                                                          576
         RI=1.0D0/R                                                     576
         EX=DEXP( -R)                                                   576
       G(1)=EX*RI                                                       577
         G(2)=EX*(RI+RI*RI)                                             577
       FL=1.0D0                                                         578
       DO 50 L=1,LMX                                                    579
       TWELP1=2.0D0*FL+1.D0                                             580
       G(L+2)=TWELP1*RI*G(L+1)+G(L)                                     581
       GD(L)=-G(L+1)+RI*G(L)                                            582
       FD(L)=0.0D0                                                      583
       F (L)=0.0D0                                                      583
    50 FL=FL+1.0D0                                                      584
       GD(1)=-G(2)                                                      585
       IF(KTLOUT(5)) 4100,4190,4100                                     586
  4100 WRITE(6,4110) R,RI,EX                                            587
  4110 FORMAT(19HOIN FLGLNG R,RI,EX=3E15.7)                             588
       WRITE(6,4120) (G (L),L=1,LMX)                                    589
       WRITE(6,4130) (GD(L),L=1,LMX)                                    590
  4120 FORMAT(4H G =,7E15.7)                                            591
  4130 FORMAT(4H GD=,7E15.7)                                            592
  4190 CONTINUE                                                         593
       RETURN                                                           594
       END                                                              595
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C      PROGRAM ON LIB=LOAD.ZYK,NAME=S036JF
C      FORMFACTORS OF THE POTENTIALS
       SUBROUTINE POTENT                                                  596
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES  ***
       IMPLICIT REAL*8 (A-H,O-Z)                                        KA597
       COMPLEX*16 TTR,TTI,ZERO                                          KA597
       COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9     KA598
       COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)            599
       COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA600
       COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  601
      1             ECM(10),                                              602
      2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  603
      3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  604
      4             WN(10),WNINI(10),WC(10)                               605
       COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,     606
      1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,       607
      2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  608
      3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,           609
      4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,    610
      5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                       611
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
       COMPLEX*16 EXSGRI                                                KA613
       COMMON      EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)    615
       COMMON       VCENTR(200),VCENTI(200),VSPIN (200),VCOULM(200),      616
      1             VCPL1R(200),VCPL1I(200),VCPL2R(200),VCPL2I(200),      617
      2             VCPD1R(200),VCPD1I(200),VCPD2R(200),VCPD2I(200),      618
      3             VCPD3R(200),VCPD3I(200)                               619
CCCCCC      ******     DIMENSION FIELDS USED ONLY IN THIS ROUTINE     **********
       COMMON     PFORM1(4),PFORM2(4),PFORM3(4),PFORM4(4),PFORM5(4),      621
      1           VLAMD1(3,5),VLAMD2(3,5),VTERM1(3,5),VTERM2(3,5)       KA622
      2          ,XMEM(300),BETAC2(4)                                   KA623
       DIMENSION VCPL3R(200),VCPL3I(200),VCPL4R(200),VCPL4I(200)        KA624
       EQUIVALENCE (VCPD1R(1),VCPL3R(1)),(VCPD1I(1),VCPL3I(1)),         KA624
      1            (VCPD2R(1),VCPL4R(1)),(VCPD2I(1),VCPL4I(1))        KA624
       PI=3.141592653589793                                             KA624
       NTTLMS=NXCPLE+4*(NDFMES-1)                                        625
       VSPFC=2.0D0*VSO/DFNSP                                             625
       XBFAC=DCBRT(TMAS)                                                KA626
         XBARW=RZEROW*XBFAC                                              627
       XBARS=RZEROS*XBFAC                                                628
         XBARC=RZEROC*XBFAC                                              628
       XBARSP=RZROSP*XBFAC                                               629
       VCLFC2=1.4398650D0*CHARGE                                         630
         VCLFC1=VCLFC2*0.5D0/XBARC                                       630
       VFAC1=-VSX*XBAR/DFN                                               631
         WFAC1=-WSX*XBARW/DFNW                                           631
       WDFC1=-4.0D0*WSF*XBARS/DFNS                                       632
       VFAC2=VFAC1*XBAR*0.5D0/DFN                                        633
         WFAC2=WFAC1*XBARW*0.5D0/DFNW                                    633
       WDFC2=WDFC1*XBARS*0.5D0/DFNS                                      634
       DO 255 NX=1,1200                                                 KA634
  255  VCPD1R(NX)=0.D0                                                  KA634
       IF(KTRL(11)) 257,258,257                                          635
  257  MESIZE=31                                                         636
         LAMAX=5                                                        KA636
         FN=30.0D0                                                       636
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```
      DCOSI=1.0D0/FN                                                    637
        DCOSI3=DCOSI/3.0D0                                              637
      BETA5=VCOUPL(1)*DSQRT(1.25D0/PI)                                KA638
      BETA9=VCOUPL(2)*DSQRT(2.25D0/PI)                                KA639
      BETA13=VCOUPL(3)*DSQRT(3.25D0/PI)                               KA639
      BETA17=VCOUPL(4)*DSQRT(4.25D0/PI)                               KA639
      ALFC0=DCOSI3*DSQRT(4.D0*PI)                                     KA640
      ALFC2=DCOSI3*DSQRT(2.D1*PI)                                     KA640
      ALFC4=DCOSI3*DSQRT(36.D0*PI)                                    KA640
      ALFC6=DCOSI3*DSQRT(52.D0*PI)                                    KA640
      ALFC8=DCOSI3*DSQRT(68.D0*PI)                                    KA640
      DO 1 LA=2,LAMAX                                                 KA640
    1 BETAC2(LA-1)=0.D0                                               KA640
      IF(KTRL(6)-2) 258,2,258                                         KA640
    2 ID=0                                                            KA640
      IE=0                                                            KA640
      IF=0                                                            KA640
      DO 10 LA=2,LAMAX                                                KA640
      IC=4*(LA-1)                                                     KA640
      FND=4.D0*PI*(IC+1)                                              KA640
      DO 5 ND=1,2                                                     KA640
      DO 5 NX=1,2                                                     KA640
      IB=4*ND                                                         KA640
      IA=4*NX                                                         KA640
      CALL CLEB                                                       KA640
      BETAC2(LA-1)=BETAC2(LA-1)+DSQRT(DFLOAT((IA+1)*(IB+1))/FND)*RAC*RAC KA640
     1*VCOUPL(ND)*VCOUPL(NX)                                          KA640
    5 CONTINUE                                                        KA640
      BETAC2(LA-1)=BETAC2(LA-1)/DFLOAT(2*(IC+1))                      KA640
   10 CONTINUE                                                        KA640
  258 DO 410 ND=1,NDFMES                                              641
      FND=2.0D0**(ND-1)                                               642
      DX=XMES1*FND                                                    643
      IF(ND-1) 263,259,263                                            644
  259 X=0.0D0                                                         645
        NXIMIN=1                                                      645
        NXIMAX=8                                                      645
      IF(NDFMES-1) 265,260,265                                        646
  260 NXIMAX=NXCPLE+2                                                 647
        GO TO 265                                                     647
  263 NXIMIN=NXIMAX+1                                                 648
        NXIMAX=NXIMAX+4                                               648
      IF(ND-NDFMES) 265,264,265                                       649
  264 NXIMAX=NTTLMS+2                                               KA649
  265 NXMAX2=NXIMAX                                                 KA650
      DO 400 NX=NXIMIN,NXIMAX                                         651
      X=X+DX                                                          652
        XMEM(NX)=X                                                    652
      PFORM1(1)=DEXP( (X-XBAR )/DFN )                                 653
      PFORM1(2)=DEXP( (X-XBARW)/DFNW)                                 654
      PFORM1(3)=DEXP( (X-XBARS)/DFNS)                                 655
      PFORM1(4)=DEXP( (X-XBARSP)/DFNSP)                               656
      DO 267 N=1,4                                                    657
      PFORM2(N)=1.0D0/(1.0D0+PFORM1(N))                               658
      PFORM3(N)=PFORM1(N)*PFORM2(N)*PFORM2(N)                         659
      PFORM4(N)=(PFORM1(N)-1.0D0)*PFORM2(N)*PFORM3(N)                 660
      PFORM5(N)=(1.0D0-PFORM1(N)*(4.0D0-PFORM1(N)))*PFORM2(N)         661
     1          *PFORM2(N)*PFORM3(N)                                  662
  267 CONTINUE                                                        663
      VCENTR(NX)=-VSX*PFORM2(1)                                       664
      VCENTI(NX)=-WSX*PFORM2(2)-4.0D0*WSF*PFORM3(3)                   665
      VSPIN(NX)=(VSPFC*PFORM3(4))/X                                   666
      IF(X-XBARC)271,271,272                                          667
  271 VCOULM(NX)=VCLFC1*(3.0D0-((X/XBARC)**2))                        668
      GO TO 275                                                       669
  272 VCOULM(NX)=VCLFC2/X                                             670
  275 VCPL1R(NX)=VFAC1*PFORM3(1)                                      671
        VCPL2R(NX)=VFAC2*PFORM4(1)                                    671
      VCPL1I(NX)=WFAC1*PFORM3(2)+WDFC1*PFORM4(3)                      672
      VCPL2I(NX)=WFAC2*PFORM4(2)+WDFC2*PFORM5(3)                      673
      IF(KTRL(11)) 285,400,285                                        674
  285 DO 287 LA=1,LAMAX                                               675
        DO 287 N=1,3                                                  675
      VLAMD1(N,LA)=0.0D0                                              676
        VLAMD2(N,LA)=0.0D0                                            676
  287 CONTINUE                                                        677
      IIPA=1                                                          678
        COSI=-DCOSI                                                   678
      DO 300 ME=1,MESIZE                                              679
        COSI=COSI+DCOSI                                               679
      COSI2=COSI*COSI                                                 680
       COSI4=COSI2*COSI2                                              680
       COSI6=COSI2*COSI4                                              680
      COSI8=COSI4*COSI4                                             KA681
      BR (1)=1.0D0                                                    681
        BR (2)=1.5D0*COSI2-0.5D0                                      681
      BR (3)=4.375D0*COSI4-3.75D0*COSI2+0.375D0                       682
      BR (4)=14.4375D0*COSI6-19.6875D0*COSI4+6.5625D0*COSI2-0.3125D0  683
      BR (5)=50.2734375D0*COSI8-93.84375D0*COSI6+54.140625D0*COSI4-  KA684
     1  9.84375D0*COSI2+0.2734375D0                                  KA684
      BETAFC=1.0D0+BETA5*BR(2)+BETA9*BR(3)                          KA684
      IF(INTYPE.EQ.4.AND.INTMAX.EQ.4) BETAFC=BETAFC+BETA13*BR(4)+   KA684
     1  BETA17*BR(5)                                                KA684
      PFORM1(1)=DEXP( (X-XBAR *BETAFC)/DFN )                          685
      PFORM1(2)=DEXP( (X-XBARW*BETAFC)/DFNW)                          686
      PFORM1(3)=DEXP( (X-XBARS*BETAFC)/DFNS)                          687
      DO 288 N=1,3                                                    688
      PFORM2(N)=1.0D0/(1.0D0+PFORM1(N))                               689
      PFORM3(N)=PFORM1(N)*PFORM2(N)*PFORM2(N)                         690
      PFORM4(N)=(PFORM1(N)-1.0D0)*PFORM2(N)*PFORM3(N)                 691
  288 CONTINUE                                                        692
      DO 289 LA=1,LAMAX                                               693
      VTERM1(1,LA)=PFORM2(1)*BR(LA)                                   694
        VTERM2(1,LA)=PFORM3(1)*BR(LA)                                 694
      VTERM1(2,LA)=PFORM2(2)*BR(LA)                                   695
        VTERM2(2,LA)=PFORM3(2)*BR(LA)                                 695
      VTERM1(3,LA)=PFORM3(3)*BR(LA)                                   696
        VTERM2(3,LA)=PFORM4(3)*BR(LA)                                 696
  289 CONTINUE                                                        697
      IF(ME-1) 291,295,291                                            698
  291 IF(ME-MESIZE) 292,295,292                                       699
  292 IF(IIPA) 293,294,293                                            700
  293 TERMFC=4.0D0                                                    701
        IIPA=0                                                        701
        GO TO 296                                                     701
  294 TERMFC=2.0D0                                                    702
```

```
      IIPA=1                                                            702
      GO TO 296                                                         702
295 TERMFC=1.0D0                                                        703
296 DO 297 LA=1,LAMAX                                                   704
      DO 297 N=1,3                                                      704
    VLAMD1(N,LA)=VLAMD1(N,LA)+VTERM1(N,LA)*TERMFC                       705
    VLAMD2(N,LA)=VLAMD2(N,LA)+VTERM2(N,LA)*TERMFC                       706
297 CONTINUE                                                            707
300 CONTINUE                                                            708
    VCENTR(NX)= -VSX*VLAMD1(1,1)*DCOSI3                                709
    VCENTI(NX)=-(WSX*VLAMD1(2,1)+4.0D0*WSF*VLAMD1(3,1))*DCOSI3          710
    VCPL1R(NX)=-VSX*VLAMD1(1,2)*ALFC2                                   711
    VCPL2R(NX)=-VSX*VLAMD1(1,3)*ALFC4                                   712
    VCPL3R(NX)=-VSX*VLAMD1(1,4)*ALFC6                                KA712
    VCPL4R(NX)=-VSX*VLAMD1(1,5)*ALFC8                                KA712
    VCPL1I(NX)=(-WSX*VLAMD1(2,2)-4.0D0*WSF*VLAMD1(3,2))*ALFC2           713
    VCPL2I(NX)=(-WSX*VLAMD1(2,3)-4.0D0*WSF*VLAMD1(3,3))*ALFC4           714
    VCPL3I(NX)=(-WSX*VLAMD1(2,4)-4.0D0*WSF*VLAMD1(3,4))*ALFC6        KA714
    VCPL4I(NX)=(-WSX*VLAMD1(2,5)-4.0D0*WSF*VLAMD1(3,5))*ALFC8        KA714
    IF(KTRL(6)) 309,309,301                                          KA714
301 TX=0.D0                                                          KA714
    IF(X-XBARC) 302,302,303                                          KA714
302 TX=1.D0                                                          KA714
303 XR=X/XBARC                                                       KA714
    XR=XR*XR                                                         KA714
    XR2=3.D0*VCLFC2/XBARC*XR*TX                                      KA714
    XRM2=3.D0*VCLFC2/X/XR*(1.D0-TX)                                  KA714
    VCPL1R(NX)=VCPL1R(NX)+VCOUPL(1)/5.D0*(XR2+XRM2)+BETAC2(1)*(-XR2+ KA714
   14.D0*XRM2)                                                       KA714
    XR2=XR2*XR                                                       KA714
    XRM2=XRM2/XR                                                     KA714
    VCPL2R(NX)=VCPL2R(NX)+VCOUPL(2)/9.D0*(XR2+XRM2)+BETAC2(2)*(-3.D0* KA714
   1XR2+6.D0*XRM2)                                                   KA714
    XR2=XR2*XR                                                       KA714
    XRM2=XRM2/XR                                                     KA714
    VCPL3R(NX)=VCPL3R(NX)+BETAC2(3)*(-5.D0*XR2+8.D0*XRM2)            KA714
    XR2=XR2*XR                                                       KA714
    XRM2=XRM2/XR                                                     KA714
    VCPL4R(NX)=VCPL4R(NX)+BETAC2(4)*(-7.D0*XR2+1.D1*XRM2)            KA714
309 IF(INTYPE-6) 400,310,400                                         KA715
310 VCPD1R(NX)= VFAC1*VLAMD2(1,1)*ALFC0                                716
    VCPD2R(NX)= VFAC1*VLAMD2(1,2)*ALFC2                                717
    VCPD3R(NX)= VFAC1*VLAMD2(1,3)*ALFC4                                718
    VCPD1I(NX)=(WFAC1*VLAMD2(2,1)+ WDFC1*VLAMD2(3,1))*ALFC0            719
    VCPD2I(NX)=(WFAC1*VLAMD2(2,2)+ WDFC1*VLAMD2(3,2))*ALFC2            720
    VCPD3I(NX)=(WFAC1*VLAMD2(2,3)+ WDFC1*VLAMD2(3,3))*ALFC4            721
400 CONTINUE                                                           722
410 CONTINUE                                                           723
    CALL DOTEST(723,NXMAX2,200)
    IF(KTLOUT(7)) 4510,4590,4510                                       724
4510 WRITE(6,4515) (XMEM(NX),VCENTR(NX),VCENTI(NX),VSPIN(NX),VCOULM(NX) KA725
   1,VCPL1R(NX),VCPL1I(NX),VCPL2R(NX),VCPL2I(NX),NX=1,NXMAX2)          KA726
4515 FORMAT(11HOPOTENTIALS/8X,1HX,10X,6HVCENTR,8X,6HVCENTI,9X,5HVSPIN, KA727
   18X,6HVCOULM,8X,6HVCPL1R,8X,6HVCPL1I,8X,6HVCPL2R,8X,6HVCPL2I/(1P9D  KA728
   214.5))                                                           KA728
    IF(KTRL(11)) 4516,4590,4516                                      KA729
4516 IF(INTYPE-6) 4517,4520,4590                                     KA729
4517 WRITE(6,4518) (XMEM(NX),VCPL3R(NX),VCPL3I(NX),VCPL4R(NX),VCPL4I(NX KA729
   1),NX=1,NXMAX2)                                                   KA729
4518 FORMAT(1HO,7X,1HX,10X,6HVCPL3R,8X,6HVCPL3I,8X,6HVCPL4R,8X,6HVCPL4I KA729
   1/(1P5D14.5))                                                     KA729
    GO TO 4590                                                       KA729
4520 WRITE(6,4525)(XMEM(NX),VCPD1R(NX),VCPD1I(NX),VCPD2R(NX),VCPD2I(NX) KA730
   1,VCPD3R(NX),VCPD3I(NX),NX=1,NXMAX2)                              KA731
4525 FORMAT(1HO,7X,1HX,10X,6HVCPD1R,8X,6HVCPD1I,8X,6HVCPD2R,8X,6HVCPD2I KA732
   1,8X,6HVCPD3R,8X,6HVCPD3I/(1P7D14.5))                             KA733
4590 RETURN                                                          KA734
     END                                                             KA735
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JG
C     RANGE OF REALS: EXPONENT < 75 FOR THE IBM 360 AND < 1024 FOR THE CDC 1604
      SUBROUTINE COUPLE                                                  761
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                        KA762
           COMPLEX*16 TTR,TTI,ZERO                                     KA762
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9     KA763
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)             764
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD       KA765
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  766
     1             ECM(10),                                              767
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  768
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  769
     4             WN(10),WNINI(10),WC(10)                               770
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,     771
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,       772
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  773
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,           774
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,    775
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                        776
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
      COMPLEX*16 UCRI,UDRI,EX,EXSGRI                                   KA778
      COMMON     EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)      780
      COMMON      VCENTR(200),VCENTI(200),VSPIN (200),VCOULM(200),       781
     1            VCPL1R(200),VCPL1I(200),VCPL2R(200),VCPL2I(200),       782
     2            VCPD1R(200),VCPD1I(200),VCPD2R(200),VCPD2I(200),       783
     3            VCPD3R(200),VCPD3I(200)                                784
      COMMCN     AMAT1 (30,30),AMAT2 (30,30),AMATCP(60   ),             785
     1           AMAT1C(30,30),AMAT2C(30,30),AMATSS(30,30)              786
      COMMON     UCR1(30),UCI1(30),UCR2(30),UCI2(30),                   787
     1           URFORD(30,5),UIFORD(30,5),SPFACT(30),                  788
     2           FPRER(5,30),FPREI(5,30),FPRERM(4,30),FPREIM(4,30),     789
     3           UCR1M(30),UCI1M(30)                                    790
      DIMENSION  FCRA(14,5,6),FDCRA(14,5,6),GCRA(14,5,6),GDCRA(14,5,6),  791
     1           UCRI(30),UDRI(30)                                      792
      EQUIVALENCE (FC(1),FCRA(1)),(FDC(1),FDCRA(1)),(GC(1),GCRA(1)),   KA 793
     1(GDC(1),GDCRA(1)),(UCRI(1),URFORD(1)),(UDRI(1),UIFORD(1))        KA 794
      NBOUND=0                                                           795
      KBOUND=0                                                           795
      MXROWI=0                                                           795
      CALL DOTEST (797,MXROW,30)
      DO 20 M1=1,MXROW                                                   797
      N1=NNROW(M1)                                                       798
      CALL DOTEST (798,N1,IICPLE)
        IF(ECM(N1)) 12,14,14                                             798
   12 NBOUND=NBOUND+1                                                    799
        KBOUND=1                                                         799
   14 IF(N1-1) 20,17,20                                                  800
   17 MXROWI=MXROWI+1                                                    801
   20 CONTINUE                                                           802
      NXRM=XBAR/XMES2                                                    803
      NXRMM=NXMAX*(1-KBOUND)+NXRM*KBOUND                                 804
      KEXCOM(41)=KBOUND                                                  805
        KEXCOM(42)=NBOUND                                                805
        KEXCOM(43)=MXROWI                                                805
      PRE41=19.DO/240.DO                                                 806
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      PRE42=-2.D0/5.D0                                                  806
      PRE43=97.D0/120.D0                                                806
      PRE44=-11.D0/15.D0                                                807
      PRE45=299.D0/240.D0                                               807
      NQPRED=4                                                          808
      NQPR  =4                                                          808
        FNQPR=4.0D0                                                     809
      KCTY2=0                                                           809
        IF(ISTRTW-2) 43,55,43                                           810
   43 IF(INTYPE-2) 55,45,55                                             811
   45 IF(IICPLE-3) 50,50,55                                             812
   50 IF(INTMAX-3) 52,55,55                                             813
   52 KCTY2=1                                                           814
   55 IF(KTRL(13)) 70,810,70                                         KA815
   70 XBARC=RZEROC*DCBRT(TMAS)                                       KA815
      XBAR2=XBARC*XBARC                                              KA815
      XBAR3=XBARC*XBAR2                                              KA815
      XBAR4=XBAR2*XBAR2                                              KA815
      VCOUVX=3.D0*1.439865D0*CHARGE                                     816
      VCX2  =VCOUVX*XBAR2/5.0D0                                         817
        VCX3  =VCOUVX*XBAR3/7.0D0                                       817
      VCXI2 =VCOUVX/(XBAR3*5.0D0)                                       818
        VCXI3 =VCOUVX/(XBAR4*7.0D0)                                     818
      VCX2P=VCX2+VCX2                                                KA 819
      VCXI2P=-.5D0*VCXI2                                             KA 819
      MIROW2=0                                                          821
        K2CHK=0                                                         821
        MIROW3=0                                                        821
        K3CHK=0                                                         821
        MIRW2P=0                                                        821
      K2CHKP=0                                                          822
      DO 670 M1=1,MXROW                                                 823
        N1=NNROW(M1)                                                    823
        I1=IIREAD(N1)                                                   823
      J1=JJROW(M1)                                                      824
        L1=LLROW(M1)                                                    824
        KP=KPRITR(N1)                                                   824
      IF(KP-2) 624,621,624                                              825
  621 IF(K3CHK) 623,622,623                                             826
  622 K3CHK=1                                                           827
        MIROW3=M1                                                       827
        GO TO 624                                                       827
  623 MXROW3=M1                                                         828
  624 IF(KCTY2) 650,660,650                                             829
  650 IF(N1-2) 660,652,652                                              830
  652 IF(KP-1) 660,654,660                                              831
  654 IF(K2CHK) 658,656,658                                             832
  656 K2CHK=1                                                           833
        MIROW2=M1                                                       833
        GO TO 660                                                       833
  658 MXROW2=M1                                                         834
  660 IF(INTYPE-3) 670,661,670                                          835
  661 IF(N1-3) 670,663,663                                              836
  663 IF(I1-2) 670,665,670                                              837
  665 IF(K2CHKP) 669,667,669                                            838
  667 K2CHKP=1                                                          839
        MIRW2P=M1                                                       839
        GO TO 670                                                       839
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  669 MXRW2P=M1                                                         840
  670 CONTINUE                                                          841
CCCCCC      MIROW3,MXROW3=MIN,MAX OF M1 FOR WHICH STATE IS 3(-).        842
CCCCCC      MIROW2,MXROW2=MIN,MAX OF M1 FOR WHICH STATE IS 2(+)-1.      843
CCCCCC      MIRW2P,MXRW2P=MIN,MAX OF M1 FOR WHICH STATE IS 2(+)-2.      844
  810 REWIND 8                                                          845
      CALL BMATRX                                                       845
      DO 815 M1=1,MXROW                                                 846
      J1=JJROW(M1)                                                      847
        L1=LLROW(M1)                                                    847
      SPFC=J1*(J1+2)-L1*(L1+2)-ISTRTW*(ISTRTW+2)                        848
  815 SPFACT(M1)=0.250D0*SPFC                                           849
      INEXMX=1+KBOUND                                                   850
      DO 1950 INEX=1,INEXMX                                             851
      FINEX=INEX                                                        852
        M3MAX=MXROW+MXROWI*(INEX-1)                                     852
      DO 1900 M3=1,M3MAX                                                853
      NDMAX=NDFMES*(2-INEX)+(INEX-1)                                    854
      DO 1890 ND=1,NDMAX                                                855
      FND=2.0D0**(ND-1)                                                 856
        DX=XMES1*FND*(2.0D0-FINEX)-XMES2*(FINEX-1.0D0)                  856
      DRSQ=(DX*WN(1))**2/ECM(1)                                      KA857
        K4COR2=4*ND-5                                                   857
      IF(ND-1) 860,822,860                                              858
  822 DO 825 M1=1,MXROW                                                 859
      UCR1(M1)=0.0D0                                                    860
      UCI1(M1)=0.0D0                                                    860
      UCR2(M1)=0.0D0                                                    860
      UCI2(M1)=0.0D0                                                    860
      UCR1M(M1)=0.D0                                                 KA 860
      UCI1M(M1)=0.D0                                                 KA 860
      DO 825 N=1,5                                                      861
      FPRER (N,M1)=0.0D0                                                862
      FPRERM(N,M1)=0.0D0                                                862
      FPREI (N,M1)=0.0D0                                                862
      FPREIM(N,M1)=0.0D0                                                862
  825 CONTINUE                                                          863
      IF(INEX-1) 925,830,925                                            864
  830 N1=NNROW(M3)                                                      865
        J1=JJROW(M3)                                                    865
        L1=LLROW(M3)                                                    865
      LL=(L1/2)+1                                                       866
        WNI=WNINI(N1)                                                   866
      X=DFLOAT(LL)*DLOG(2.D0*DX*WNI)+FACLOG(LL)-FACLOG(2*LL)         KA  867
      SHIFT=0.D0                                                     KA 867
      IF(KTRL(2))831,833,831                                         KA 867
  831 KTRL(2)=IABS(KTRL(2))                                          KA 867
      IF(X+DFLOAT(KTRL(2))) 832,833,833                              KA 867
  832 SHIFT=-X-DFLOAT(KTRL(2))                                       KA 867
      X=X+SHIFT                                                      KA 867
      EXPKT=DEXP(DFLOAT(KTRL(2)))                                    KA 867
      EXPINV=1.D0/(EXPKT*EXPKT)                                      KA 867
  833 UCR2(M3)=DEXP(X)/2.D0                                          KA 868
      IF(LL-2) 840,834,840                                              868
  834 FPRERM(1,M3)=CFUNIT*0.6666666666666666*WNI*WNI*DRSQ*DEXP(SHIFT) KA 869
      FPRER (1,M3)=FPRERM(1,M3)                                         869
  840 X=0.0D0                                                           870
        NXIMIN=2                                                        870
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      NXIMAX=8                                                          870
      NXPRCH=3                                                          870
      NNX=2                                                             870
    IF(NDFMES-1) 1225,857,1225                                          871
857 NXIMAX=NXRMM+2                                                      872
      NXMAX3=NXIMAX-5                                                   872
      GO TO 1225                                                        872
860 NXIMIN=5                                                            873
      X=3.0D0*DX                                                        873
    IF(ND-NDFMES) 862,863,862                                           874
862 NXIMAX=8                                                            875
      GO TO 865                                                         875
863 NXIMAX=NXRMM+2                                                      876
      NXMAX3=NXIMAX-5                                                   876
865 DO 875 M1=1,MXROW                                                   877
    DO 870 NQ=1,NQPR                                                    878
    FPRER(NQ,M1)=FPRERM(NQ,M1)*4.0D0                                    879
870 FPREI(NQ,M1)=FPREIM(NQ,M1)*4.0D0                                    880
    FPRERM(1,M1)=FPRER(1,M1)                                            881
      FPRERM(2,M1)=FPRER(3,M1)                                          881
    FPREIM(1,M1)=FPREI(1,M1)                                            882
      FPREIM(2,M1)=FPREI(3,M1)                                          882
    UCR1(M1)=UCR1M(M1)                                                  883
      UCI1(M1)=UCI1M(M1)                                                883
875 CONTINUE                                                            884
    NXPRCH=5                                                            885
      NNX=3                                                             885
    GO TO 1225                                                          886
925 GR1=1.0D0                                                           887
    FI1=1.0D0                                                           887
    GI1=0.0D0                                                           887
    FR1=0.0D0                                                           887
      M4=M3                                                             887
    IF(M3-MXROW) 935,935,930                                            888
930 GR1=0.0D0                                                           889
    GI1=0.0D0                                                           889
    FI1=0.0D0                                                           889
      FR1=1.D0                                                          889
      M4=M3-MXROW                                                       889
935 N1=NNROW(M4)                                                        890
      L1=LLROW(M4)                                                      890
      J1=JJROW(M4)                                                      890
      LL=(L1/2)+1                                                       890
    X=DFLOAT(NXMAX+3)*XMES2                                            KA891
      CFFCLL=DFLOAT(LL*(LL-1))*CFUNIT                                  KA891
    FAC=L1+1                                                            892
      FAC=DSQRT( FAC*((WN(1)/WN(N1))**3))                               892
    DO 950 NQ=1,5                                                       893
    X=X-XMES2                                                           894
    V1=(1.4398650D0*CHARGE/X+CFFCLL/(X*X)-ECM(N1))*DRSQ                 895
    FRR    =GR1*GCRA(LL,NQ,N1)+FR1*FCRA(LL,NQ,N1)                       896
    FII    =GI1*GCRA(LL,NQ,N1)+FI1*FCRA(LL,NQ,N1)                       897
    EX=DCMPLX(FRR,FII)*FAC*EXSGRI(LL,N1)                               KA 898
    FPRERR=EX                                                           899
    FPREII=-TTI*EX                                                      899
    FPRER(NQ,M4)=FPRERR*V1                                              900
      FPREI(NQ,M4)=FPREII*V1                                            900
    IF(NQ-4) 950,945,947                                                901
 945 UCR1(M4)=FPRERR                                                    902
       UCI1(M4)=FPREII                                                  902
       GO TO 950                                                        902
 947 UCR2(M4)=FPRERR                                                    903
       UCI2(M4)=FPREII                                                  903
 950 CONTINUE                                                           904
     NXIMIN=1                                                           905
       NXIMAX=NXMAX-NXRM                                                905
       NXMAX3=NXIMAX-5                                                  905
     X=DFLOAT(NXMAX-1)*XMES2                                           KA906
       K4COR2=NXMAX+4*NDFMES-5                                          906
1225 DO 1800 NX=NXIMIN,NXIMAX                                           907
     N3=(NX+K4COR2)*(2-INEX)+(K4COR2-NX)*(INEX-1)                       908
     X=X+DX                                                             909
       XX2=X*X                                                          909
       XX2INV=1.0D0/XX2                                                 909
     IF(KTRL(13)) 1235,1245,1235                                        910
1235 XX3=X*XX2                                                          911
       XX4=X*XX3                                                        911
       XX3INV=1.0D0/XX3                                                 911
       XX4INV=1.0D0/XX4                                                 911
     IF(X-XBARC) 1241,1241,1243                                        KA912
1241 VCX2X=VCXI2*XX2                                                    913
      VCX2XP=VCXI2P*XX2                                                 913
      VCX3X=VCXI3*XX3                                                   913
      GO TO 1244                                                       KA 913
1243 VCX2X=VCX2*XX3INV                                                  914
       VCX2XP=VCX2P*XX3INV                                              914
       VCX3X=VCX3*XX4INV                                                914
1244 A1=DRSQ*VCX2X                                                     KA914
     A2=DRSQ*VCX2XP                                                    KA914
     A3=DRSQ*VCX3X                                                     KA914
1245 DO 1700 M1=1,MXROW                                                 915
     L1=LLROW(M1)                                                       916
      LL=(L1/2)+1                                                       916
      CFFCLL=DFLOAT((LL-1)*LL)*CFUNIT                                  KA 916
     N1=NNROW(M1)                                                       916
     WCOREC=WC(N1)                                                      917
       IF(NX-(NXCPLE+2)) 1310,1310,1315                                 917
1310 AR2=VCENTR(N3)+VCOULM(N3)+CFFCLL*XX2INV                            918
    1   -SPFACT(M1)*VSPIN(N3)-ECM(N1)                                   919
     AI2=VCENTI(N3)*WCOREC                                              920
       GO TO 1320                                                       920
1315 AR2=CFFCLL*XX2INV+1.4398650D0*CHARGE/X-ECM(N1)                     921
       AI2=0.0D0                                                        921
1320 BR2=AR2*UCR2(M1)-AI2*UCI2(M1)                                      922
     BI2=AR2*UCI2(M1)+AI2*UCR2(M1)                                      923
     BR(M1)=BR2*DRSQ                                                    924
       BI(M1)=BI2*DRSQ                                                  924
CCCCCC      ******      REAL COUPLING      ************************************
     IF(NX-NXCPLE+2) 1330,1330,1610                                     926
1330 AFAC1R=DRSQ      *VCPL1R(N3)                                       927
       AFAC2R=DRSQ      *VCPL2R(N3)                                     927
     IF(KTRL(12)) 1510,1410,1510                                        928
1410 M2MAX=MXROW                                                        929
     IF(INTYPE-3) 1412,1475,1416                                        930
1412 IF(KCTY2) 1413,1415,1413                                           931
1413 IF(M1-1) 1414,1470,1414                                            932
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 1414 M2MAX=1                                                                933
        GO TO 1470                                                           933
 1415 IF(INTMAX-2) 1470,1470,1475                                            934
 1416 IF(INTYPE-4) 1431,1418,1431                                            935
 1418 IF(KTRL(19)) 1485,1420,1485                                            936
 1420 IF(INTMAX-2) 1470,1475,1490                                           KA937
 1431 IF(INTYPE-5) 1490,1420,1490                                            938
 1470 DO 1473 M2=1,M2MAX                                                     939
      AFACTR=AMAT1(M1,M2)*AFAC1R                                             940
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)                                          941
      BI(M1)=BI(M1)+AFACTR*UCI2(M2)                                          942
 1473 CONTINUE                                                               943
      GOTO 1610                                                              943
 1475 DO 1477 M2=1,MXROW                                                     944
      AFACTR=AMAT1(M1,M2)*AFAC1R+AMAT2(M1,M2)*AFAC2R                         945
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)                                          946
      BI(M1)=BI(M1)+AFACTR*UCI2(M2)                                          947
 1477 CONTINUE                                                               948
      GOTO 1610                                                              948
 1485 AFAC3R=DRSQ       *( VCOUPL(9)/VSX)*VCENTR(N3)                         949
      DO 1487 M2=1,MXROW                                                     950
      AFACTR=AMAT1(M1,M2)*AFAC1R+AMAT2(M1,M2)*AFAC2R                         951
     1                          +AMATSS(M1,M2)*AFAC3R                       952
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)                                          953
        BI(M1)=BI(M1)+AFACTR*UCI2(M2)                                        953
 1487 CONTINUE                                                               954
      GOTO 1610                                                              955
 1490 AFAC3R=DRSQ       *VCPD1R(N3)                                          955
      AFAC4R=DRSQ       *VCPD2R(N3)                                          956
        AFAC5R=DRSQ       *VCPD3R(N3)                                        956
      DO 1492 M2=1,MXROW                                                     957
      AFACTR=AMAT1 (M1,M2)*AFAC1R+AMAT2 (M1,M2)*AFAC2R                       958
     1       +AMAT1C(M1,M2)*AFAC3R+AMAT2C(M1,M2)*AFAC4R                      959
     2       +AMATSS(M1,M2)*AFAC5R                                           960
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)                                          961
        BI(M1)=BI(M1)+AFACTR*UCI2(M2)                                        961
 1492 CONTINUE                                                               962
      GOTO 1610                                                              962
CCCCCC      ******      COMPLEX COUPLING.          ***************************
 1510 AFAC1I=DRSQ       *VCPL1I(N3)                                          964
        AFAC2I=DRSQ       *VCPL2I(N3)                                        964
      M2MAX=MXROW                                                            965
      IF(INTYPE-3) 1512,1575,1516                                            966
 1512 IF(KCTY2) 1513,1515,1513                                               967
 1513 IF(M1-1) 1514,1570,1514                                                968
 1514 M2MAX=1                                                                969
        GO TO 1570                                                           969
 1515 IF(INTMAX-2) 1570,1570,1575                                            970
 1516 IF(INTYPE-4) 1531,1520,1531                                            971
 1520 IF(INTMAX-2) 1570,1575,1590                                           KA972
 1531 IF(INTYPE-5) 1590,1520,1590                                            973
 1570 DO 1573 M2=1,M2MAX                                                     974
      AFACTR=AMAT1(M1,M2)*AFAC1R                                             975
        AFACTI=AMAT1(M1,M2)*AFAC1I                                           975
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)-AFACTI*UCI2(M2)                          976
      BI(M1)=BI(M1)+AFACTR*UCI2(M2)+AFACTI*UCR2(M2)                          977
 1573 CONTINUE                                                               978
      GOTO 1610                                                              978
 1575 DO 1577 M2=1,MXROW                                                     979
      AFACTR=AMAT1(M1,M2)*AFAC1R+AMAT2(M1,M2)*AFAC2R                         980
      AFACTI=AMAT1(M1,M2)*AFAC1I+AMAT2(M1,M2)*AFAC2I                         981
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)-AFACTI*UCI2(M2)                          982
      BI(M1)=BI(M1)+AFACTR*UCI2(M2)+AFACTI*UCR2(M2)                          983
 1577 CONTINUE                                                               984
      GOTO 1610                                                              984
 1590 AFAC3R=DRSQ       *VCPD1R(N3)                                          985
      AFAC4R=DRSQ       *VCPD2R(N3)                                          986
      AFAC5R=DRSQ       *VCPD3R(N3)                                          987
      AFAC3I=DRSQ       *VCPD1I(N3)                                          988
      AFAC4I=DRSQ       *VCPD2I(N3)                                          989
      AFAC5I=DRSQ       *VCPD3I(N3)                                          990
      DO 1592 M2=1,MXROW                                                     991
      AFACTR=AMAT1 (M1,M2)*AFAC1R+AMAT2 (M1,M2)*AFAC2R                       992
     1       +AMAT1C(M1,M2)*AFAC3R+AMAT2C(M1,M2)*AFAC4R                      993
     2       +AMATSS(M1,M2)*AFAC5R                                           994
      AFACTI=AMAT1 (M1,M2)*AFAC1I+AMAT2 (M1,M2)*AFAC2I                       995
     1       +AMAT1C(M1,M2)*AFAC3I+AMAT2C(M1,M2)*AFAC4I                      996
     2       +AMATSS(M1,M2)*AFAC5I                                           997
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)-AFACTI*UCI2(M2)                          998
      BI(M1)=BI(M1)+AFACTR*UCI2(M2)+AFACTI*UCR2(M2)                          999
 1592 CONTINUE                                                              1000
CCCCCC      ******      COULOMB EXCITATION.        ***************************
 1610 IF(KTRL(13)) 1620,1700,1620                                           1002
 1620 IF(KCTY2) 1622,1637,1622                                              1003
 1622 IF(MIROW2) 1624,1645,1624                                             1004
 1624 IF(M1-1) 1628,1626,1628                                               1005
 1626 M2MIN=MIROW2                                                          1006
        M2MAX=MXROW2                                                        1006
        GO TO 1640                                                          1006
 1628 IF(M1-MIROW2) 1645,1633,1633                                          1007
 1633 IF(M1-MXROW2) 1635,1635,1645                                          1008
 1635 M2MIN=1                                                               1009
        M2MAX=1                                                             1009
        GO TO 1640                                                          1009
 1637 M2MIN=1                                                               1010
        M2MAX=MXROW                                                         1010
CCCCCC      ******      L=2 MULTIPLE COULOMB COUPLING.     *******         1011
 1640 DO 1643 M2=M2MIN,M2MAX                                               KA1013
      AFACTR=AMAT1C(M1,M2)*A1                                              KA1014
      BR(M1)=BR(M1)+AFACTR*UCR2(M2)                                          1015
      BI(M1)=BI(M1)+AFACTR*UCI2(M2)                                          1016
 1643 CONTINUE                                                              1017
CCCCCC      ******      L=2 DIRECT COULOMB COUPLING.       ******          1018
 1645 IF(MIRW2P) 1650,1665,1650                                             1019
 1650 IF(M1-1) 1655,1651,1655                                               1020
 1651 DO 1653 M2=MIRW2P,MXRW2P                                             KA1022
      AFACTR=AMATCP(M2)*A2                                                 KA1023
      BR( 1)=BR( 1)+AFACTR*UCR2(M2)                                          1024
 1653 BI( 1)=BI( 1)+AFACTR*UCI2(M2)                                          1025
      GO TO 1665                                                            1026
 1655 IF(M1-MIRW2P) 1665,1657,1657                                          1027
 1657 IF(M1-MXRW2P) 1659,1659,1665                                          1028
 1659 AFACTR=AMATCP(M1)*A2                                                 KA1030
      BR(M1)=BR(M1)+AFACTR*UCR2(1)                                          1031
      BI(M1)=BI(M1)+AFACTR*UCI2(1)                                          1032
CCCCCC      ******      L=3 COULOMB COUPLING.      ************            1034
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1665 IF(MIROW3) 1670,1700,1670
1670 IF(M1-1) 1674,1672,1674
1672 M2MIN=MIROW3
       M2MAX=MXROW3
       GO TO 1680
1674 IF(M1-MIROW3) 1700,1676,1676
1676 IF(M1-MXROW3) 1678,1678,1700
1678 M2MIN=1
       M2MAX=1
1680 DO 1685 M2=M2MIN,M2MAX
     AFACTR=AMAT2C(M1,M2)*A3
     BR(M1)=BR(M1)+AFACTR*UCR2(M2)
     BI(M1)=BI(M1)+AFACTR*UCI2(M2)
1685 CONTINUE
1700 CONTINUE
     IF(KTLOUT(10)-2)4190,4110,4190
4110 IF(LLROW(1)-2) 4120,4120,4190
4120 WRITE(6,4125) NX,X,(UCR2(M),UCI2(M),UCR1(M),UCI1(M),M=1,2)
4125 FORMAT(4H NX=I3,3H X=F8.4,8E12.4)
4190 CONTINUE
     DO 1740 M1=1,MXROW
     IF(INEX-1) 1714,1711,1714
1711 IF(ND-1) 1714,1712,1714
1712 IF(NX-4) 1713,1713,1714
1713 TERMR=BR(M1)
     FPRER(NX,M1)=TERMR
     TERMI=BI(M1)
     FPREI(NX,M1)=TERMI
     GO TO 1715
1714 FPRER(5,M1)=BR(M1)
       FPREI(5,M1)=BI(M1)
     TERMR =PRE41*FPRER (1,M1)+PRE42*FPRER (2,M1)+PRE43*FPRER (3,M1)
    1       +PRE44*FPRER (4,M1)+PRE45*FPRER (5,M1)
     TERMI =PRE41*FPREI (1,M1)+PRE42*FPREI (2,M1)+PRE43*FPREI (3,M1)
    1       +PRE44*FPREI (4,M1)+PRE45*FPREI (5,M1)
1715 IF(KTRL(2).LE.0) GO TO 1720
     IF(DABS(TERMR).LT.EXPINV) TERMR=0.DO
     IF(DABS(TERMI).LT.EXPINV) TERMI=0.DO
1720 ARR=2.0D0*UCR2(M1)-UCR1(M1)+TERMR
     AII=2.0D0*UCI2(M1)-UCI1(M1)+TERMI
     UCR1(M1)=UCR2(M1)
       UCR2(M1)=ARR
     UCI1(M1)=UCI2(M1)
       UCI2(M1)=AII
     IF(KTRL(2))1716,1716,1721
1721 IF(DABS(ARR)+DABS(AII)-EXPKT) 1716,1716,1722
1722 CALL RANGE(SHIFT)
1716 IF(INEX-1) 1735,1717,1735
1717 IF(ND-NDFMES) 1718,1729,1718
1718 IF(NX-NXPRCH) 1729,1719,1729
1719 FPRERM(NNX,M1)=BR(M1)
       FPREIM(NNX,M1)=BI(M1)
     IF(M1-MXROW) 1725,1723,1725
1723 NXPRCH=NXPRCH+2
       NNX=NNX+1
1725 IF(NX-(NXIMAX-1)) 1729,1728,1729
1728 UCR1M(M1)=UCR1(M1)
       UCI1M(M1)=UCI1(M1)
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 1729 IF(ND-1) 1735,1730,1735                                          1076
 1730 IF(NX-4) 1740,1740,1735                                          1077
 1735 DO 1738 NQ=1,NQPR                                                1078
      FPRER(NQ,M1)=FPRER(NQ+1,M1)                                      1079
 1738 FPREI(NQ,M1)=FPREI(NQ+1,M1)                                      1080
 1740 CONTINUE                                                         1081
      IF(ND-NDMAX ) 1800,176C,1800                                     1082
 1760 NXCH2=NX-NXMAX3                                                  1083
        IF(NXCH2)1800,1800,1765                                        1083
 1765 DO 1770 M1=1,MXROW                                               1084
      URFORD(M1,NXCH2)=UCR2(M1)                                        1085
        UIFORD(M1,NXCH2)=UCI2(M1)                                      1085
 1770 CONTINUE                                                         1086
 1800 CONTINUE                                                         1087
CCCCCC      ******      CALCULATION OF THE DERIVATIVES      ******     1088
      IF(ND-NDMAX ) 1890,1805,1890                                     1089
 1805 DO 1850 M1=1,MXROW                                               1090
      UCR1(M1)=URFORD(M1,3)                                            1091
        UCI1(M1)=UIFORD(M1,3)                                          1091
      N1=NNROW(M1)                                                     1092
        DENOM=1.0D0/(12.0D0*DX*WN(N1))                                 1092
      UCR2(M1)   =(8.0D0*(URFORD(M1,4)-URFORD(M1,2))                   1093
     1                -(URFORD(M1,5)-URFORD(M1,1)))*DENOM               1094
      UCI2(M1)   =(8.0D0*(UIFORD(M1,4)-UIFORD(M1,2))                   1095
     1                -(UIFORD(M1,5)-UIFORD(M1,1)))*DENOM               1096
 1850 CONTINUE                                                         1097
 1890 CONTINUE                                                         1098
      IF(KBOUND) 1892,1897,1892                                        1099
 1892 CALL RANGE(SHIFT)                                               KA1100
      IF(SHIFT.NE.0.D0) GO TO 1892                                     KA1100
      DO 1895 M1=1,MXROW                                               KA1100
      UCRI(M1)=DCMPLX(UCR1(M1),UCI1(M1))                               KA1101
 1895 UDRI(M1)=DCMPLX(UCR2(M1),UCI2(M1))                               KA1102
      WRITE (8)    (UCRI(M1),UDRI(M1),M1=1,MXROW)                      1103
      GO TO 1898                                                       KA1104
 1897 WRITE (8)    (UCR1(M1),UCI1(M1),UCR2(M1),UCI2(M1),M1=1,MXROW)    1105
 1898 IF(KTLOUT(10)-3) 1900,1899,1900                                  KA1105
 1899 WRITE(6,4060) (UCR1(M1),UCI1(M1),UCR2(M1),UCI2(M1),M1=1,MXROW)   KA1105
 4060 FORMAT(3H UC/(4(2H (,E14.7,1H,,E14.7,1H))))                      KA1105
 1900 CONTINUE                                                         1106
 1950 CONTINUE                                                         1107
      CALL SMATRX                                                      1108
      RETURN                                                           KA1109
      END                                                              1110
```

```
C     EXPONENT SHIFT FOR REALS
      SUBROUTINE RANGE(SHIFT)
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                          KA762
           COMPLEX*16 TTR,TTI,ZERO                                       KA762
      CCMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9       KA763
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)              764
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD         KA765
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  766
     1             ECM(10),                                                767
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),   768
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  769
     4             WN(10),WNINI(10),WC(10)                                 770
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,       771
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,         772
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,   773
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,            774
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,     775
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                         776
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
      COMPLEX*16 UCRI,UDRI,EX,EXSGRI                                     KA778
      COMMON     EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)        780
      COMMON      VCENTR(200),VCENTI(200),VSPIN (200),VCOULM(200),         781
     1            VCPL1R(200),VCPL1I(200),VCPL2R(200),VCPL2I(200),         782
     2            VCPD1R(200),VCPD1I(200),VCPD2R(200),VCPD2I(200),         783
     3            VCPD3R(200),VCPD3I(200)                                  784
      COMMON     AMAT1 (30,30),AMAT2 (30,30),AMATCP(60   ),               785
     1           AMAT1C(30,30),AMAT2C(30,30),AMATSS(30,30)                786
      COMMON     UCR1(30),UCI1(30),UCR2(30),UCI2(30),                     787
     1           URFORD(30,5),UIFORD(30,5),SPFACT(30),                    788
     2           FPRER(5,30),FPREI(5,30),FPRERM(4,30),FPREIM(4,30),       789
     3           UCR1M(30),UCI1M(30)                                      790
      DIMENSION  FCRA(14,5,6),FDCRA(14,5,6),GCRA(14,5,6),GDCRA(14,5,6),   791
     1           UCRI(30),UDRI(30)                                        792
      EQUIVALENCE (FC(1),FCRA(1)),(FDC(1),FDCRA(1)),(GC(1),GCRA(1)),     KA 793
     1(GDC(1),GDCRA(1)),(UCRI(1),URFORD(1)),(UDRI(1),UIFORD(1))          KA 794
      IF(SHIFT) 1,6,1
    1 A=DMIN1(DABS(SHIFT),DFLOAT(KTRL(2)))
      A=DSIGN(A,SHIFT)
      SHIFT=SHIFT-A
      A=DEXP(-A)
      DO 5 I=1,MXROW
      BR(I)=A*BR(I)
      BI(I)=A*BI(I)
      UCR1(I)=A*UCR1(I)
      UCI1(I)=A*UCI1(I)
      UCR2(I)=A*UCR2(I)
      UCI2(I)=A*UCI2(I)
      UCR1M(I)=A*UCR1M(I)
      UCI1M(I)=A*UCI1M(I)
      DO 4 J=1,5
      IF(J-5) 2,3,3
    2 FPRERM(J,I)=A*FPRERM(J,I)
      FPREIM(J,I)=A*FPREIM(J,I)
    3 FPRER(J,I)=A*FPRER(J,I)
      FPREI(J,I)=A*FPREI(J,I)
    4 CONTINUE
    5 CONTINUE
    6 RETURN
      END
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JH
      SUBROUTINE BMATRX                                                  1111
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                         KA1112
      COMPLEX*16 TTR,TTI,ZERO                                           KA1112
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      KA1113
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)             1114
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA1115
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  1116
     1             ECM(10),                                                1117
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),   1118
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  1119
     4             WN(10),WNINI(10),WC(10)                                 1120
      CCMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,       1121
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,         1122
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,   1123
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,            1124
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,     1125
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                         1126
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
      COMPLEX*16 EXSGRI                                                 KA1129
      COMMON     EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)       1130
      COMMON      VCENTR(200),VCENTI(200),VSPIN (200),VCOULM(200),        1131
     1            VCPL1R(200),VCPL1I(200),VCPL2R(200),VCPL2I(200),        1132
     2            VCPD1R(200),VCPD1I(200),VCPD2R(200),VCPD2I(200),        1133
     3            VCPD3R(200),VCPD3I(200)                                 1134
      COMMON     AMAT1 (30,30),AMAT2 (30,30),AMATCP(60   ),              1135
     1           AMAT1C(30,30),AMAT2C(30,30),AMATSS(30,30),              1136
     2           B(10,10,10),KII(24),ALP23P(7,3),ALSQ3P(7,3),            1137
     3           IITYPE(10),KQNOTW(7)                                    1138
      PI=3.141592653589793                                              KA1139
      CON1=1.D0/DSQRT(4.D0*PI)                                          KA1139
      CON2=DSQRT(2.D0*PI)                                               KA1139
      CON3=DSQRT(.5D0)                                                  KA1139
      CON4=1.D0/DSQRT(2.5D0)                                            KA1139
      CON5=1.D0/DSQRT(3.5D0)                                            KA1139
      CON6=1.D0/DSQRT(5.D0)                                             KA1139
      CON7=1.D0/DSQRT(7.D0)                                             KA1139
      CON8=DSQRT(.1D0)                                                  KA1139
      CON9=DSQRT(18.D0/35.D0)                                           KA1139
      CON10=DSQRT(4.9D0)                                                KA1139
      CON11=DSQRT(2.D1/35.D0)                                           KA1139
      CON12=DSQRT(36.D0/35.D0)                                          KA1139
      CON13=DSQRT(1.25D0)                                               KA1139
      CON14=DSQRT(5.D0/14.D0)                                           KA1139
      JJ=KEXCOM(45)                                                       1139
       KTRL1T=KTRL(1)*(1-KTRL(7))                                         1139
      KT1PIS=KTRL1T+ISTRTW                                                1140
        KTISCK=MOD(KT1PIS,2)                                            KA1140
      JJTRTW=2*JJ-2+KTISCK                                                1141
      DO 50 N1=1,6                                                        1142
        DO 50 N2=1,6                                                      1142
        DO 50 K1=1,10                                                     1142
   50 B(N1,N2,K1)=0.0D0                                                   1143
      CALL DOTEST( 1143,MXROW,30)
      DO 60 M=1,MXROW                                                     1144
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      DO 55 N=1,MXROW                                                    1145
      AMAT1 (M,N)=0.0D0                                                  1146
      AMAT2 (M,N)=0.0D0                                                  1146
      AMAT1C(M,N)=0.0D0                                                  1146
      AMAT2C(M,N)=0.0D0                                                  1146
      AMATSS(M,N)=0.0D0                                                  1146
   55 CONTINUE                                                           1146
   60 AMATCP(M)=0.0D0                                                    1147
      IF(KTRL(7)) 1000,70,1000                                           1148
   70 COMFAC= CON1                                                      KA1149
        KII(1)=IIREAD(2)                                                 1149
      B(1,2,1)=VCOUPL(1)*COMFAC                                          1150
      GO TO (1000,210,310,410,510,610), INTYPE                           1151
  210 KII(2)=3                                                           1152
      B(1,3,2)=VCOUPL(2)*COMFAC                                          1153
        IF(INTMAX-3) 1000,232,232                                        1153
  232 HATISQ=IIREAD(IICPLE)*2+1                                        KA1154
        HATI=DSQRT( HATISQ)                                              1154
      B(3,4,1)=VCOUPL(3)*COMFAC*HATI*CON6                              KA1155
      B(2,4,2)=VCOUPL(4)*COMFAC*HATI*CON7*((-1.D0)**IIREAD(IICPLE))    KA1156
      VCPL23=VCOUPL(3)*VCOUPL(4)*COMFAC*CON1                           KA1157
      KII(3)=1                                                           1158
        KII(4)=3                                                         1158
        KII(5)=5                                                         1158
        IA=4                                                             1158
        IB=6                                                             1158
        ID=0                                                             1158
      IE=0                                                               1159
        IF=0                                                             1159
      DO 240 K1=3,5                                                      1160
      IC=KII(K1)*2                                                       1161
        CALL CLEB                                                        1161
        B(2,3,K1)=VCPL23*RAC                                             1161
      IF(KII(K1)-IIREAD(IICPLE)) 240,235,240                           KA1162
  235 B(1,4,K1)=VCPL23*RAC                                               1163
  240 CONTINUE                                                           1164
      GO TO 1000                                                         1165
  310 COMFC2=COMFAC/CON2                                               KA1166
        IIRMX1=IICPLE-KEXCOM(13)                                         1166
      NTPHST=IIRMX1-2                                                    1167
        KII(2)=0                                                         1167
        KII(3)=2                                                         1167
        KII(4)=4                                                         1167
      KII(5)=0                                                           1168
        KII(6)=2                                                         1168
        KII(7)=4                                                         1168
      CALL DOTEST( 1169,NTPHST,8)
      DO 340 N1=3,IIRMX1                                                 1169
      I1=IIREAD(N1)                                                      1170
       N2=I1+2                                                           1170
       N3=N2+1                                                           1170
       N4=(I1/2)+2                                                       1170
       HAT=I1+I1+1                                                       1170
      HAT=DSQRT( HAT)                                                    1171
      B(2,N1,1)=COMFAC*VCOUPL(N2)*HAT*CON4                             KA1172
      N22=(I1/2)+8                                                       1173
        N44=N22-3                                                        1173
      B(1,N1,N44)=COMFAC*VCOUPL(N22)                                     1174
        I1M2=I1-2                                                        1175
          IF(I1M2)331,333,335                                            1175
  331 CLEB1=CON6                                                       KA1176
          GO TO 337                                                      1176
  333 CLEB1=-CON5                                                      KA1177
          GO TO 337                                                      1177
  335 CLEB1=CON9                                                       KA1178
  337 VC12=VCOUPL(N3)                                                    1179
      B(1,N1,N4)=(VC12**2)*COMFC2*CLEB1                                  1180
  340 CONTINUE                                                           1181
      INTMAX=7                                                           1182
        IF(KTRL(4)) 351,375,351                                          1182
  351 ALFADG=VCOUPL(1)**2                                                1183
        ALFADG=ALFADG*COMFC2                                             1183
      B(1,1,2)=ALFADG*CON3                                             KA1184
        B(2,2,2)=ALFADG*CON10                                          KA1184
      B(2,2,3)=ALFADG*CON11                                            KA1185
        B(2,2,4)=ALFADG*CON12                                          KA1185
      DO 370 K1=2,4                                                      1186
      K1M1=K1-1                                                          1187
        GO TO (353,355,357),K1M1                                         1187
  353 FKFAC=CON13                                                      KA1188
        FKHAT=1.0D0                                                      1188
        IF=0                                                             1188
        GO TO 360                                                        1188
  355 FKFAC=CON14                                                      KA1189
        FKHAT=1.D0/CON6                                                KA1189
        IF=4                                                             1189
        GO TO 360                                                        1189
  357 FKFAC=CON14                                                      KA1190
        FKHAT=3.0D0                                                      1190
        IF=8                                                             1190
  360 IA=4                                                               1191
        IC=4                                                             1191
        IE=4                                                             1191
      DO  370 N1=1,NTPHST                                                1192
        I1=IIREAD(N1+2)                                                  1192
        IB=I1+I1                                                         1192
      HAT1SQ=IB+1                                                        1193
        HAT1=DSQRT(0.2D0*HAT1SQ)                                         1193
      DO  370 N2=N1,NTPHST                                               1194
        IF(N1-N2) 369,365,369                                            1194
  365 IF(K1-2) 369,367,369                                               1195
  367 B(N1+2,N2+2,2)=HAT1                                                1196
  369 I2=IIREAD(N2+2)                                                    1197
       ID=I2+I2                                                          1197
       HAT2SQ=ID+1                                                       1197
      HAT2=DSQRT(3.2D0*HAT2SQ)                                           1198
      CALL RAC7                                                          1198
        SNDTRM=HAT1*HAT2*FKHAT*RAC                                       1198
      B(N1+2,N2+2,K1)=FKFAC*VCOUPL(2*N1+1)*VCOUPL(2*N2+1)                1199
     1         *(B(N1+2,N2+2,K1)+SNDTRM)                                 1200
  370 CONTINUE                                                           1201
  375 IF(KEXCOM(13)) 377,1000,377                                        1202
  377 SQRT10=CON8                                                      KA1203
        SQRT2 =CON3                                                    KA1203
      C1FAC=COMFAC*SQRT10*VCOUPL(11)                                     1204
       C2FAC=COMFC2*SQRT2*(VCOUPL(12)**2)                                1204
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      DO 379 K1=1,3                                                     1205
        DO 379 J1=1,7                                                   1205
      ALP23P(J1,K1)=0.0D0                                               1206
        ALSQ3P(J1,K1)=0.D0                                              1206
  379 CONTINUE                                                          1207
C     TABLE I(B)
      ALP23P(1,2)= DSQRT(6.D0)                                        KA1208
      ALP23P(3,1)= DSQRT(14.D0)                                       KA1209
      ALP23P(3,2)= DSQRT(40.D0/7.D0)                                  KA1210
      ALP23P(3,3)= DSQRT(72.D0/7.D0)                                  KA1211
      ALP23P(4,2)=-DSQRT(30.D0)                                       KA1212
      ALP23P(4,3)= DSQRT(12.D0)                                       KA1213
      ALP23P(5,2)= DSQRT(198.D0/7.D0)                                 KA1214
      ALP23P(5,3)= DSQRT(180.D0/7.D0)                                 KA1215
      ALP23P(7,3)= DSQRT(78.D0)                                       KA1216
C     TABLE I(C)
      ALSQ3P(1,2)=-DSQRT(12.D0/35.D0)                                 KA1217
      ALSQ3P(3,1)= DSQRT(14.D0/5.D0)                                  KA1218
      ALSQ3P(3,2)=-DSQRT(16.D0/49.D0)                                 KA1219
      ALSQ3P(3,3)= DSQRT(144.D0/245.D0)                               KA1220
      ALSQ3P(4,2)= DSQRT(4.D0/21.D0)                                  KA1221
      ALSQ3P(4,3)= DSQRT(8.D0/105.D0)                                 KA1222
      ALSQ3P(5,2)=-DSQRT(396.D0/245.D0)                               KA1223
      ALSQ3P(5,3)= DSQRT(72.D0/49.D0)                                 KA1224
      ALSQ3P(7,3)= DSQRT(156.D0/35.D0)                                KA1225
      N3P=IIRMX1+1                                                      1226
        I3PP1=IIREAD(N3P)+1                                             1226
      DO 380 N1=1,NTPHST                                                1227
       N2P=N1+2                                                         1227
       I2PP=(IIREAD(N2P)/2)+1                                           1227
      B(N2P,N3P,1)=C1FAC*ALP23P(I3PP1,I2PP)                             1228
  380 CONTINUE                                                          1229
      DO 385 K1=1,3                                                     1230
      B(2,N3P,K1+1)=C2FAC*ALSQ3P(I3PP1,K1)                              1231
  385 CONTINUE                                                          1232
      GO TO 1000                                                        1233
  410 ROTFAC=CON1                                                     KA1234
        KII(1)=2                                                        1234
        KII(2)=4                                                        1234
       KII(3)=6                                                       KA1234
       KII(4)=8                                                       KA1234
      IF=2*IIREAD(1)-KTRL(1)                                            1235
      ID=IF                                                             1235
        IE=0                                                            1235
      DO 450 N3=1,INTMAX                                                1236
      IF(KTRL(19)) 415,420,415                                          1237
  415 IF(N3-INTMAX) 420,435,420                                         1238
  420 IB=2*KII(N3)                                                      1239
      DO 430 N1= 1,IICPLE                                               1240
        I1=IIREAD(N1)                                                   1240
        IC=2*I1-KTRL(1)                                                 1240
      DO 430 N2=N1,IICPLE                                               1241
        I2=IIREAD(N2)                                                   1241
        IA=2*I2-KTRL(1)                                                 1241
      HATA=IA+1                                                         1242
        HATA=DSQRT( HATA)                                               1242
      CALL CLEB                                                         1243
  430 B(N1,N2,N3)=ROTFAC*HATA*RAC                                       1244
      GO TO 450                                                         1245
  435 DO 440 N1=1,IICPLE                                                1246
      ITW=IIREAD(N1)*2-1                                                1247
        ELSQ=ITW*(ITW+1)*(ITW+2)                                        1247
      ELSQ=DSQRT( ELSQ)                                                 1248
  440 B(N1,N2,N3)=0.5D0*ELSQ*VCOUPL(3)                                  1249
  450 CONTINUE                                                          1250
      GO TO 1000                                                        1251
  510 IF(INTMAX-1) 555,515,555                                          1252
  515 KII(1)=2+IABS( KPRITR(2)-KPRITR(1))                               1253
        I1=IIREAD(1)                                                    1253
      DO 520 N2=2,IICPLE                                                1254
      I2=IIREAD(N2)                                                     1255
        HATI2=2*I2                                                      1255
      HATFC=DSQRT(HATI2/5.D0)*((-1.D0)**(I2-I1))                        1256
  520 B(1,N2,1)=COMFAC*HATFC*VCOUPL(N2-1)                               1257
      GO TO 1000                                                        1258
  555 N1PHST=IICPLE-1                                                   1259
        IIGRND=IIREAD(1)                                                1259
      IRTRTW=KEXCOM(12)*2                                               1260
        HATR=IRTRTW+1                                                   1260
      KII(1)=2                                                          1261
        KII(2)=KEXCOM(12)                                               1261
      A3=VCOUPL(7)                                                      1262
        B3=VCOUPL(8)*DSQRT(1.0D0-A3*A3)                                 1262
      A5=VCOUPL(9)                                                      1263
       B5=VCOUPL(10)*DSQRT( 1.0D0-A5*A5)                                1263
      COMFC2=COMFAC/CON2                                              KA1264
      DO 585 N1=2,IICPLE                                                1265
        III=IIREAD(N1)                                                  1265
        HAT1=III*2                                                      1265
      HATI=(III/2)*4+1                                                  1266
      IF(N1-N1PHST) 561,561,564                                         1267
  561 IF(III-2) 563,562,563                                             1268
  562 A1=A3                                                             1269
        B1=B3                                                           1269
        GO TO 569                                                       1269
  563 A1=A5                                                             1270
        B1=B5                                                           1270
        GO TO 569                                                       1270
  564 IF(KEXCOM(12)/2-1) 565,566,565                                    1271
  565 A1=0.D0                                                           1272
        B1=1.D0                                                         1272
        GO TO 569                                                       1272
  566 IF(III-2) 568,567,568                                             1273
  567 A1=-B3*VCOUPL(4)                                                  1274
        B1=A3                                                           1274
        GO TO 569                                                       1274
  568 A1=-B5*VCOUPL(4)                                                  1275
        B1=A5                                                           1275
  569 S1=(-1.D0 )**MOD(III-IIGRND,2)                                  KA1276
      B(1,N1,1)=COMFAC*S1*DSQRT( HAT1/HATI)*VCOUPL(1)*A1                1277
      IA=4                                                              1278
      IB=4                                                              1278
        IC=(III/2)*4                                                    1278
      ID=0                                                              1278
      IE=0                                                              1278
      IF=0                                                              1278
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      CALL CLEB                                                          1278
     C1=RAC                                                              1278
    B(1,N1,2)=COMFC2*S1*C1*DSQRT( HAT1/HATI)*(VCOUPL(3)**2)*B1           1279
    DO 585 N2=N1,IICPLE                                                 1280
      II2=IIREAD(N2)                                                    1280
      HAT2=II2*2                                                        1280
    HATII=(II2/2)*4+1                                                   1281
    IF(N2-N1PHST) 571,571,574                                           1282
571 IF(II2-2) 573,572,573                                               1283
572 A2=A3                                                               1284
      B2=B3                                                             1284
      GO TO 579                                                         1284
573 A2=A5                                                               1285
      B2=B5                                                             1285
      GO TO 579                                                         1285
574 IF(KEXCOM(12)/2-1) 575,576,575                                      1286
575 A2=0.D0                                                             1287
      B2=1.D0                                                           1287
      GO TO 579                                                         1287
576 IF(II2-2) 578,577,578                                               1288
577 A2=-B3*VCOUPL(4)                                                    1289
      B2=A3                                                             1289
      GO TO 579                                                         1289
578 A2=-B5*VCOUPL(4)                                                    1290
      B2=A5                                                             1290
579 IA=4                                                                1291
      IB=(II1/2)*4                                                      1291
      IC=II2*2-1                                                        1291
    ID=IIGRND*2-1                                                       1292
      IE=(II2/2)*4                                                      1292
      IF=II1*2-1                                                        1292
    CALL RAC7                                                           1293
      R1=RAC                                                            1293
    GEOFAC=DSQRT(0.4D0*HATII*HAT1*HAT2)*((-1.D0)**(II1-II2))*VCOUPL(2)  1294
    B(N1,N2,1)=COMFAC*GEOFAC*(A2*B1+A1*B2)*R1                           1295
585 CONTINUE                                                            1296
    GO TO 1000                                                          1297
610 ROTFAC=CON1                                                        KA1298
      ROTFC2=ROTFAC*ROTFAC                                              1298
    KQNOTW(1)=0                                                         1299
      KQNOTW(2)=0                                                       1299
      KQNOTW(3)=0                                                       1299
      KQNOTW(4)=4                                                       1299
    KQNOTW(5)=2                                                         1300
      KQNOTW(6)=4                                                       1300
      KQNOTW(7)=6                                                       1300
    SQRT5=1.D0/CON6                                                    KA1301
    SQRT7=1.D0/CON7                                                    KA1301
    NB=0                                                                1302
    DO 620 N=1,7                                                        1303
    IF(KEXCOM(N+20)) 615,620,615                                        1304
615 ITRANG=KEXCOM(N+20)                                                 1305
    DO 617 IT=1,ITRANG                                                  1306
      NB=NB+1                                                           1306
617 IITYPE(NB)=N                                                        1307
620 CONTINUE                                                            1308
    DO 690 KIREPT=1,4                                                   1309
      KEXCOM(28)=KIREPT                                                 1309
    GO TO (631,632,633,634),KIREPT                                      1310
631 INTMAX=2                                                            1311
    KII(1)=2                                                            1312
      KII(2)=4                                                          1312
      GO TO 640                                                         1312
632 INTMAX=2                                                            1313
      LAMDAP=0                                                          1313
    KII(1)=2                                                            1314
      KII(2)=3                                                          1314
      GO TO 640                                                         1314
633 INTMAX=6                                                            1315
      LAMDAP=2                                                          1315
    KII(1)=0                                                            1316
      KII(2)=2                                                          1316
      KII(3)=4                                                          1316
    KII(4)=1                                                            1317
      KII(5)=3                                                          1317
      KII(6)=5                                                          1317
      GO TO 640                                                         1317
634 INTMAX=7                                                            1318
      LAMDAP=4                                                          1318
    KII(1)=2                                                            1319
      KII(2)=4                                                          1319
      KII(3)=6                                                          1319
    KII(4)=1                                                            1320
      KII(5)=3                                                          1320
      KII(6)=5                                                          1320
      KII(7)=7                                                          1320
640 DO 641 N1=1,IICPLE                                                  1321
      DO 641 N2=1,IICPLE                                                1321
      DO 641 N3=1,INTMAX                                                1321
641 B(N1,N2,N3)=0.0 D0                                                  1322
    IF(KIREPT-1) 643,645,643                                            1323
643 LMDPTW=LAMDAP*2                                                     1324
      HATLDP=LMDPTW+1                                                   1324
      HATLDP=DSQRT( HATLDP)                                             1324
645 DO 680 K1=1,INTMAX                                                  1325
    LAMDA=KII(K1)                                                       1326
      LAMDTW=LAMDA*2                                                    1326
    HATLMD=LAMDTW+1                                                     1327
      HATLMD=DSQRT( HATLMD)                                             1327
    DO 680 N1=1,IICPLE                                                  1328
    I1=IIREAD(N1)                                                       1329
      I1TW=I1+I1-KTRL(1)                                                1329
      IT1=IITYPE(N1)                                                    1329
    DO 675 N2=N1,IICPLE                                                 1330
    I2=IIREAD(N2)                                                       1331
      I2TW=2*I2-KTRL(1)                                                 1331
    HATI2=I2TW+1                                                        1332
      HATI2=DSQRT( HATI2)                                               1332
      IT2=IITYPE(N2)                                                    1332
    IF(KIREPT-1) 655,651,655                                            1333
651 IF(IT1-IT2) 675,652,675                                             1334
652 IA=I2TW                                                             1335
      IB=2*KII(K1)                                                      1335
      IC=I1TW                                                           1335
    IF=KQNOTW(IT1)                                                      1335
    ID=IF                                                               1335
```

```
      IE=0                                                              1336
        CALL CLEB                                                       1336
     B(N1,N2,K1)=ROTFAC*HATI2*RAC                                       1337
        GO TO 675                                                       1337
  655 IF(IT1-1) 675,656,675                                             1338
  656 IF(IT2-1) 657,675,657                                             1339
  657 IT2M1=IT2-1                                                       1340
      GO TO (661,662,661,662,662,662),IT2M1                             1341
  661 IA=4                                                              1342
        C1=SQRT5                                                        1342
        GO TO 663                                                       1342
  662 IA=6                                                              1343
        C1=SQRT7                                                        1343
  663 IB=LMDPTW                                                         1344
        IC=LAMDTW                                                       1344
      ID=0                                                              1344
      IE=0                                                              1344
      IF=0                                                              1344
        CALL CLEB                                                       1344
        R1=RAC                                                          1344
      GO TO (666,666,665,665,665,665),IT2M1                             1345
  665 IF=KQNOTW(IT2)                                                    1346
      ID=IF                                                             1346
        CALL CLEB                                                       1346
  666 R2=RAC                                                            1347
      IE=-ID                                                            1348
        IF=0                                                            1348
      IA=I2TW                                                           1349
        IB=LAMDTW                                                       1349
        IC=I1TW                                                         1349
        CALL CLEB                                                       1349
        R3=RAC                                                          1349
      RCFAC=R1*R2*R3*C1*VCOUPL(IT2+1)                                   1350
      ROTFC3=ROTFC2*HATI2*HATLDP/HATLMD                                 1351
      B(N1,N2,K1)=ROTFC3*RCFAC                                          1352
  675 CONTINUE                                                          1353
  680 CONTINUE                                                          1354
      CALL AMATRX                                                       1355
  690 CONTINUE                                                          1356
      GO TO 2000                                                        1357
 1000 CALL AMATRX                                                       1358
 2000 RETURN                                                        KA 1359
      END                                                               1360
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JI
      SUBROUTINE AMATRX                                                 1361
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                        KA1362
      COMPLEX*16 TTR,TTI,ZERO                                          KA1362
      COMMON      FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      KA1363
      COMMON      KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)             1364
      COMMON      F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA1365
      COMMON      ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  1366
     1            ECM(10),                                               1367
     2            IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  1368
     3            NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  1369
     4            WN(10),WNINI(10),WC(10)                                1370
      COMMON      ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,      1371
     1            IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,        1372
     2            AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  1373
     3            PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,           1374
     4            RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,    1375
     5            XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                        1376
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES   *******
      COMPLEX*16 EXSGRI                                                KA1378
      COMMON     EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)      1380
      COMMON      VCENTR(200),VCENTI(200),VSPIN (200),VCOULM(200),       1381
     1            VCPL1R(200),VCPL1I(200),VCPL2R(200),VCPL2I(200),       1382
     2            VCPD1R(200),VCPD1I(200),VCPD2R(200),VCPD2I(200),       1383
     3            VCPD3R(200),VCPD3I(200)                                1384
      COMMON     AMAT1 (30,30),AMAT2 (30,30),AMATCP(60    ),            1385
     1           AMAT1C(30,30),AMAT2C(30,30),AMATSS(30,30),              1386
     2           B(10,10,10),KII(24)                                     1387
      KIREPT=KEXCOM(28)                                                  1388
      PI=3.1415926535897793                                            KA1388
      CON1=1.D0/DSQRT(4.D0*PI)                                         KA1388
        JJ=KEXCOM(45)                                                    1388
      KTRL1T=KTRL(1)*(1-KTRL(7))                                         1389
        KT1PIS=KTRL1T+ISTRTW                                             1389
      KTISCK=KT1PIS-2*(KT1PIS/2)                                         1390
        JJTRTW=2*JJ-2+KTISCK                                             1390
      MJBRTW=-JJTRTW                                                     1391
        IF(KTRL(7)) 910,570,910                                          1391
  570 CALL DOTEST (1391,MXROW,30)
      CALL DOTEST (1392,INTMAX,10)
      DO 900 M1=1,MXROW                                                  1392
      N1=NNROW(M1)                                                       1393
       I1=IIREAD(N1)                                                     1393
       J1=JJROW(M1)                                                      1393
       L1=LLROW(M1)                                                      1393
      DO 900 M2=M1,MXROW                                                 1394
      N2=NNROW(M2)                                                       1395
       I2=IIREAD(N2)                                                     1395
       J2=JJROW(M2)                                                      1395
       L2=LLROW(M2)                                                      1395
      KISELC=1                                                           1396
      DO 890 K1=1,INTMAX                                                 1397
      KASPSP=0                                                           1398
        IF(KTRL(19)) 711,713,711                                         1398
  711 IF(K1-3) 713,712,713                                               1399
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712 KASPSP=1                                                          1400
713 B1=B(N1,N2,K1)                                                    1401
      IF(B1) 720,890,720                                              1401
720 KI=KII(K1)                                                        1402
    IF(INTYPE-2) 730,725,730                                          1403
725 KISELC=1                                                          1404
    IF(K1-3) 750,726,726                                              1405
726 KISELC=2                                                          1406
      GO TO 750                                                       1406
730 IF(INTYPE-3) 740,735,740                                          1407
735 KISELC=1                                                          1408
    GO TO (750,726,726,726,750,750,750),K1                            1409
740 IF(INTYPE-4) 743,745,743                                          1410
743 IF(INTYPE-5) 750,745,750                                          1411
745 KISELC=K1                                                         1412
750 KITRTW=KI+KI                                                      1413
     IA=I1+I1-KTRL(1)                                                 1413
     IB=J1                                                            1413
     IC=I2+I2-KTRL(1)                                                 1413
    ID=J2                                                             1414
     IE=JJTRTW                                                        1414
     IF=KITRTW                                                        1414
     CALL RAC7                                                        1414
     RAC1=RAC                                                         1414
    IF(KASPSP) 785,751,785                                            1415
751 IA=L1                                                             1416
     IB=L2                                                            1416
     IC=KITRTW                                                        1416
     ID=0                                                             1416
     IE=0                                                             1416
     IF=0                                                             1416
     CALL CLEB                                                        1416
    RAC2=RAC                                                          1417
    IA=L1                                                             1418
     IB=J1                                                            1418
     IC=L2                                                            1418
     ID=J2                                                            1418
    IE=ISTRTW                                                         1418
     IF=KITRTW                                                        1418
    CALL RAC7                                                         1419
      RAC3=RAC                                                        1419
    HAT=(L1+1)*(L2+1)*(J1+1)*(J2+1)                                   1420
      HAT=DSQRT( HAT)                                                 1420
    S1=(-1.D0 )**MOD(((JJTRTW-ISTRTW-I2*2+KTRL(1)+L1+L2)/2      KA1421
   1          +((L1-L2)/2+KPRITR(N1)-KPRITR(N2))/2),2)          KA1422
    T2=S1*HAT*RAC1*RAC2*RAC3                                          1423
      T1=T2*B1                                                        1423
    IF(INTYPE-6) 752,754,752                                          1424
752 GO TO ( 761,766,771,773),KISELC                                   1425
754 IF(KIREPT-1) 756,755,756                                          1426
755 IF(K1-1) 766,761,766                                              1427
756 GO TO (755,763,765,790),KIREPT                                    1428
761 AMAT1(M1,M2)=AMAT1(M1,M2)+T1                                      1429
    IF(KTRL(13)) 762,890,762                                          1430
762 IF(KI-2) 890,763,764                                              1431
763 AMAT1C(M1,M2)=AMAT1C(M1,M2)+T1                                    1432
      GO TO 890                                                       1432
764 IF(KI-3) 890,765,890                                              1433
765 AMAT2C(M1,M2)=AMAT2C(M1,M2)+T1                                    1434
      GO TO 890                                                       1434
766 AMAT2(M1,M2)=AMAT2(M1,M2)+T1                                      1435
    IF(INTYPE-3) 890,767,890                                          1436
767 IF(I2-2) 890,768,890                                              1437
768 IF(M1-1) 890,769,890                                              1438
769 AMATCP(M2)=AMATCP(M2)+T1                                          1439
      GO TO 890                                                       1439
771 AMAT1C(M1,M2)=AMAT1C(M1,M2)+T1                                    1440
      GO TO 890                                                       1440
773 AMAT2C(M1,M2)=AMAT2C(M1,M2)+T1                                    1441
      GO TO 890                                                       1441
785 IF(L1-L2) 890,786,890                                             1442
786 IA=1                                                              1443
     IC=1                                                             1443
     IE=L1                                                            1443
     IF=2                                                             1443
     CALL RAC7                                                        1443
      RAC2=RAC                                                        1443
    C1=(-1.0D0)**MOD(((JJTRTW+J1+J2+L1-IIMULT(N1))/2+1),2)      KA1444
    HAT=6*(IB+1)*(ID+1)                                               1445
     HAT=DSQRT( HAT)                                                  1445
     T2=RAC1*RAC2*C1*HAT                                              1445
    T1=T2*B1                                                          1446
790 AMATSS(M1,M2)=AMATSS(M1,M2)+T1                                    1447
890 CONTINUE                                                          1448
    AMAT1 (M2,M1)=AMAT1 (M1,M2)                                       1449
      AMAT2 (M2,M1)=AMAT2 (M1,M2)                                     1449
    AMATSS(M2,M1)=AMATSS(M1,M2)                                       1450
      AMAT1C(M2,M1)=AMAT1C(M1,M2)                                     1450
    AMAT2C(M2,M1)=AMAT2C(M1,M2)                                       1451
900 CONTINUE                                                          1452
    GO TO 990                                                         1453
910 ROTFAC=CON1                                                 KA1454
    DO 930 M1=1,MXROW                                                 1455
    L1=LLROW(M1)                                                      1456
      J1=JJROW(M1)                                                    1456
      HATSQ1=(L1+1)*(J1+1)                                            1456
    DO 930 M2=M1,MXROW                                                1457
    L2=LLROW(M2)                                                      1458
      J2=JJROW(M2)                                                    1458
     HATSQ2=(L2+1)*(J2+1)                                             1458
    DO 925 K1=1,INTMAX                                                1459
    LAMDA=2*K1                                                        1460
     LAMDTW=LAMDA*2                                                   1460
     HATLMD=LAMDTW+1                                                  1460
    HATFAC=DSQRT( HATSQ1*HATSQ2/HATLMD)                               1461
    S1=(-1.0D0)**MOD(((ISTRTW+MJBRTW)/2+(L1-L2)/4),2)           KA1462
    IA=L1                                                             1463
     IB=L2                                                            1463
     IC=LAMDTW                                                        1463
     ID=0                                                             1463
     IE=0                                                             1463
     IF=0                                                             1463
     CALL CLEB                                                        1463
    C1=RAC                                                            1463
    IC=J1                                                             1464
     ID=J2                                                            1464
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      IE=LAMDTW                                                          1464
      IF=ISTRTW                                                          1464
      CALL RAC7                                                          1464
      R1=RAC                                                             1464
     IA=J1                                                               1465
      IB=J2                                                              1465
      IC=LAMDTW                                                          1465
      IE=MJBRTW                                                          1465
      ID=-IE                                                             1465
      IF=0                                                               1465
     CALL CLEB                                                           1466
       C2=RAC                                                            1466
     T1=ROTFAC*S1*HATFAC*C1*C2*R1                                        1467
     GO TO (921,922,923,924), K1                                      KA1467
 921 AMAT1(M1,M2)=AMAT1(M1,M2)+T1                                       1468
       GO TO 925                                                        1468
 922 AMAT2(M1,M2)=AMAT2(M1,M2)+T1                                       1469
     GO TO 925                                                        KA1469
 923 AMAT1C(M1,M2)=AMAT1C(M1,M2)+T1                                   KA1469
     GO TO 925                                                        KA1469
 924 AMAT2C(M1,M2)=AMAT2C(M1,M2)+T1                                   KA1469
 925 CONTINUE                                                           1470
     AMAT1(M2,M1)=AMAT1(M1,M2)                                          1471
       AMAT2(M2,M1)=AMAT2(M1,M2)                                        1471
     AMAT1C(M2,M1)=AMAT1C(M1,M2)                                      KA1471
     AMAT2C(M2,M1)=AMAT2C(M1,M2)                                      KA1471
 930 CONTINUE                                                           1472
4050 FORMAT(8E15.5)                                                     1474
4060 FORMAT(1H )                                                      KA1475
 990 IF(KTLOUT(9)) 4210,4250,4210                                       1476
4210 IF(JJ-KEXCOM(5)) 4250,4212,4212                                    1477
4212 IF(JJ-KEXCOM(6)) 4214,4214,4250                                    1478
4214 IF(KEXCOM(46)-KEXCOM(7)) 4250,4220,4250                            1479
4220 WRITE(6,4230) INTYPE,INTMAX,(KII(N1),N1=1,INTMAX)                  1480
4230 FORMAT(22HO**BMATRIX FOR INTYPE=I1,8H INTMAX=I1,7H LAMDA=10I3)     1481
     DO 4232 K1=1,INTMAX                                                1482
     WRITE(6,4060)                                                      1483
     DO 4232 N1=1,IICPLE                                                1484
     WRITE(6,4050) (B(N1,N2,K1),N2=1,IICPLE)                            1485
4232 CONTINUE                                                           1486
     IF(KTLOUT(10)) 4233,4250,4233                                      1487
4233 WRITE(6,4234)                                                      1488
4234 FORMAT(10HO**AMATRIX)                                              1489
     DO 4240 M1=1,MXROW                                                 1490
4240 WRITE(6,4050) (AMAT1 (M1,M2),M2=1,MXROW)                           1491
     WRITE(6,4060)                                                      1491
     DO 4245 M1=1,MXROW                                                 1492
4245 WRITE(6,4050) (AMAT2 (M1,M2),M2=1,MXROW)                           1493
     WRITE(6,4060)                                                      1493
     DO 4246 M1=1,MXROW                                                 1494
4246 WRITE(6,4050) (AMATSS(M1,M2),M2=1,MXROW)                           1495
     WRITE(6,4060)                                                      1495
     DO 4247 M1=1,MXROW                                                 1496
4247 WRITE(6,4050) (AMAT1C(M1,M2),M2=1,MXROW)                           1497
     WRITE(6,4060)                                                      1497
     DO 4249 M1=1,MXROW                                                 1498
4249 WRITE(6,4050) (AMAT2C(M1,M2),M2=1,MXROW)                           1499
     WRITE(6,4060)                                                      1499
     WRITE(6,4050) (AMATCP(   M2),M2=1,MXROW)                           1500
4250 RETURN                                                           KA 1502
     END                                                                1503
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JJ
      SUBROUTINE SMATRX                                                 1504
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                        KA1505
      COMPLEX*16 TTR,TTI,ZERO                                          KA1505
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      1506
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)            1507
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        1508
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  1509
     1             ECM(10),                                             1510
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  1511
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  1512
     4             WN(10),WNINI(10),WC(10)                              1513
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,    1514
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,      1515
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  1516
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,         1517
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,  1518
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                      1519
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
      COMPLEX*16 Q,ARI,BRI,EX,DIVQ,SUMRI,EXSGRI                        KA1521
      COMMON     EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)      1523
      COMMON      VCENTR(200),VCENTI(200),VSPIN (200),VCOULM(200),       1524
     1            VCPL1R(200),VCPL1I(200),VCPL2R(200),VCPL2I(200),       1525
     2            VCPD1R(200),VCPD1I(200),VCPD2R(200),VCPD2I(200),       1526
     3            VCPD3R(200),VCPD3I(200)                                1527
      COMMON     H(6710)                                                 1528
      DIMENSION  URC(30,30),UIC(30,30),UDRC(30,30),UDIC(30,30),          1529
     1           WNRATO(10),Q(38,39),ARI(70),BRI(70)                   KA1530
      EQUIVALENCE (H(3101),URC(1)),(H(4001),UIC(1)),(H(4901),UDRC(1)),  KA1531
     1(H(5801),UDIC(1)),(H(6701),WNRATO(1)),(H(1),Q(1)),(AR(1),ARI(1)),  KA1532
     2(BR(1),BRI(1))                                                    KA1533
      KBOUND=KEXCOM(41)                                                   1535
        NBOUND=KEXCOM(42)                                                 1535
        MXROWI=KEXCOM(43)                                                 1535
      JJ=KEXCOM(45)                                                       1536
        K=KEXCOM(46)                                                      1536
      MXROW1=MXROW+1                                                      1537
        MXRBRI=MXROW+MXROW*KBOUND                                         1537
      CALL DOTEST(1537,MXROW,30)
      CALL DOTEST(1538,IICPLE,10)
      DO 105 I1=1,IICPLE                                                  1538
      WNR=WN(I1)/WN(1)                                                    1539
        WNRATO(I1)=WNR*DSQRT( WNR)                                        1539
  105 CONTINUE                                                            1540
      KWRIT2=0                                                            1541
      IF(KTLOUT(12)) 113,119,113                                          1542
  113 IF(KTRL(9)) 118,114,118                                             1543
  114 IF(JJ-3) 118,118,119                                                1544
  118 KWRIT2=1                                                            1545
  119 NMATCH=(1-KBOUND)+KBOUND*MXROWI                                     1546
      DO 700 NMAT=1,NMATCH                                                1547
      REWIND 8                                                            1548
      IF(KBOUND) 125,145,125                                              1549
  125 MXROW2=2*MXROW                                                      1550
        IM=MXROW2+1                                                       1550
```

```
      CALL DOTEST( 1551,IM,39)
      DO 127 M3=1,MXROW2                                              1551
  127 READ (8)     (Q(M1,M3),M1=1,MXROW2)                             1552
      DO 129 M3=1,NMAT                                                1553
  129 READ (8)     (Q(M1,IM),M1=1,MXROW2)                             1554
      DO 130 M3=MXROW1,MXROW2                                         1555
      DO 130 M1=1,MXROW2                                              1556
  130 Q(M1,M3)=-Q(M1,M3)                                              1557
      NLJMAX=1                                                        1558
      IF(KWRIT2) 4610,170,4610                                       KA1559
 4610 WRITE(6,4615) KBOUND                                           KA1559
 4615 FORMAT(21HOQMATRIX FOR KBOUND =,I2)                            KA1559
      DO 4620 M3=1,IM                                                KA1560
 4620 WRITE(6,4060) (Q(M1,M3),M1=1,MXROW2)                           KA1561
      GO TO 170                                                       1563
  145 DO 150 M3=1,MXROW                                               1564
      READ (8)    (URC(M1,M3),UIC(M1,M3),UDRC(M1,M3),UDIC(M1,M3),     1565
     1             M1=1,MXROW)                                        1566
  150 CONTINUE                                                        1567
      IM=MXROW1                                                       1568
 4060 FORMAT((4(2H (,E14.7,1H,,E14.7,1H))))                          KA 1570
      IF(KWRIT2) 4120,160,4120                                       KA1571
 4120 WRITE(6,4150)                                                   1572
 4150 FORMAT(8HOURC ETC)                                              1573
      DO 4160 M3=1,MXROW                                              1574
      WRITE(6,4060) (URC(M1,M3),UIC(M1,M3),UDRC(M1,M3),UDIC(M1,M3),  KA 1575
     1              M1=1,MXROW)                                       1576
 4160 CONTINUE                                                        1577
  160 IF(KTRL(7)) 162,165,162                                        KA1579
  162 NLJMAX=MXROW                                                    1580
        GO TO 170                                                     1580
  165 NLJMAX=MXROWI                                                   1581
      CALL DOTEST(1581,MXROWI,30)
  170 DO 600 NLJ=1,NLJMAX                                             1582
      IF(KBOUND) 300,175,300                                          1583
  175 DO 179 N=1,MXROW                                                1584
      Q(N,IM)=ZERO                                                    1585
        NS=NNROW(N)                                                   1585
        LT=(LLROW(N)/2)+1                                             1585
      FT=FC(LT,NS)                                                    1586
       GT=GC(LT,NS)                                                   1586
       FDT=FDC(LT,NS)                                                 1586
       GDT=GDC(LT,NS)                                                 1586
      DO 179 M=1,MXROW                                                1587
      UR=URC(N,M)                                                     1588
        UI=UIC(N,M)                                                   1588
        UDR=UDRC(N,M)                                                 1588
        UDI=UDIC(N,M)                                                 1588
      QR=UR*GDT-UI*FDT-UDR*GT+UDI*FT                                  1589
       QI=UR*FDT+UI*GDT-UDR*FT-UDI*GT                                 1589
      Q(N,M)=DCMPLX(QR,QI)                                           KA1590
  179 CONTINUE                                                        1591
      LT=(LLROW(NLJ)/2)+1                                             1592
        HAT=2*LT-1                                                    1592
        FAC=-DSQRT( HAT)                                              1592
      Q(NLJ,IM)=FAC*EXSGRI(LT,1)                                      1593
      IF(KWRIT2) 4220,300,4220                                       KA1594
 4220 WRITE(6,4230) NLJ,NLJMAX                                        1595
 4230 FORMAT(26HO**QMATRIX FOR NLJ,NLJMAX=2I3)                       KA1596
      M=IM                                                           KA1596
      IF(NLJ-1)4235,4234,4235                                        KA1597
 4234 M=1                                                            KA1598
 4235 DO 4240 M2=M,IM                                                KA1599
 4240 WRITE (6,4060)(Q(M1,M2),M1=1,MXROW)                            KA1600
  300 CALL SIMLEQ                                                     1602
      IF(KWRIT2) 4320,320,4320                                       KA1603
 4320 WRITE(6,4330)                                                   1604
 4330 FORMAT(6HO**AMP)                                               KA1605
      WRITE(6,4060) (BRI(N),N=1,MXRBRI)                               1606
  320 IF(KBOUND) 330,340,330                                         KA1608
  330 DO 335 M1=1,MXROW                                               1609
      M2=M1+MXROW                                                     1610
  335 BRI(M1)=BRI(M2)                                                 1611
      GO TO 490                                                       1612
  340 DO 430 N=1,MXROW                                                1613
      NS=NNROW(N)                                                     1614
       LT=(LLROW(N)/2)+1                                              1614
       FT=FC(LT,NS)                                                   1614
       FDT=FDC(LT,NS)                                                 1614
      DO 430 M=1,MXROW                                                1615
      UR=URC(N,M)                                                     1616
        UI=UIC(N,M)                                                   1616
        UDR=UDRC(N,M)                                                 1616
        UDI=UDIC(N,M)                                                 1616
      QR=UR*FDT-UDR*FT                                                1617
        QI=UI*FDT-UDI*FT                                              1617
      Q(N,M)=DCMPLX(QR,QI)                                           KA1617
  430 CONTINUE                                                        1618
      DO 445 N1=1,MXROW                                               1619
      ARI(N1)=ZERO                                                    1620
  445 CONTINUE                                                        1621
      DO 450 N1=1,MXROW                                               1622
      DO 447 M1=1,MXROW                                               1623
  447 ARI(N1)=ARI(N1)+Q(N1,M1)*BRI(M1)                                1624
  450 CONTINUE                                                        1625
      DO 455 N1=1,MXROW                                               1626
      NT=NNROW(N1)                                                    1627
        LT=(LLROW(N1)/2)+1                                            1627
        HAT=LT+LT-1                                                   1627
      FAC=WNRATO(NT)/DSQRT( HAT)                                      1628
      SUMRI=FAC/EXSGRI(LT,NT)                                         1629
  455 BRI(N1)=ARI(N1)*SUMRI                                           1630
  490 WRITE (9)     (BRI(N),N=1,MXROW)                                1631
      IF(KTLOUT(11)) 4510,600,4510                                   KA1632
 4510 WRITE(6,4520) JJ,K,NLJ                                          1633
 4520 FORMAT(24HO**CMATRIX FOR JJ,K,NLJ=3I3)                          1634
      WRITE(6,4060) (BRI(N1),N1=1,MXROW)                              1635
  600 CONTINUE                                                        1637
  700 CONTINUE                                                        1638
 1000 RETURN                                                          1639
      END                                                             1640
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C      PROGRAM ON LIB=LOAD.ZYK,NAME=S036JK
C      INTEGRATION OF DIFFERENTIAL EQUATIONS
       SUBROUTINE SIMLEQ                                                    1641
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
       IMPLICIT REAL*8 (A-H,O-Z)                                          KA1642
       COMPLEX*16 TTR,TTI,ZERO                                            KA1642
       COMMON      FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9        KA1643
       COMMON      KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)                1644
       COMMON      F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD          KA1645
       COMMON      ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),   1646
      1            ECM(10),                                                 1647
      2            IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),    1648
      3            NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),   1649
      4            WN(10),WNINI(10),WC(10)                                  1650
       COMMON      ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,        1651
      1            IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,          1652
      2            AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,    1653
      3            PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,             1654
      4            RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,      1655
      5            XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                          1656
CCCCCC      *****      COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
       COMPLEX*16 Q,ARI,BRI,EX,DIVQ,SUMRI,EXSGRI                          KA1658
       COMMON     EXSGRI(70,6),FC(70,6),FDC(70,6),GC(70,6),GDC(70,6)        1660
       COMMON      VCENTR(200),VCENTI(200),VSPIN (200),VCOULM(200),         1661
      1            VCPL1R(200),VCPL1I(200),VCPL2R(200),VCPL2I(200),         1662
      2            VCPD1R(200),VCPD1I(200),VCPD2R(200),VCPD2I(200),         1663
      3            VCPD3R(200),VCPD3I(200)                                  1664
       COMMON     Q(38,39)                                                  1665
       DIMENSION ARI(70),BRI(70)                                           1666
       EQUIVALENCE (AR(1),ARI(1)),(BR(1),BRI(1))                          KA1666
       MXROWM=MXROW                                                        1668
         KBOUND=KEXCOM(41)                                                 1668
         MXROW=MXROW*(1+KBOUND)                                            1668
       IM=MXROW+1                                                          1669
       CALL DOTEST(1670,MXROW,38)
       DO 870 I=1,MXROW                                                    1670
       BIGQ=Q(I,I)*DCONJG(Q(I,I))                                         KA1671
         MXI=I                                                             1671
       DO 816 I1=I,MXROW                                                   1672
       B1=Q(I1,I)*DCONJG(Q(I1,I))                                         KA1673
         IF(BIGQ-B1) 815,816,816                                           1673
  815  BIGQ=B1                                                             1674
         MXI=I1                                                            1674
  816  CONTINUE                                                            1675
       IF(MXI-I) 818,822,818                                               1676
  818  DO 820 J=I,IM                                                       1677
       EX=Q(I,J)                                                           1678
         Q(I,J)=Q(MXI,J)                                                   1678
  820  Q(MXI,J)=EX                                                         1679
  822  DIVQ=Q(I,I)                                                         1680
         DIVQAB=DIVQ*DCONJG(DIVQ)                                       KA 1680
         IF(DIVQAB) 830,830,840                                            1680
  830  WRITE(6,835) I,I                                                  KA1681
  835  FORMAT(3H Q(I2,1H,I2,15H) = 0 IN SIMLEQ)                          KA1682
       DO 836 I=1,MXROW                                                  KA1682
  836  BRI(I)=ZERO                                                       KA1682
       GO TO 1000                                                          1683
  840  DIVQ=TTR/DIVQ                                                    KA 1683
       Q(I,I)=TTR                                                       KA 1684
       I1=I+1                                                           KA 1685
       DO 850 J=I1,IM                                                   KA 1686
  850  Q(I,J)=Q(I,J)*DIVQ                                               KA 1687
       IF(I1-IM) 860,880,880                                               1688
  860  DO 870 K1=I1,MXROW                                                  1689
       EX=Q(K1,I)                                                          1690
       DO 870 K2=I,IM                                                      1691
       Q(K1,K2)=Q(K1,K2)-EX*Q(I,K2)                                        1692
  870  CONTINUE                                                            1693
  880  BRI(MXROW)=Q(MXROW,IM)                                              1694
       I=MXROW                                                             1695
       IF(MXROW-1) 1000,1000,892                                        KA 1696
  892  SUMRI=ZERO                                                          1697
       DO 894 K2=I,MXROW                                                   1698
       SUMRI=SUMRI+BRI(K2)*Q(I-1,K2)                                       1699
  894  CONTINUE                                                            1700
       I=I-1                                                               1701
       BRI(I)=Q(I,IM)-SUMRI                                                1702
       IF(I-1) 1000,1000,892                                            KA 1703
 1000  MXROW=MXROWM                                                        1705
       RETURN                                                              1706
       END                                                                 1707
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C      PROGRAM ON LIB=LOAD.ZYK,NAME=S036JL
C      CROSS SECTIONS
       SUBROUTINE XSEC                                                    1708
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
       IMPLICIT REAL*8 (A-H,O-Z)                                         KA1709
       COMPLEX*16 TTR,TTI,ZERO                                           KA1709
       COMMON      FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9       KA1710
       COMMON      KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)              1711
       COMMON      F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD          KA1712
       COMMON      ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  1713
      1            ECM(10),                                                1714
      2            IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),   1715
      3            NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  1716
      4            WN(10),WNINI(10),WC(10)                                 1717
       COMMON      ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,       1718
      1            IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,         1719
      2            AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,   1720
      3            PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,            1721
      4            RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,     1722
      5            XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                         1723
CCCCCC      ******     DIMENSION FIELDS USED ONLY IN THIS ROUTINE     **********
       COMMON      EXSGRI(840),CMXR(10,30),CMXI(10,30),                    1727
      1            ZBART (10,10,3),ZBARS (10,10,3),ZBARP (10,10,3),        1728
      2            ZBART1(10,10,3),ZBARS1(10,10,3),ZBARP1(10,10,3),        1729
      3            CBAR1T(3,10,10),CBAR2T(3,10,10),CBAR3T(3,10,10),        1730
      4            CBAR1S(3,10,10),CBAR2S(3,10,10),CBAR3S(3,10,10),        1731
      5            CBAR1P(3,10,10),CBAR2P(3,10,10),CBAR3P(3,10,10),        1732
      6            REACCR(3),TOTLXC(3),STRGFN(3),STRGFS(3),STRGFP(3),      1733
      7            TOTLXS(3),TOTLXP(3),EXTRA4(1729)                        1734
       COMPLEX*16 ZBART,ZBARS,ZBARP,CBAR1T,CBAR2T,CBAR3T,CBAR1S,CBAR2S,    KA1736
      1             CBAR3S,CBAR1P,CBAR2P,CBAR3P,EX,EXS,EX1,                 1737
      2             ZBART1,ZBARS1,ZBARP1                                    1738
CCCCCC      *****      COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
       COMMON      AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),       1740
      1            NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,      1741
      2            NPOLST                                                  1742
       REWIND 9                                                          KA1743
       REWIND 8                                                           1743
       IF(KTRL(7)) 30,45,30                                               1744
   30  CALL ACCSAB                                                        1745
       GOTO 990                                                           1746
   45  MULT1Z=IIMULT(1)                                                   1746
         ISMULT=ISTRTW+1                                                  1746
       MSREPT=(ISTRTW/2)+1                                               KA1747
         IF(KTRL(3)) 61,65,61                                             1747
   61  DO 63 M1=1,MULT1Z                                                  1748
         DO 63 M2=1,MULT1Z                                                1748
         DO 63 M3=1,ISMULT                                                1748
       ZBART1(M1,M2,M3)=ZERO                                              1749
       ZBARS1(M1,M2,M3)=ZERO                                              1749
       ZBARP1(M1,M2,M3)=ZERO                                              1749
       ZBART (M1,M2,M3)=ZERO                                              1749
       ZBARS (M1,M2,M3)=ZERO                                              1749
       ZBARP (M1,M2,M3)=ZERO                                              1749
   63  CONTINUE                                                           1750
       CALL DOTEST(1750,NPOLST,3)
       DO 64 NPS=1,NPOLST                                                 1751
       TOTLXS(NPS)=0.D0                                                   1751
       TOTLXP(NPS)=0.D0                                                   1751
       TOTLXC(NPS)=0.D0                                                   1751
       REACCR(NPS)=0.D0                                                   1751
       STRGFN(NPS)=0.D0                                                   1751
       STRGFS(NPS)=0.D0                                                   1751
       STRGFP(NPS)=0.D0                                                   1751
   64  CONTINUE                                                           1751
       PI=3.141592653589793                                           KA 1752
       PAISQ=PI*PI                                                    KA 1752
       XSQ=(WN(1)*XBAR)**2                                            KA 1753
       C1=6.D0*PAISQ*XSQ/(1.D0+XSQ)                                   KA 1754
       STGFCP=WN(1)*WN(1)/DSQRT(ELAB)                                 KA 1755
       STGFCS=.5D0/PAISQ*STGFCP                                       KA 1756
       STGFCP=STGFCP/C1                                               KA 1757
   65  DO 600 JJ=1,JJJMAX                                                 1758
       KT1PIS=KTRL(1)+ISTRTW                                              1759
         KTISCK=MOD(KT1PIS,2)                                         KA 1759
       JJTRTW=2*JJ-2+KTISCK                                               1760
         KEXCOM(45)=JJ                                                    1760
       DO 595 K=1,2                                                       1761
       KEXCOM(46)=K                                                       1762
         CALL NLJJJK                                                      1762
       IF(MXROW) 595,595,70                                               1763
   70  NRT7MX=0                                                           1764
       DO 75 N1=1,MXROW                                                   1765
       IF(NNROW(N1)-1) 75,73,80                                           1766
   73  NRT7MX=NRT7MX+1                                                    1767
   75  CONTINUE                                                           1768
   80  DO 110 NRT7=1,NRT7MX                                               1769
  110  READ (9)    (CMXR(NRT7,N1),CMXI(NRT7,N1),N1=1,MXROW)          KA1770
       DO 127 NE1=1,3                                                     1771
         DO 127 NE2=1,10                                                  1771
         DO 127 N1=1,NRT7MX                                               1771
       CBAR1T(NE1,NE2,N1)=ZERO                                            1772
       CBAR2T(NE1,NE2,N1)=ZERO                                            1772
       CBAR3T(NE1,NE2,N1)=ZERO                                            1772
       CBAR1S(NE1,NE2,N1)=ZERO                                            1772
       CBAR2S(NE1,NE2,N1)=ZERO                                            1772
       CBAR3S(NE1,NE2,N1)=ZERO                                            1773
       CBAR1P(NE1,NE2,N1)=ZERO                                            1773
       CBAR2P(NE1,NE2,N1)=ZERO                                            1773
       CBAR3P(NE1,NE2,N1)=ZERO                                            1773
  127  CONTINUE                                                           1774
       DO 405 MSRE=1,MSREPT                                               1775
         MSTRTW=ISTRTW*(2-MSRE)                                           1775
       DO 400 MTII=1,MULT1Z                                               1776
         MTIINV=MULT1Z+1-MTII                                             1776
       MTITTW=2*MTII-1-MULT1Z                                             1777
         MJTRTW=MSTRTW+MTITTW                                             1777
       DO 130 N1=1,MXROW                                                  1778
           BI(N1)=0.0D0                                                   1778
       BR(N1)=0.D0                                                        1778
  130  CONTINUE                                                           1779
       IF(JJTRTW-IABS( MJTRTW)) 250,160,160                               1780
  160  DO 240 NRT7=1,NRT7MX                                               1781
         CG1=1.D0                                                         1781
```

```
      IF(ISTRTW) 210,212,210                                                1781
210 JT=JJROW(NRT7)                                                          1782
      LT=LLROW(NRT7)                                                        1782
    IA=LT                                                                   1783
      IB=ISTRTW                                                             1783
      IC=JT                                                                 1783
      ID=0                                                                  1783
    IF=MSTRTW                                                               1783
    IE=IF                                                                   1783
    CALL CLEB                                                               1784
      CG1=RAC                                                               1784
212 CG2=1.DO                                                                1785
    IF(KTRL(1)) 214,216,214                                                 1786
214 IA=JT                                                                   1787
      IB=MULT1Z-1                                                           1787
      IC=JJTRTW                                                             1787
      ID=MSTRTW                                                             1787
      IE=MTITTW                                                             1787
    IF=MJTRTW                                                               1788
      CALL CLEB                                                             1788
      CG2=RAC                                                               1788
216 CG12=CG1*CG2                                                            1789
    DO 230 N1=1,MXROW                                                       1790
    BR(N1)=BR(N1)+CG12*CMXR(NRT7,N1)                                        1791
230 BI(N1)=BI(N1)+CG12*CMXI(NRT7,N1)                                        1792
240 CONTINUE                                                                1793
250 WRITE (8)     (BR(N1),BI(N1),N1=1,MXROW)                                1794
    IF(KTRL(3)) 252,400,252                                                 1795
252 DO 395 NLJ=1,NRT7MX                                                     1796
    J2TRTW=JJROW(NLJ)                                                       1797
      L2TRTW=LLROW(NLJ)                                                     1797
    TWL2P1=L2TRTW+1                                                         1798
      SQRTLB=DSQRT( TWL2P1)                                                 1798
      SIGNIV=0.DO                                                           1798
    IF(ISTRTW-1) 262,261,254                                                1799
254 IF(MSRE-1) 262,261,262                                                  1800
261 SIGNIV=(-1.DO )**MOD((L2TRTW+ISTRTW-MULT1Z+1-JJTRTW)/2,2)          KA 1801
262 DO 295 MTFF=1,MULT1Z                                                    1802
      MTFTTW=2*MTFF-1-MULT1Z                                                1802
    MSFTTW=MJTRTW-MTFTTW                                                    1803
      IF(ISTRTW-IABS( MSFTTW)) 295,264,264                                  1803
264 MSFF=(ISMULT+1-MSFTTW)/2                                                1804
      CG1=1.DO                                                              1804
      IF(KTRL(1)) 266,267,266                                               1804
266 IA=J2TRTW                                                               1805
      IB=MULT1Z-1                                                           1805
      IC=JJTRTW                                                             1805
      ID=MSFTTW                                                             1805
    IE=MTFTTW                                                               1806
      IF=MJTRTW                                                             1806
      CALL CLEB                                                             1806
      CG1=RAC                                                               1806
267 CG2=1.DO                                                                1807
      IF(ISTRTW) 268,269,268                                                1807
268 IA=L2TRTW                                                               1808
      IB=ISTRTW                                                             1808
      IC=J2TRTW                                                             1808
      ID=0                                                                  1808
    IF=MSFTTW                                                               1808
    IE=IF                                                                   1808
    CALL CLEB                                                               1809
      CG2=RAC                                                               1809
269 T1=CG1*CG2*TWL2P1                                                       1810
      TR1=T1*BR(NLJ)                                                        1810
      TI1=T1*BI(NLJ)                                                        1810
    EX=DCMPLX(TR1,TI1)                                                  KA 1811
      EX1=ZERO                                                              1811
    IF(MSRE-1) 271,273,271                                                  1812
271 EX1=EX                                                                  1813
      EX=ZERO                                                               1813
273 ZBART (MTII,MTFF,MSFF)=ZBART (MTII,MTFF,MSFF)+EX                       1814
    ZBART1(MTII,MTFF,MSFF)=ZBART1(MTII,MTFF,MSFF)+EX1                       1815
    IF(L2TRTW-2) 276,277,295                                                1816
276 ZBARS (MTII,MTFF,MSFF)=ZBARS (MTII,MTFF,MSFF)+EX                        1817
    ZBARS1(MTII,MTFF,MSFF)=ZBARS1(MTII,MTFF,MSFF)+EX1                       1818
      GO TO 295                                                             1818
277 ZBARP (MTII,MTFF,MSFF)=ZBARP (MTII,MTFF,MSFF)+EX                       1819
    ZBARP1(MTII,MTFF,MSFF)=ZBARP1(MTII,MTFF,MSFF)+EX1                       1820
295 CONTINUE                                                                1821
    DO 370 NPS=1,NPOLST                                                     1822
    NENS1=NENSBP(NPS)                                                       1823
      NENS2=NENSBT(NPS)                                                     1823
    DO 370 NE1=1,NENS1                                                      1824
    A2=AMS(NE1,MSRE,NPS)                                                    1825
      A22=AMS(NE1,ISMULT,NPS)*SIGNIV                                        1825
    DO 365 NE2=1,NENS2                                                      1826
    A2B2R=A2*BMTR(NE2,MTII,NPS)+A22*BMTR(NE2,MTIINV,NPS)                    1827
    A2B2I=A2*BMTI(NE2,MTII,NPS)+A22*BMTI(NE2,MTIINV,NPS)                    1828
    TR1=(A2B2R*BR(NLJ)-A2B2I*BI(NLJ))*SQRTLB                                1829
    TI1=(A2B2R*BI(NLJ)+A2B2I*BR(NLJ))*SQRTLB                                1830
    EX=DCMPLX(TR1,TI1)                                                  KA 1831
    GO TO (321,322,323),NPS                                                 1832
321 CBAR1T(NE1,NE2,NLJ)=CBAR1T(NE1,NE2,NLJ)+EX                              1833
      GO TO 330                                                             1833
322 CBAR2T(NE1,NE2,NLJ)=CBAR2T(NE1,NE2,NLJ)+EX                              1834
      GO TO 330                                                             1834
323 CBAR3T(NE1,NE2,NLJ)=CBAR3T(NE1,NE2,NLJ)+EX                              1835
330 IF(L2TRTW-2) 341,346,365                                                1836
341 GO TO (342,343,344),NPS                                                 1837
342 CBAR1S(NE1,NE2,NLJ)=CBAR1S(NE1,NE2,NLJ)+EX                              1838
      GO TO 365                                                             1838
343 CBAR2S(NE1,NE2,NLJ)=CBAR2S(NE1,NE2,NLJ)+EX                              1839
      GO TO 365                                                             1839
344 CBAR3S(NE1,NE2,NLJ)=CBAR3S(NE1,NE2,NLJ)+EX                              1840
      GO TO 365                                                             1840
346 GO TO (347,348,349),NPS                                                 1841
347 CBAR1P(NE1,NE2,NLJ)=CBAR1P(NE1,NE2,NLJ)+EX                              1842
      GO TO 365                                                             1842
348 CBAR2P(NE1,NE2,NLJ)=CBAR2P(NE1,NE2,NLJ)+EX                              1843
      GO TO 365                                                             1843
349 CBAR3P(NE1,NE2,NLJ)=CBAR3P(NE1,NE2,NLJ)+EX                              1844
365 CONTINUE                                                                1845
370 CONTINUE                                                                1846
395 CONTINUE                                                                1847
400 CONTINUE                                                                1848
405 CONTINUE                                                                1849
```

```
      IF(KTRL(3)) 505,595,505                                          1850
  505 DO 520 NPS=1,NPOLST                                              1851
      NENS1=NENSBP(NPS)                                                1852
        NENS2=NENSBT(NPS)                                              1852
      DO 520 NE1=1,NENS1                                               1853
      DO 520 NE2=1,NENS2                                               1854
      DO 520 NLJ=1,NRT7MX                                              1855
      GO TO (510,511,512),NPS                                          1856
  510 EX =CBAR1T(NE1,NE2,NLJ)                                          1857
        EXS=CBAR1S(NE1,NE2,NLJ)                                        1857
      EX1=CBAR1P(NE1,NE2,NLJ)                                          1858
        GO TO 515                                                      1858
  511 EX =CBAR2T(NE1,NE2,NLJ)                                          1859
        EXS=CBAR2S(NE1,NE2,NLJ)                                        1859
      EX1=CBAR2P(NE1,NE2,NLJ)                                          1860
        GO TO 515                                                      1860
  512 EX =CBAR3T(NE1,NE2,NLJ)                                          1861
        EXS=CBAR3S(NE1,NE2,NLJ)                                        1861
      EX1=CBAR3P(NE1,NE2,NLJ)                                          1862
  515 STRGFN(NPS)=STRGFN(NPS)+EX*DCONJG(EX)                            1863
      STRGFS(NPS)=STRGFS(NPS)+EXS*DCONJG(EXS)                          1864
      STRGFP(NPS)=STRGFP(NPS)+EX1*DCONJG(EX1)                          1865
  520 CONTINUE                                                         1866
  595 CONTINUE                                                         1867
  600 CONTINUE                                                         1868
      IF(KTRL(3)) 610,990,610                                          1869
  610 SGABS=4.D1*PI/(WN(1)*WN(1))                                   KA 1870
      DO 675 NPS=1,NPOLST                                              1871
        NENS1=NENSBP(NPS)                                              1871
        NENS2=NENSBT(NPS)                                              1871
      DO 670 NE1=1,NENS1                                               1872
        DO 670 NE2=1,NENS2                                             1872
        DO 670 MTFF=1,MULT1Z                                           1872
      MTFTTW=2*MTFF-MULT1Z-1                                           1873
        MTFINV=MULT1Z+1-MTFF                                           1873
      B2R=BMTR(NE2,MTFF,NPS)                                           1874
        B2I=BMTI(NE2,MTFF,NPS)                                         1874
      DO 670 MSFF=1,ISMULT                                             1875
      MSFTTW=ISTRTW+2-2*MSFF                                           1876
        MSFINV=ISMULT+1-MSFF                                           1876
      A2=AMS(NE1,MSFF,NPS)                                             1877
        A2B2R=A2*B2R                                                   1877
        A2B2I=A2*B2I                                                   1877
      DO 670 MTII=1,MULT1Z                                             1878
      MTITTW=2*MTII-MULT1Z-1                                           1879
        MTIINV=MULT1Z+1-MTII                                           1879
      B1R=BMTR(NE2,MTII,NPS)                                           1880
        B1I=BMTI(NE2,MTII,NPS)                                         1880
      DO 660 MSII=1,ISMULT                                             1881
      MSITTW=ISTRTW+2-2*MSII                                           1882
      IF(MSITTW+MTITTW-MSFTTW-MTFTTW) 660,615,660                      1883
  615 A1=AMS(NE1,MSII,NPS)                                             1884
        A1B1R=A1*B1R                                                   1884
        A1B1I=A1*B1I                                                   1884
      ABFACR=A1B1R*A2B2R+A1B1I*A2B2I                                   1885
        ABFACI=A1B1I*A2B2R-A1B1R*A2B2I                                 1885
      IF(ISTRTW-1) 621,617,618                                         1886
  617 IF(MSII-1) 622,621,622                                           1887
  618 IF(MSII-2) 621,621,622                                           1888
  621 MTIIT=MTII                                                       1889
        MTFFT=MTFF                                                     1889
        MSFFT=MSFF                                                     1889
        GO TO 623                                                      1889
  622 MTIIT=MTIINV                                                     1890
        MTFFT=MTFINV                                                   1890
        MSFFT=MSFINV                                                   1890
  623 IF(ISTRTW-1) 631,631,624                                         1891
  624 IF(MSII-2) 631,633,631                                           1892
  631 EX =ZBART (MTIIT,MTFFT,MSFFT)                                    1893
      EXS=ZBARS (MTIIT,MTFFT,MSFFT)                                    1894
      EX1=ZBARP (MTIIT,MTFFT,MSFFT)                                    1895
        GO TO 635                                                      1895
  633 EX =ZBART1(MTIIT,MTFFT,MSFFT)                                    1896
      EXS=ZBARS1(MTIIT,MTFFT,MSFFT)                                    1897
      EX1=ZBARP1(MTIIT,MTFFT,MSFFT)                                    1898
  635 TSGT=((ABFACR+TTI*ABFACI)*EX)*(0.D0,-1.D0)                       1899
      TSGS=((ABFACR+TTI*ABFACI)*EXS)*(0.D0,-1.D0)                      1900
      TSGP=((ABFACR+TTI*ABFACI)*EX1)*(0.D0,-1.D0)                      1901
      TOTLXC(NPS)=TOTLXC(NPS)+TSGT                                     1902
      TOTLXS(NPS)=TOTLXS(NPS)+TSGS                                     1903
      TOTLXP(NPS)=TOTLXP(NPS)+TSGP                                     1904
  660 CONTINUE                                                         1905
  670 CONTINUE                                                         1906
      TOTLXC(NPS)=SGABS*TOTLXC(NPS)                                    1907
      TOTLXS(NPS)=SGABS*TOTLXS(NPS)                                    1908
      TOTLXP(NPS)=SGABS*TOTLXP(NPS)                                    1909
      REACCR(NPS)=TOTLXC(NPS)-SGABS*STRGFN(NPS)                        1910
      REACCS     =TOTLXS(NPS)-SGABS*STRGFS(NPS)                        1911
      REACCP     =TOTLXP(NPS)-SGABS*STRGFP(NPS)                        1912
      STRGFS(NPS)=REACCS*STGFCS                                        1913
      STRGFP(NPS)=REACCP*STGFCP                                        1914
  675 CONTINUE                                                         1915
      IF(KTRL(5)) 977,977,990                                       KA1915
  977 DO 980 NPS=1,NPOLST                                           KA1916
      WRITE(6,978) TOTLXC(NPS),REACCR(NPS),STRGFS(NPS),STRGFP(NPS),NPS 1917
  978 FORMAT(9HOSGTOTL =E13.6,6X,8HREACCR =E13.6,6X,8HSTRGFS =E13.6,6X,8 KA1918
     1HSTRGFP =E13.6,4X,9HFOR NPS =I2)                              KA1919
  980 CONTINUE                                                         1920
  990 IF(KTRL(3)-2) 995,2000,995                                       1921
  995 CALL CROSPL                                                      1922
 2000 RETURN                                                           1923
      END                                                              1924
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JM
C     ADIABATIC COUPLING
      SUBROUTINE ACCSAB                                                  1925
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                         KA1926
      COMPLEX*16 TTR,TTI,ZERO                                           KA1926
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      KA1927
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)            1928
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA1929
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  1930
     1             ECM(10),                                               1931
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  1932
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  1933
     4             WN(10),WNINI(10),WC(10)                                1934
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,      1935
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,        1936
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  1937
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,           1938
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,    1939
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                        1940
CCCCCC      ******     DIMENSION FIELDS USED ONLY IN THIS ROUTINE     **********
      COMMON       EXSGRI(840)                                           1943
      COMMON       CMXADR(30,30),CMXADI(30,30),CMXSJR(3,49,30),          1944
     1             CMXSJI(3,49,30),ZBAR1R(8,8,2),ZBAR1I(8,8,2),          1945
     2             ZBAR2R(8,8,2),ZBAR2I(8,8,2),REACCR(3),TOTLXC(3),      1946
     3             STRGFN(3),STRGFS(3),STRGFP(3),EXTRA4(203)             1947
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *******
      COMMON       AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),     1950
     1             NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,     1951
     2             NPOLST                                                 1952
      CALL DOTEST(1952,NPOLST,3)
      MULT1Z=IIMULT(1)                                                  1953
        ISMULT=ISTRTW+1                                                 1953
        KQNOTW=MULT1Z-1                                                 1953
      MSREPT=ISTRTW+1                                                   1954
      JSMAX=(IIREAD(1)+IIREAD(IIXCAL)-KTRL(1))/2+1                      1955
      JS1MAX=(2*IIREAD(1)-KTRL(1))/2+1                                  1956
      JMJRPT=JSMAX*JSMAX                                                KA1957
      DO 1165 M1=1,MULT1Z                                               1960
        DO 1165 M2=1,MULT1Z                                             1960
        DO 1165 MSP=1,2                                                 1960
      ZBAR1R(M1,M2,MSP)=0.D0                                            1961
      ZBAR1I(M1,M2,MSP)=0.D0                                            1961
      ZBAR2R(M1,M2,MSP)=0.D0                                            1962
      ZBAR2I(M1,M2,MSP)=0.D0                                            1962
 1165 CONTINUE                                                          1963
      DO 1167 NSP=1,NPOLST                                              1964
        TOTLXC(NSP)=0.D0                                                1964
 1167 CONTINUE                                                          1965
      REWIND 8                                                          1966
      DO 1500 KK=1,2                                                    1967
      DO 1170 MS=1,MSREPT                                               1968
        DO 1170 JS=1,JMJRPT                                             1968
        DO 1170 NR=1,30                                                 1968
      CMXSJR(MS,JS,NR)=0.D0                                             1969
 1170 CMXSJI(MS,JS,NR)=0.D0                                             1970
      REWIND 9                                                          KA1971
      DO 1390 JJ=1,JJJMAX                                                 1972
        KTISCK=MOD(ISTRTW,2)                                            KA1972
      MBARTW=-(2*JJ-2+KTISCK)                                             1973
        CRONEC=1.D0                                                     1973
      IF(MBARTW) 1173,1172,1173                                         1974
 1172 CRONEC=0.5D0                                                      1975
 1173 DO 1380 K=1,2                                                     1976
      KEXCOM(45)=JJ                                                     1977
       KEXCOM(46)=K                                                     1977
        CALL NLJJJK                                                     1977
      IF(MXROW) 1380,1380,1175                                          1978
 1175 DO 1177 N1=1,MXROW                                                1979
      READ (9)     (CMXADR(N1,N2),CMXADI(N1,N2),N2=1,MXROW)             KA1980
 1177 CONTINUE                                                          1981
      IF(KK-K) 1380,1180,1380                                           1982
 1180 IF(JJ-1) 1190,1185,1190                                           1983
 1185 MXROWM=MXROW                                                      1984
 1190 JS=1                                                              KA1985
      DO 1375 JMJ=1,JMJRPT                                              KA1986
      IF(JMJ-JS*JS) 1235,1235,1230                                      KA1987
 1230 JS=JS+1                                                           KA1988
 1235 JSTRTW=4*JS-4                                                     KA1989
      MJSTTW=2*(JMJ-JS*(JS-2)-2)                                        KA1989
      DO 1370 MSII=1,MSREPT                                               1990
        MSITTW=ISTRTW+2-2*MSII                                            1990
      DO 1365 N2=1,MXROW                                                  1991
      L2TW=LLROW(N2)                                                      1992
        J2TW=JJROW(N2)                                                    1992
      CMLJPR=0.D0                                                         1992
      CMLJPI=0.D0                                                         1992
      DO 1280 N1=1,MXROW                                                  1993
      L1TW=LLROW(N1)                                                      1994
        J1TW=JJROW(N1)                                                    1994
        C1=1.D0                                                           1994
      IF(ISTRTW) 1255,1260,1255                                           1995
 1255 IA=L1TW                                                             1996
        IB=ISTRTW                                                         1996
        IC=J1TW                                                           1996
        ID=0                                                              1996
      IF=MSITTW                                                           1996
      IE=IF                                                               1996
      CALL CLEB                                                           1997
        C1=RAC                                                            1997
 1260 IA=J1TW                                                             1998
        IB=J2TW                                                           1998
        IC=JSTRTW                                                         1998
        ID=MSITTW                                                         1998
        IF=MJSTTW                                                         1998
      IE=IF-ID                                                            1999
        CALL CLEB                                                         1999
        C2=RAC                                                            1999
        MSFTTW=-IE                                                        1999
      ID=MBARTW                                                           2000
        IE=-MBARTW                                                        2000
        IF=0                                                              2000
        CALL CLEB                                                         2000
        C3=RAC                                                            2000
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      S1=(-1.D0)**MOD(((MBARTW-MSFTTW)/2),2)                                KA2001
      GEOFAC=S1*C1*C2*C3*CRONEC                                               2002
      TERMR=GEOFAC*CMXADR(N1,N2)                                              2003
        TERMI=GEOFAC*CMXADI(N1,N2)                                            2003
      CMLJPR=CMLJPR+TERMR                                                     2004
        CMLJPI=CMLJPI+TERMI                                                   2004
      CMXSJR(MSII,JMJ,N2)=CMXSJR(MSII,JMJ,N2)+TERMR                           2005
      CMXSJI(MSII,JMJ,N2)=CMXSJI(MSII,JMJ,N2)+TERMI                           2006
 1280 CONTINUE                                                                2007
      IF(KTRL(3)) 1310,1365,1310                                              2008
 1310 IF(JS-JS1MAX) 1312,1312,1365                                            2009
 1312 IF(IABS( MSFTTW)-ISTRTW) 1314,1314,1365                                 2010
 1314 MSFF=(ISTRTW-MSFTTW)/2+1                                                2011
      F1=2*(L2TW+1)                                                           2012
        C1=1.D0                                                               2012
      IF(ISTRTW) 1316,1318,1316                                               2013
 1316 IA=L2TW                                                                 2014
        IB=ISTRTW                                                             2014
        IC=J2TW                                                               2014
        ID=0                                                                  2014
      IF=MSFTTW                                                               2014
      IE=IF                                                                   2014
      CALL CLEB                                                               2015
        C1=RAC                                                                2015
 1318 C2=1.D0                                                                 2016
      IF(KQNOTW) 1330,1332,1330                                               2017
 1330 IF=KQNOTW                                                               2018
      IA=IF                                                                   2018
      IC=IF                                                                   2018
      ID=IF                                                                   2018
        IB=JSTRTW                                                             2018
        IE=0                                                                  2018
        CALL CLEB                                                             2018
        C2=RAC                                                                2018
 1332 FC12=F1*C1*C2                                                           2019
      DO 1360 MTII=1,MULT1Z                                                   2020
      C3=1.0D0                                                                2021
        MTFF=MTII                                                             2021
      IF(KQNOTW) 1334,1338,1334                                               2022
 1334 MTITTW=2*MTII-1-MULT1Z                                                  2023
      MTFTTW=MTITTW+MJSTTW                                                    2024
        MTFF=(MTFTTW+1+MULT1Z)/2                                              2024
      IF(IABS( MTFTTW)-KQNOTW) 1336,1336,1360                                 2025
 1336 ID=MTITTW                                                               2026
        IE=MJSTTW                                                             2026
        IF=MTFTTW                                                             2026
        CALL CLEB                                                             2026
        C3=RAC                                                                2026
 1338 GEO=FC12*C3                                                             2027
        TER=GEO*CMLJPR                                                        2027
        TEI=GEO*CMLJPI                                                        2027
      IF(MSII-1) 1352,1351,1352                                               2028
 1351 ZBAR1R(MTII,MTFF,MSFF)=ZBAR1R(MTII,MTFF,MSFF)+TER                       2029
      ZBAR1I(MTII,MTFF,MSFF)=ZBAR1I(MTII,MTFF,MSFF)+TEI                       2030
        GO TO 1360                                                            2030
 1352 ZBAR2R(MTII,MTFF,MSFF)=ZBAR2R(MTII,MTFF,MSFF)+TER                       2031
      ZBAR2I(MTII,MTFF,MSFF)=ZBAR2I(MTII,MTFF,MSFF)+TEI                       2032
 1360 CONTINUE                                                                2033
 1365 CONTINUE                                                                2034
 1370 CONTINUE                                                                2035
 1375 CONTINUE                                                                2036
 1380 CONTINUE                                                                2037
 1390 CONTINUE                                                                2038
      DO 1400 N2=1,MXROWM                                                     2039
      WRITE (8)   ((CMXSJR(MSRE,JMJ,N2),CMXSJI(MSRE,JMJ,N2),                 2040
     1            JMJ=1,JMJRPT),MSRE=1,MSREPT)                                2041
      IF(KTLOUT(18)) 4200,1400,4200                                          KA2042
 4200 WRITE(6,4210) KK,N2,KQNOTW,JSMAX,JS1MAX                                KA2043
 4210 FORMAT(12H04200-ACCSAB,10I4)                                           KA2044
      WRITE(6,4215)((CMXSJR(MSRE,JMJ,N2),CMXSJI(MSRE,JMJ,N2),                KA2045
     1            JMJ=1,JMJRPT),MSRE=1,MSREPT)                               KA2046
 4215 FORMAT((4(2H (,E14.7,1H,,E14.7,1H))))                                  KA2047
 1400 CONTINUE                                                                2049
 1500 CONTINUE                                                                2050
      IF(KTRL(3)) 1610,2000,1610                                              2051
 1610 PI=3.141592653589793                                                   KA2052
      SGABS=4.D1*PI/(WN(1)*WN(1))                                            KA2052
      DO1655 NPS=1,NPOLST                                                     2053
        NENS1=NENSBP(NPS)                                                     2053
        NENS2=NENSBT(NPS)                                                     2053
      DO1650 NE1=1,NENS1                                                      2054
       DO1650 NE2=1,NENS2                                                     2054
       DO1650 MTFF=1,MULT1Z                                                   2054
      MTFTTW=2*MTFF-MULT1Z-1                                                  2055
        MTFINV=MULT1Z+1-MTFF                                                  2055
      B2R=BMTR(NE2,MTFF,NPS)                                                  2056
        B2I=BMTI(NE2,MTFF,NPS)                                                2056
      DO1650 MSFF=1,ISMULT                                                    2057
      MSFTTW=ISTRTW+2-2*MSFF                                                  2058
        MSFINV=ISMULT+1-MSFF                                                  2058
      A2=AMS(NE1,MSFF,NPS)                                                    2059
        A2B2R=A2*B2R                                                          2059
        A2B2I=A2*B2I                                                         KA2059
      DO1650 MTII=1,MULT1Z                                                    2060
      MTITTW=2*MTII-MULT1Z-1                                                  2061
        MTIINV=MULT1Z+1-MTII                                                  2061
      B1R=BMTR(NE2,MTII,NPS)                                                  2062
        B1I=BMTI(NE2,MTII,NPS)                                                2062
      DO1630 MSII=1,ISMULT                                                    2063
      MSITTW=ISTRTW+2-2*MSII                                                  2064
        MSIINV=ISMULT+1-MSII                                                  2064
      IF(MSITTW+MTITTW-MSFTTW-MTFTTW) 1630,1615,1630                          2065
 1615 A1=AMS(NE1,MSII,NPS)                                                    2066
        A1B1R=A1*B1R                                                          2066
        A1B1I=A1*B1I                                                          2066
      ABFACR=A1B1R*A2B2R+A1B1I*A2B2I                                          2067
        ABFACI=A1B1I*A2B2R-A1B1R*A2B2I                                        2067
      IF(MTFTTW-MTITTW) 1618,1617,1617                                        2069
 1617 MTIIT=MTII                                                              2070
        MTFFT=MTFF                                                            2070
        MSIIT=MSII                                                            2070
        MSFFT=MSFF                                                            2070
      GO TO 1619                                                              2071
 1618 MTIIT=MTIINV                                                            2072
        MTFFT=MTFINV                                                          2072
        MSIIT=MSIINV                                                          2072
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      MSFFT=MSFINV
1619  IF(MSIIT-1) 1622,1621,1622
1621  ZBR =ZBAR1R(MTIIT,MTFFT,MSFFT)
        ZBI=ZBAR1I(MTIIT,MTFFT,MSFFT)
      GO TO 1623
1622  ZBR =ZBAR2R(MTIIT,MTFFT,MSFFT)
        ZBI=ZBAR2I(MTIIT,MTFFT,MSFFT)
1623  TSG=ABFACR*ZBI+ABFACI*ZBR
      TOTLXC(NPS)=TOTLXC(NPS)+TSG
1630  CONTINUE
1650  CONTINUE
      TOTLXC(NPS)=SGABS*TOTLXC(NPS)
1655  CONTINUE
      IF(KTRL(5)) 1700,1700,2000
1700  DO 1730 NPS=1,NPOLST
      WRITE(6,1710) TOTLXC(NPS),NPS
1710  FORMAT(///10X,7HTOTLXC=E15.7,9H FOR NPS=I1)
1730  CONTINUE
2000  RETURN
      END
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JN                                  2072
C     CROSS SECTIONS AND POLARISATIONS                                     2073
      SUBROUTINE CROSPL                                                    2074
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES  2074
      IMPLICIT REAL*8 (A-H,O-Z)                                            2075
      COMPLEX*16 TTR,TTI,ZERO                                              2076
      COMMON      FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9          2076
      COMMON      KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)                2077
      COMMON      F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD            2078
      COMMON      ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),   2079
     1            ECM(10),                                                 2080
     2            IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),    2081
     3            NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),   2082
     4            WN(10),WNINI(10),WC(10)                                  KA2082
      COMMON      ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,        KA2083
     1            IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,          2084
     2            AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,    2085
     3            PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,             2086
     4            RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,      2087
     5            XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                          2088
CCCCCC     *****     COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES     *******
      COMMON      EXSGRI(840),EXTRA4(10812),EXTRA5(530)                    KA 2107
      COMMON      MULT1Z,MULTPC,MULTP1,MULTP2,NANGMI,NANGMX,N5INC,         2108
     1            NAGR12,IIOUT,KQNOTW,CLEBCH,FMULFC,WNFAC                  2109
      COMMON      AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),        2110
     1            NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,       2111
     2            NPOLST                                                   2112
CCCCCC      ******     DIMENSIONS CHARACTERISTIC TO THE PRESENT ROUTINE    *****
      DIMENSION   BFAC1R(8,16,7),BFAC2R(8,16,7),BFAC3R(8,16,7),            2114
     1            BFAC4R(8,16,7),BFAC5R(8,16,7),BFAC1I(8,16,7),            2115
     2            BFAC2I(8,16,7),BFAC3I(8,16,7),BFAC4I(8,16,7),            2116
     3            BFAC5I(8,16,7),                                          2117
     4            XAMP1R(16,2,7),XAMP2R(16,2,7),XAMP3R(16,2,7),            2118
     5            XAMP1I(16,2,7),XAMP2I(16,2,7),XAMP3I(16,2,7)             2119
      EQUIVALENCE (EXTRA4(   1),BFAC1R(1)),(EXTRA4( 897),BFAC1I(1)),       KA2120
     1            (EXTRA4(1793),BFAC2R(1)),(EXTRA4(2689),BFAC2I(1)),       KA2121
     2            (EXTRA4(3585),BFAC3R(1)),(EXTRA4(4481),BFAC3I(1)),       KA2122
     3            (EXTRA4(5377),BFAC4R(1)),(EXTRA4(6273),BFAC4I(1)),       KA2123
     4            (EXTRA4(7169),BFAC5R(1)),(EXTRA4(8065),BFAC5I(1)),       KA2124
     5            (EXTRA4(8961),XAMP1R(1)),(EXTRA4(9185),XAMP1I(1)),       KA2125
     6            (EXTRA4(9409),XAMP2R(1)),(EXTRA4(9633),XAMP2I(1)),       KA2126
     7            (EXTRA4(9857),XAMP3R(1)),(EXTRA4(10081),XAMP3I(1))       KA2127
      DIMENSION   FCR(35),FCI(35),SGMAC(35),POLTHN(35,2,3),                2128
     1            SGMTHN(35,2,3),FCR5(100),FCI5(100),SGMAC5(100),          2129
     2            POLTH5(100),SGMTH5(100)                                  2130
      EQUIVALENCE (EXTRA5(1),FCR(1)),(EXTRA5(36),FCI(1)),(EXTRA5(71),       KA2131
     1SGMAC(1)),(EXTRA5(106),POLTHN(1)),(EXTRA5(316),SGMTHN(1)),           KA2132
     2(EXTRA5(1),FCR5(1)),(EXTRA5(101),FCI5(1)),(EXTRA5(201),SGMAC5(1)),   KA2133
     3(EXTRA5(301),POLTH5(1)),(EXTRA5(401),SGMTH5(1))                      KA2134
      CALL DOTEST(2137,NPOLST,3)
      KQNOTW=IIREAD(1)*2**KTRL(1)                                          KA2137
      CLEBCH=1.D-7                                                         KA2138
      SQRT10=DSQRT(10.D0)                                                  2138
        ISMULT=ISTRTW+1                                                    2138
      LINMAX=ISTRTW*ISTRTW+1                                               2139
        MULT1Z=IIMULT(1)                                                   2139
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```
      IF(CHARGE) 264,252,264                                              2140
  252 IF(KTRL(8)) 254,256,254                                             2141
  254 DO 255 N=1,NANGLR                                                   2142
        FCR(N)=0.D0                                                       2142
  255 FCI(N)=0.D0                                                         2143
        GO TO 281                                                         2143
  256 DO 257 N=1,NANGLR                                                   2144
        FCR5(N)=0.D0                                                      2144
  257 FCI5(N)=0.D0                                                        2145
        GO TO 281                                                         2145
  264 ETA=CE(1)                                                           2146
      DO 270 N=1,NANGLR                                                   2147
        SN=DSIN( THETA(N)*0.5D0)                                          2147
        SN=SN*SN                                                          2147
      FLN=ETA*(DLOG(SN))-2.D0*SGMAZZ(1)                                   2148
        FNO=ETA/(2.D0*WN(1)*SN)                                           2148
      FCRT=-FNO*DCOS( FLN)*SQRT10                                         2149
        FCIT= FNO*DSIN( FLN)*SQRT10                                       2149
      IF(KTRL(8)) 265,266,265                                             2150
  265 FCR(N)=FCRT                                                         2151
        FCI(N)=FCIT                                                       2151
        GO TO 270                                                         2151
  266 FCR5(N)=FCRT                                                        2152
        FCI5(N)=FCIT                                                      2152
  270 CONTINUE                                                            2153
      DO 280 N=1,NANGLR                                                   2154
      IF(KTRL(8)) 273,275,273                                             2155
  273 SGMAC (N)=FCR (N)**2+FCI (N)**2                                     2156
        GO TO 280                                                         2156
  275 SGMAC5(N)=FCR5(N)**2+FCI5(N)**2                                     2157
  280 CONTINUE                                                            2158
  281 NAGREP=((NANGLR-1)/7)+1                                             2159
      IF(KTLOUT(15)) 4110,4190,4110                                       2160
 4060 FORMAT((4(2H (,E14.7,1H,,E14.7,1H))))                              KA2161
 4110 WRITE(6,4120)                                                       2162
 4120 FORMAT(15HORUTHERFORD-AMP)                                          2163
      IF(KTRL(8)) 4125,4135,4125                                          2164
 4125 WRITE(6,4060) (FCR (N),FCI (N),N=1,NANGLR)                         KA2165
      GO TO 4190                                                          2167
 4135 WRITE(6,4060) (FCR5(N),FCI5(N),N=1,NANGLR)                         KA2168
 4190 CONTINUE                                                            2170
CCCCCC      ******      DO LOOP FOR DIFFERENT STATES      ******         2171
      DO 2000 I1=1,IIXCAL                                                 2172
      MULTPO=IIMULT(I1)                                                   2173
       MULTP1=MULTPO+1                                                    2173
       MULTP2=MULTPO+2                                                    2173
      IF(KTRL(7)) 1000,1001,1000                                         KA2174
 1000 WNFAC=SQRT10/WN(1)                                                 KA2174
      GO TO 1002                                                         KA2174
 1001 WNFAC=SQRT10/WN(I1)                                                KA2174
 1002 I1OUT=I1                                                           KA2175
      NAGR12=0                                                            2176
        CALL CMMMFC                                                       2176
CCCCCC      ******      DO LOOP FOR DIFFERENT BLOCKS OF ANGLES      ******2177
      DO 1900 NAGR12=1,NAGREP                                             2178
      N5INC=7*(NAGR12-1)                                                  2179
        NANGMI=1                                                          2179
        NAGXCH=7+N5INC                                                    2179
      NANGMX= MINO ( NAGXCH,NANGLR)-N5INC                                 2180
      REWIND 8                                                            2181
      REWIND 9                                                           KA 2181
      CALL BFCTOR                                                         2182
      KDIF=KPRITR(I1)-KPRITR(1)+IIREAD(I1)-IIREAD(1)                      2183
      DO 1600 NPS=1,NPOLST                                                2184
      NENS1=NENSBP(NPS)                                                   2185
        NENS2=NENSBT(NPS)                                                 2185
        I2=NPS                                                            2185
      DO 1030 N3=NANGMI,NANGMX                                            2186
        N5=N3+N5INC                                                       2186
      IF(KTRL(8)) 1010,1005,1010                                          2187
 1005 SGMTH5(N5)=0.D0                                                     2188
       POLTH5(N5)=0.D0                                                    2188
        GO TO 1030                                                        2188
 1010 DO 1020 N4=1,NFAI                                                   2189
      SGMTHN(N5,N4,I2)=0.D0                                               2190
        POLTHN(N5,N4,I2)=0.D0                                             2190
 1020 CONTINUE                                                            2191
 1030 CONTINUE                                                            2192
      DO 1500 NE1=1,NENS1                                                 2193
        DO 1500 NE2=1,NENS2                                               2193
      DO 1050 MN=1,MULTPO                                                 2194
        DO 1050 N4=1,NFAI                                                 2194
      DO 1050 N3=NANGMI,NANGMX                                            2195
      XAMP1R(MN,N4,N3)=0.D0                                               2196
        XAMP1I(MN,N4,N3)=0.D0                                             2196
      XAMP2R(MN,N4,N3)=0.D0                                               2197
        XAMP2I(MN,N4,N3)=0.D0                                             2197
      XAMP3R(MN,N4,N3)=0.D0                                               2198
        XAMP3I(MN,N4,N3)=0.D0                                             2198
 1050 CONTINUE                                                            2199
      DO 1350 MSII=1,ISMULT                                               2200
      MSITTW=ISTRTW+2-2*MSII                                              2201
        WEITSS=AMS(NE1,MSII  ,NPS)                                        2201
      DO 1350 MSFF=1,ISMULT                                               2202
      MSFTTW=ISTRTW+2-2*MSFF                                              2203
        LINT=MSII+ISMULT*(MSFF-1)                                         2203
      DO 1350 MTII=1,MULT1Z                                               2204
      MTITTW=2*MTII-IIMULT(1)-1                                           2205
        MTIINV=MULT1Z+1-MTII                                              2205
      WEITTS=BMTR(NE2,MTII  ,NPS)                                         2206
      DO 1340 MTFF=1,MULTPO                                               2207
      MTFTTW=2*MTFF-IIMULT(I1)-1                                          2208
        MTFINV=MULTPO+1-MTFF                                              2208
      MEL=(MSITTW+MTITTW-MSFTTW-MTFTTW)/2                                 2209
      WEIT1=WEITSS*WEITTS                                                 2210
        FMEL=MEL                                                          2210
        IF(LINT-LINMAX) 1075,1075,1077                                    2210
 1075 LIN=LINT                                                            2211
        MTIT=MTII                                                         2211
        MTFT=MTFF                                                         2211
        GO TO 1080                                                        2211
 1077 LIN=ISMULT*ISMULT+1-LINT                                            2212
      SIGNKM=(-1.D0)**MOD((KDIF+MEL),2)                                  KA 2212
      WEIT1=WEIT1*SIGNKM                                                  2213
        MTIT=MTIINV                                                       2213
        MTFT=MTFINV                                                       2213
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```
1080 DO 1300 N3=NANGMI,NANGMX
     GO TO (1111,1113,1115,1117,1119),LIN
1111 AZMF1R=BFAC1R(MTIT,MTFT,N3)
     AZMF1I=BFAC1I(MTIT,MTFT,N3)
       GO TO 1130
1113 AZMF1R=BFAC2R(MTIT,MTFT,N3)
     AZMF1I=BFAC2I(MTIT,MTFT,N3)
       GO TO 1130
1115 AZMF1R=BFAC3R(MTIT,MTFT,N3)
     AZMF1I=BFAC3I(MTIT,MTFT,N3)
       GO TO 1130
1117 AZMF1R=BFAC4R(MTIT,MTFT,N3)
     AZMF1I=BFAC4I(MTIT,MTFT,N3)
       GO TO 1130
1119 AZMF1R=BFAC5R(MTIT,MTFT,N3)
     AZMF1I=BFAC5I(MTIT,MTFT,N3)
1130 DO 1300 N4=1,NFAI
     ARG=FMEL*FAI(N4)
       EXPMLR=DCOS( ARG)
       EXPMLI=DSIN( ARG)
     TERM1R=(EXPMLR*AZMF1R-EXPMLI*AZMF1I)*WEIT1
     TERM1I=(EXPMLR*AZMF1I+EXPMLI*AZMF1R)*WEIT1
     GO TO (1161,1163,1165),MSFF
1161 XAMP1R(MTFF,N4,N3)=XAMP1R(MTFF,N4,N3)+TERM1R
     XAMP1I(MTFF,N4,N3)=XAMP1I(MTFF,N4,N3)+TERM1I
       GO TO 1300
1163 XAMP2R(MTFF,N4,N3)=XAMP2R(MTFF,N4,N3)+TERM1R
     XAMP2I(MTFF,N4,N3)=XAMP2I(MTFF,N4,N3)+TERM1I
       GO TO 1300
1165 XAMP3R(MTFF,N4,N3)=XAMP3R(MTFF,N4,N3)+TERM1R
     XAMP3I(MTFF,N4,N3)=XAMP3I(MTFF,N4,N3)+TERM1I
1300 CONTINUE
1340 CONTINUE
1350 CONTINUE
     IF(I1-1) 1407,1361,1407
1361 IF(CHARGE) 1362,1407,1362
1362 AMS1=AMS(NE1  ,1,NPS)
     AMS2=AMS(NE1  ,2,NPS)
     AMS3=AMS(NE1  ,3,NPS)
     DO 1405 N3=NANGMI,NANGMX
       N5=N3+N5INC
     IF(KTRL(8)) 1380,1385,1380
1380 FCRR=FCR (N5)
       FCII=FCI (N5)
       GO TO 1390
1385 FCRR=FCR5(N5)
       FCII=FCI5(N5)
1390 DO 1405 N4=1,NFAI
     DO 1405 MTFF=1,MULTPO
     BMT1=BMTR(NE2 ,MTFF,NPS)
     AMBM1=AMS1*BMT1
       AMBM2=AMS2*BMT1
       AMBM3=AMS3*BMT1
     XAMP1R(MTFF,N4,N3)=XAMP1R(MTFF,N4,N3)+FCRR*AMBM1
     XAMP1I(MTFF,N4,N3)=XAMP1I(MTFF,N4,N3)+FCII*AMBM1
     XAMP2R(MTFF,N4,N3)=XAMP2R(MTFF,N4,N3)+FCRR*AMBM2
     XAMP2I(MTFF,N4,N3)=XAMP2I(MTFF,N4,N3)+FCII*AMBM2
     XAMP3R(MTFF,N4,N3)=XAMP3R(MTFF,N4,N3)+FCRR*AMBM3
     XAMP3I(MTFF,N4,N3)=XAMP3I(MTFF,N4,N3)+FCII*AMBM3
1405 CONTINUE
1407 I2=NPS
     DO 1450 N3=NANGMI,NANGMX
       N5=N3+N5INC
     DO 1450 N4=1,NFAI
       CO=DCOS( FAI(N4))
       SI=DSIN( FAI(N4))
     DO 1430 MTFF=1,MULTPO
     XP1R=XAMP1R(MTFF,N4,N3)
       XP1I=XAMP1I(MTFF,N4,N3)
     XP2R=XAMP2R(MTFF,N4,N3)
       XP2I=XAMP2I(MTFF,N4,N3)
     XP3R=XAMP3R(MTFF,N4,N3)
       XP3I=XAMP3I(MTFF,N4,N3)
     GO TO (1421,1423,1425), ISMULT
1421 TERMSG=XP1R*XP1R+XP1I*XP1I
       TERMPL=0.D0
       GO TO 1427
1423 TERMSG=XP1R*XP1R+XP1I*XP1I+XP2R*XP2R+XP2I*XP2I
     TERMPL=CO*(XP1R*XP2I-XP1I*XP2R)
    1       -SI*(XP1R*XP2R+XP1I*XP2I)
     GO TO 1427
1425 TERMSG=XP1R*XP1R+XP1I*XP1I+XP2R*XP2R+XP2I*XP2I+XP3R*XP3R+XP3I*XP3I
     TERMPL=0.D0
1427 IF(KTRL(8)) 1428,1429,1428
1428 SGMTHN(N5,N4,I2)=SGMTHN(N5,N4,I2)+TERMSG
     POLTHN(N5,N4,I2)=POLTHN(N5,N4,I2)+TERMPL
     GO TO 1430
1429 SGMTH5(N5)=SGMTH5(N5)+TERMSG
     POLTH5(N5)=POLTH5(N5)+TERMPL
1430 CONTINUE
1450 CONTINUE
1500 CONTINUE
     DO 1560 N3=NANGMI,NANGMX
       N5=N3+N5INC
     IF(KTRL(8)) 1547,1545,1547
1545 IF(SGMTH5(N5).EQ.0.D0) GO TO 1560                                  KA2285
     POLTH5(N5)=2.D0*POLTH5(N5)/SGMTH5(N5)
       GO TO 1560
1547 DO 1550 N4=1,NFAI
     IF(SGMTHN(N5,N4,I2).EQ.0.D0)   GO TO 1550                          KA2287
     POLTHN(N5,N4,I2)=2.D0*POLTHN(N5,N4,I2)/SGMTHN(N5,N4,I2)
1550 CONTINUE
1560 CONTINUE
1600 CONTINUE
1900 CONTINUE
     IF(KTRL(17)) 1905,1930,1905
1905 IF(KTRL(8)) 1930,1910,1930
1910 IF(CHARGE) 1912,1930,1912
1912 IF(I1-1) 1930,1915,1930
1915 DO 1920 NA=1,NANGLR
1920 SGMTH5(NA)=SGMTH5(NA)/SGMAC5(NA)
1930 CALL OUTPUT
2000 CONTINUE
     RETURN
     END
```

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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JO
      SUBROUTINE CMMMFC                                                  2303
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                         KA2304
      COMPLEX*16 TTR,TTI,ZERO                                           KA2304
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      KA2305
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)             2306
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA2307
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  2308
     1             ECM(10),                                               2309
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  2310
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  2311
     4             WN(10),WNINI(10),WC(10)                                2312
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,      2313
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,        2314
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  2315
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,           2316
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,    2317
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                        2318
CCCCCC      ******      COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES  *****
      COMPLEX*16 EXSGRI                                                 KA2320
      COMMON       EXSGRI(70,6),EXTRA4(10812),EXTRA5(530)               KA2322
      COMMON       MULT1Z,MULTPO,MULTP1,MULTP2,NANGMI,NANGMX,N5INC,       2323
     1             NAGR12,I1OUT,KQNOTW,CLEBCH,FMULFC,WNFAC               2324
      COMMON       AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),      2325
     1             NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,     2326
     2             NPOLST                                                 2327
CCCCCC      ******     DIMENSIONS CHARACTERISTIC TO THE PRESENT ROUTINE    *****
      DIMENSION  CMMM1R(8,16,8),CMMM2R(8,16,8),CMMM3R(8,16,8),            2329
     1           CMMM4R(8,16,8),CMMM5R(8,16,8),CMMM1I(8,16,8),            2330
     2           CMMM2I(8,16,8),CMMM3I(8,16,8),CMMM4I(8,16,8),            2331
     3           CMMM5I(8,16,8)                                           2332
      DIMENSION  CMXR(3,8,13),CMXI(3,8,13)                                2333
      DIMENSION  CMXSJR(3,49),CMXSJI(3,49),CGJSME(7)                      2334
      EQUIVALENCE  (EXTRA4(   1),CMMM1R(1)),(EXTRA4(1025),CMMM1I(1)),     2335
     1             (EXTRA4(2049),CMMM2R(1)),(EXTRA4(3073),CMMM2I(1)),     2336
     2             (EXTRA4(4097),CMMM3R(1)),(EXTRA4(5121),CMMM3I(1)),     2337
     3             (EXTRA4(6145),CMMM4R(1)),(EXTRA4(7169),CMMM4I(1)),     2338
     4             (EXTRA4(8193),CMMM5R(1)),(EXTRA4(9217),CMMM5I(1))      2339
      EQUIVALENCE  (EXTRA4(10241),CMXR(1)),(EXTRA4(10553),CMXI(1))       2340
      EQUIVALENCE  (EXTRA4(10241),CMXSJR(1)),(EXTRA4(10388),CMXSJI(1)),   2341
     1             (EXTRA4(10535),CGJSME(1))                              2342
      DIMENSION  NROWST(6)                                                2343
      CALL DOTEST(2343,NPOLST,3)
      I1=I1OUT                                                            2344
      SQRT10=DSQRT(10.D0)                                                 2345
        LINMAX=ISTRTW*ISTRTW+1                                            2345
        ISMULT=ISTRTW+1                                                   2345
      MSREPT=(ISTRTW/2)+1                                                 2346
      JSMAX=(IIREAD(1)+IIREAD(IIXCAL)-KTRL(1))/2+1                        2347
      JSMAXI=(IIREAD(1)+IIREAD(I1)-KTRL(1))/2+1                           2350
      JMJRPT=JSMAX*JSMAX                                                KA2351
      JMJRPI=JSMAXI*JSMAXI                                              KA2352
      K14=KEXCOM(14)-1                                                    2353
        K14RPT=(K14/8)+1                                                  2353
      REWIND 9                                                          KA2354
      DO 1200 K14R=1,K14RPT                                             KA2355
      REWIND 8                                                            2356
      LTRUMI=8*(K14R-1)                                                   2357
        LTRUMX=LTRUMI+7                                                   2357
      LTRUMX= MINO (K14,LTRUMX)                                           2358
        LWRTMX=LTRUMX-LTRUMI+1                                            2358
      DO 310 MTII=1,MULT1Z                                                2359
      DO 310 MTFF=1,MULTPO                                                2360
      DO 310 LWRT=1,LWRTMX                                                2361
      CMMM1R(MTII,MTFF,LWRT)=0.D0                                         2362
        CMMM2R(MTII,MTFF,LWRT)=0.D0                                       2362
      CMMM3R(MTII,MTFF,LWRT)=0.D0                                         2363
        CMMM4R(MTII,MTFF,LWRT)=0.D0                                       2363
      CMMM5R(MTII,MTFF,LWRT)=0.D0                                         2364
      CMMM1I(MTII,MTFF,LWRT)=0.D0                                         2365
        CMMM2I(MTII,MTFF,LWRT)=0.D0                                       2365
      CMMM3I(MTII,MTFF,LWRT)=0.D0                                         2366
        CMMM4I(MTII,MTFF,LWRT)=0.D0                                       2366
      CMMM5I(MTII,MTFF,LWRT)=0.D0                                         2367
310   CONTINUE                                                            2368
      IF(KTRL(7)) 332,330,332                                             2369
330   JJMAX=JJJMAX                                                        2370
        KMAX=2                                                            2370
        GO TO 350                                                         2370
332   WNFCAD=SQRT10/WN(1)                                                 2371
        KEXCOM(45)=1                                                      2371
        KEXCOM(46)=1                                                      2371
      CALL NLJJJK                                                         2372
        MXROW1=MXROW                                                      2372
      KEXCOM(46)=2                                                        2373
        CALL NLJJJK                                                       2373
        MXROW2=MXROW                                                      2373
      JJMAX=MXROW1+MXROW2                                                 2374
       KMAX=1                                                             2374
       HAT1=IIMULT(1)                                                     2374
       HATN=IIMULT(I1)                                                    2374
      HATFAC=DSQRT( HAT1/HATN)*2.D0*WNFCAD                                2375
        ID=0                                                              2375
        IE=KQNOTW                                                         2375
      IF=KQNOTW                                                           2376
        IB=IIMULT(1)-1                                                    2376
        IC=IIMULT(I1)-1                                                   2376
      DO 340 JS=1,JSMAX                                                   2377
      JSTRTW=4*JS-4                                                       2378
        IA=JSTRTW                                                         2378
        CALL CLEB                                                         2378
      CGJSME(JS)=RAC*HATFAC                                               2379
340   CONTINUE                                                            2380
350   DO 1010 JJ=1,JJMAX                                                  2381
      IF(KTRL(7)) 353,351,353                                             2382
351   KS=KTRL(1)+ISTRTW                                                   2383
      KTISCK=MOD(KS,2)                                                  KA2383
       JJTRTW=2*JJ-2+KTISCK                                               2383
      GO TO 360                                                           2384
353   IF(JJ-1) 357,355,357                                                2385
355   KEXCOM(45)=1                                                        2386
        KEXCOM(46)=1                                                      2386
        CALL NLJJJK                                                       2386
```

```
      MXROWM=MXROW                                                      2386
357 IF(JJ-MXROW1-1) 360,359,360                                         2387
359 KEXCOM(45)=1                                                        2388
      KEXCOM(46)=2                                                      2388
      CALL NLJJJK                                                       2388
      MXROWM=MXROW                                                      2388
360 DO 1005 K=1,KMAX                                                    2389
    IF(KTRL(7)) 511,411,511                                             2390
411 SIGN7=(-1.D0)**MOD(((ISTRTW+IIMULT(1)-1-JJTRTW)/2+K+1),2)           KA2391
    KEXCOM(45)=JJ                                                       2392
      KEXCOM(46)=K                                                      2392
      CALL NLJJJK                                                       2392
    IF(MXROW) 1005,1005,412                                             2393
412 DO 420 I2=1,I1                                                      2394
      NROWST(I2)=0                                                      2394
    DO 415 N1=1,MXROW                                                   2395
      IF(NNROW(N1)-I2) 415,413,420                                      2395
413 NROWST(I2)=NROWST(I2)+1                                             2396
415 CONTINUE                                                            2397
420 CONTINUE                                                            2398
    I3=I1-1                                                             2399
      NROWMI=1                                                          2399
     IF(I3) 422,425,422                                                 2399
422 DO 423 I2=1,I3                                                      2400
423 NROWMI=NROWMI+NROWST(I2)                                            2401
425 NROWNS=NROWST(I1)                                                   2402
    DO 450 MSRE=1,MSREPT                                                2403
    DO 450 MTII=1,MULT1Z                                                2404
    MTIINV=MULT1Z+1-MTII                                                2405
    READ (8)    (BR(N1),BI(N1),N1=1,MXROW)                              2406
    DO 448 NRW=1,NROWNS                                                 2407
    N1=NRW+NROWMI-1                                                     2408
      CR=BR(N1)*WNFAC                                                   2408
      CI=BI(N1)*WNFAC                                                   2408
    L1=(LLROW(N1)/2)+1                                                  2409
     ER1=EXSGRI(L1,I1)                                                  2409
     EI1=EXSGRI(L1,I1)*(0.D0,-1.D0)                                     2410
    ER=ER1*ER1-EI1*EI1                                                  2410
     EI=2.D0*ER1*EI1                                                    2410
     CMR=CR*ER-CI*EI                                                    2410
    CMI=CR*EI+CI*ER                                                     2411
    IF(MSRE-1) 443,441,443                                              2412
441 CMXR(1,MTII,NRW)=CMR                                                2413
      CMXI(1,MTII,NRW)=CMI                                              2413
    IF(ISTRTW-1) 448,442,442                                            2414
442 ISR=ISTRTW+1                                                        2415
    CMXR(ISR,MTIINV,NRW)=CMR*SIGN7                                      2416
    CMXI(ISR,MTIINV,NRW)=CMI*SIGN7                                      2417
      GO TO 448                                                         2417
443 CMXR(2,MTII,NRW)=CMR                                                2418
      CMXI(2,MTII,NRW)=CMI                                              2418
448 CONTINUE                                                            2419
450 CONTINUE                                                            2420
    GO TO 530                                                           2421
511 IF(JJ-MXROW1) 512,512,514                                           2422
512 N1=JJ                                                               2423
      GO TO 515                                                         2423
514 N1=JJ-MXROW1                                                        2424
515 L1TRTW=LLROW(N1)                                                    2425
      L1TR=L1TRTW/2                                                     2425
    READ (8)    ((CMXSJR(MSRE,JMJ),CMXSJI(MSRE,JMJ),                   2426
   1             JMJ=1,JMJRPT),MSRE=1,ISMULT)                         2427
    IF(KTLOUT(20)) 4200,516,4200                                        KA2428
4200 WRITE(6,4210) K14R                                                 KA2429
4210 FORMAT(12H04210-CMMMFC,10I4)                                       KA2430
    WRITE(6,4215) ((CMXSJR(MSRE,JMJ),CMXSJI(MSRE,JMJ),                  KA2431
   1             JMJ=1,JMJRPT),MSRE=1,ISMULT)                         KA2432
4215 FORMAT ((4(2H (,E14.7,1H,,E14.7,1H))))                             KA2433
 516 IF((L1TR-LTRUMI)*(L1TR-LTRUMX)) 517,517,1010                       KA2434
 517 J1TRTW=JJROW(N1)                                                   2437
      L1=L1TR+1                                                         2437
    ER1=EXSGRI(L1,1)                                                    2438
      EI1=EXSGRI(L1,1)*(0.D0,-1.D0)                                     2438
    ER=ER1*ER1-EI1*EI1                                                  2439
     EI=2.D0*ER1*EI1                                                    2439
    DO 520 JMJ=1,JMJRPI                                                 2440
    DO 520 MSRE=1,ISMULT                                                2441
    CR=CMXSJR(MSRE,JMJ)                                                 2442
      CI=CMXSJI(MSRE,JMJ)                                               2442
    CMXSJR(MSRE,JMJ)=CR*ER-CI*EI                                        2443
      CMXSJI(MSRE,JMJ)=CR*EI+CI*ER                                      2443
 520 CONTINUE                                                           2444
    IF(KTLOUT(20)) 4510,530 ,4510                                       KA2445
4510 WRITE(6,4520) JJ,K,L1TR,LTRUMI,LTRUMX,ER1,EI1                      2446
4520 FORMAT(12H04500-CMMMFC,  5I5,2E15.7)                               2447
    WRITE(6,4215) ((CMXSJR(MSRE,JMJ),CMXSJI(MSRE,JMJ),                  KA2448
   1             JMJ=1,JMJRPT),MSRE=1,ISMULT)                         KA2449
 530 NRWMAX=NROWNS*(1-KTRL(7))+KTRL(7)                                  2451
    DO 1002 NRW=1,NRWMAX                                                2452
    IF(KTRL(7)) 650,610,650                                             2453
 610 NRWT=NROWMI+NRW-1                                                  2454
      L1TRTW=LLROW(NRWT)                                                2454
      L1TR=L1TRTW/2                                                     2454
    IF((L1TR-LTRUMI)*(L1TR-LTRUMX)) 615,615,1002                        KA2456
 615 J1TRTW=JJROW(NRWT)                                                 2457
 650 DO 1000 MSII=1,ISMULT                                              2458
    MSITTW=ISTRTW+2-2*MSII                                              2459
     MSIINV=ISMULT+1-MSII                                               2459
    DO 1000 MTII=1,MULT1Z                                               2460
    MTITTW=2*MTII-IIMULT(1)-1                                           2461
      MSMITW=MSITTW+MTITTW                                              2461
    DO 990 MTFF=1,MULTPO                                                2462
    MTFTTW=2*MTFF-IIMULT(I1)-1                                          2463
    DO 980 MSFF=1,MSREPT                                                2464
    MSFTTW=ISTRTW+2-2*MSFF                                              2465
      LINEAR=MSII+ISMULT*(MSFF-1)                                       2465
    IF(LINEAR-LINMAX) 660,660,980                                       2466
 660 IF(KTRL(7)) 710,670,710                                            2467
 670 IA=J1TRTW                                                          2468
     IB=MULTPO-1                                                        2468
     IC=JJTRTW                                                          2468
     IE=MTFTTW                                                          2468
     IF=MSMITW                                                          2468
    ID=IF-IE                                                            2469
      CALL CLEB                                                         2469
      CLEBS1=RAC                                                        2469
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      PLFACR=CMXR(MSII,MTII,NRW)*RAC                                    2470
      PLFACI=CMXI(MSII,MTII,NRW)*RAC                                    2471
       GO TO 750                                                        2471
  710 SUMJJR=0.D0                                                       2472
        SUMJJI=0.D0                                                     2472
        MJTRTW=MTFTTW-MTITTW                                            2472
      IB=IIMULT(1)-1                                                    2473
       IC=IIMULT(I1)-1                                                  2473
       ID=MJTRTW                                                        2473
       IE=MTITTW                                                        2473
      IF=MTFTTW                                                         2474
      DO 720 JS=1,JSMAXI                                                2475
      JSTRTW=4*JS-4                                                     2476
      IF(JSTRTW-IABS( MJTRTW)) 720,712,712                              2477
  712 IA=JSTRTW                                                         2478
        CALL CLEB                                                       2478
        T1=RAC*CGJSME(JS)                                               2478
      M1=IABS( MJTRTW)/2                                                2479
      JMJ=(JS-1)*(JS-1)+M1+1                                         KA2480
      IF(MJTRTW) 718,717,717                                            2482
  717 SUMJJR=SUMJJR+T1*CMXSJR(MSII,JMJ)                                 2483
      SUMJJI=SUMJJI+T1*CMXSJI(MSII,JMJ)                                 2484
        GO TO 720                                                       2484
  718 T1=T1*((-1.D0)**MOD((L1TRTW+J1TRTW-ISTRTW-JSTRTW)/2,2))        KA 2485
      SUMJJR=SUMJJR+T1*CMXSJR(MSIINV,JMJ)                               2486
      SUMJJI=SUMJJI+T1*CMXSJI(MSIINV,JMJ)                               2487
  720 CONTINUE                                                          2488
      PLFACR=SUMJJR                                                     2489
        PLFACI=SUMJJI                                                   2489
  750 IA=L1TRTW                                                      KA2491
       IB=ISTRTW                                                        2491
       IC=J1TRTW                                                        2491
       IE=MSFTTW                                                        2491
       IF=MSMITW-MTFTTW                                                 2491
      ID=IF-IE                                                          2492
       CALL CLEB                                                        2492
       CLEBS2=RAC                                                       2492
       MEL=ID/2                                                         2492
       MELABS=IABS( MEL)                                                2492
      FL2=L1TRTW+1                                                      2493
       K1=L1TR+MELABS+1                                                 2493
       K2=L1TR-MELABS+1                                                 2493
      IF(K2) 980,980,760                                                2494
  760 FCC=FACLOG(K1)-FACLOG(K2)                                         2495
      FCC=DEXP(-0.5D0*FCC)                                              2495
      GEOFAC=FL2*FCC*CLEBS2*((-1.D0)**MOD((MEL+MELABS)/2,2))         KA 2496
      PLFACR=GEOFAC*PLFACR                                              2497
        PLFACI=GEOFAC*PLFACI                                            2497
      N1=L1TR+1-LTRUMI                                                  2498
      IF(KTLOUT(20)) 4310,830,4310                                   KA2499
 4310 WRITE(6,4320) NRW,MSII,MTII,MSFF,MTFF,JSMAXI,MEL,K1,K2,N1,LINEAR,KA2500
     1               SUMJJR,SUMJJI,PLFACR,PLFACI,GEOFAC,(CGJSME(N),N=1,3)KA2501
 4320 FORMAT(12H0430C-CMMMFC,11I5/(8E15.7))                          KA2502
  830 GO TO ( 831,833,835,837,839 ),LINEAR                           KA2504
  831 CMMM1R(MTII,MTFF,N1)=CMMM1R(MTII,MTFF,N1)+PLFACR                  2505
      CMMM1I(MTII,MTFF,N1)=CMMM1I(MTII,MTFF,N1)+PLFACI                  2506
      GO TO 980                                                      KA2506
  833 CMMM2R(MTII,MTFF,N1)=CMMM2R(MTII,MTFF,N1)+PLFACR                  2507
      CMMM2I(MTII,MTFF,N1)=CMMM2I(MTII,MTFF,N1)+PLFACI                  2508
      GO TO 980                                                      KA2508
  835 CMMM3R(MTII,MTFF,N1)=CMMM3R(MTII,MTFF,N1)+PLFACR                  2509
      CMMM3I(MTII,MTFF,N1)=CMMM3I(MTII,MTFF,N1)+PLFACI                  2510
      GO TO 980                                                      KA2510
  837 CMMM4R(MTII,MTFF,N1)=CMMM4R(MTII,MTFF,N1)+PLFACR                  2511
      CMMM4I(MTII,MTFF,N1)=CMMM4I(MTII,MTFF,N1)+PLFACI                  2512
      GO TO 980                                                      KA2512
  839 CMMM5R(MTII,MTFF,N1)=CMMM5R(MTII,MTFF,N1)+PLFACR                  2513
      CMMM5I(MTII,MTFF,N1)=CMMM5I(MTII,MTFF,N1)+PLFACI                  2514
  980 CONTINUE                                                          2516
  990 CONTINUE                                                          2517
 1000 CONTINUE                                                          2518
 1002 CONTINUE                                                          2519
 1005 CONTINUE                                                          2520
 1010 CONTINUE                                                          2521
      DO 1130 N1=1,LWRTMX                                               2522
      DO 1120 LIN=1,LINMAX                                              2523
      GO TO (1110,1112,1114,1116,1118 ),LIN                             2524
 1110 WRITE (9)     ((CMMM1R(MTII,MTFF,N1),CMMM1I(MTII,MTFF,N1),    KA2525
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                        2526
        GO TO 1120                                                      2526
 1112 WRITE (9)     ((CMMM2R(MTII,MTFF,N1),CMMM2I(MTII,MTFF,N1),    KA2527
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                        2528
        GO TO 1120                                                      2528
 1114 WRITE (9)     ((CMMM3R(MTII,MTFF,N1),CMMM3I(MTII,MTFF,N1),    KA2529
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                        2530
        GO TO 1120                                                      2530
 1116 WRITE (9)     ((CMMM4R(MTII,MTFF,N1),CMMM4I(MTII,MTFF,N1),    KA2531
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                        2532
        GO TO 1120                                                      2532
 1118 WRITE (9)     ((CMMM5R(MTII,MTFF,N1),CMMM5I(MTII,MTFF,N1),    KA2533
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                        2534
 1120 CONTINUE                                                          2535
 1130 CONTINUE                                                          2536
      IF(KTLOUT(21)) 4100,1200,4100                                  KA2537
 4100 WRITE(6,4105) K14R                                             KA2538
 4105 FORMAT(12H0410C-CMMMFC,10I4)                                   KA2539
      DO 4130 N1=1,LWRTMX                                            KA2540
      DO 4120 LIN=1,LINMAX                                           KA2541
      GO TO (4110,4112,4114),LIN                                     KA2542
 4110 WRITE(6,4215)    ((CMMM1R(MTII,MTFF,N1),CMMM1I(MTII,MTFF,N1),KA2543
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                     KA2544
        GO TO 4120                                                   KA2544
 4112 WRITE(6,4215)    ((CMMM2R(MTII,MTFF,N1),CMMM2I(MTII,MTFF,N1),KA2545
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                     KA2546
        GO TO 4120                                                   KA2546
 4114 WRITE(6,4215)    ((CMMM3R(MTII,MTFF,N1),CMMM3I(MTII,MTFF,N1),KA2547
     1            MTFF=1,MULTPO),MTII=1,MULT1Z)                     KA2548
 4120 CONTINUE                                                       KA2549
 4130 CONTINUE                                                       KA2550
 1200 CONTINUE                                                          2552
      RETURN                                                            2553
      END                                                               2554
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JP
      SUBROUTINE BFCTOR                                                  2555
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                         KA2556
      COMPLEX*16 TTR,TTI,ZERO                                           KA2556
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      KA2557
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)            2558
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD        KA2559
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  2560
     1             ECM(10),                                             2561
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),  2562
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  2563
     4             WN(10),WNINI(10),WC(10)                              2564
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,    2565
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,      2566
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,  2567
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,         2568
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,  2569
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                      2570
CCCCCC      ******       COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES  *****
      COMMON       EXSGRI(840),EXTRA4(10812),EXTRA5(530)                KA2573
      COMMON       MULT1Z,MULTPO,MULTP1,MULTP2,NANGMI,NANGMX,N5INC,     2574
     1             NAGR12,I1OUT,KQNOTW,CLEBCH,FMULFC,WNFAC             2575
      COMMON       AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),    2576
     1             NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,   2577
     2             NPOLST                                               2578
CCCCCC      ******      DIMENSIONS CHARACTERISTIC TO THE PRESENT ROUTINE  *****
      DIMENSION  BFAC1R(8,16,7),BFAC2R(8,16,7),BFAC3R(8,16,7),          2580
     1           BFAC4R(8,16,7),BFAC5R(8,16,7),BFAC1I(8,16,7),          2581
     2           BFAC2I(8,16,7),BFAC3I(8,16,7),BFAC4I(8,16,7),          2582
     3           BFAC5I(8,16,7)                                         2583
      DIMENSION  P(9,14,7),CMMMR(8,16),CMMMI(8,16)                      2584
      EQUIVALENCE  (EXTRA4(   1),BFAC1R(1)),(EXTRA4( 897),BFAC1I(1)),   2585
     1             (EXTRA4(1793),BFAC2R(1)),(EXTRA4(2689),BFAC2I(1)),   2586
     2             (EXTRA4(3585),BFAC3R(1)),(EXTRA4(4481),BFAC3I(1)),   2587
     3             (EXTRA4(5377),BFAC4R(1)),(EXTRA4(6273),BFAC4I(1)),   2588
     4             (EXTRA4(7169),BFAC5R(1)),(EXTRA4(8065),BFAC5I(1))    2589
      EQUIVALENCE  (EXTRA4(8961),P(1)),(EXTRA4(9843),CMMMR(1)),         2590
     1                              (EXTRA4(9971),CMMMI(1))             2591
      CALL DOTEST(2592,NPOLST,3)
      I1=I1OUT                                                          2592
      SQRT10=DSQRT(10.D0)                                               2593
        LINMAX=ISTRTW*ISTRTW+1                                          2593
        ISMULT=ISTRTW+1                                                 2593
      MSREPT=(ISTRTW/2)+1                                               2594
      JSMAX=(IIREAD(1)+IIREAD(IIXCAL)-KTRL(1))/2+1                      2595
      JSMAXI=(IIREAD(1)+IIREAD(I1)-KTRL(1))/2+1                         2598
      JMJRPT=JSMAX*JSMAX                                               KA2599
      JMJRPI=JSMAXI*JSMAXI                                             KA2600
      K14=KEXCOM(14)-1                                                  2601
        K14RPT=(K14/8)+1                                                2601
      REWIND 9                                                         KA2602
      DO 1410 MTII=1,MULT1Z                                            KA2603
      DO 1410 MTFF=1,MULTPO                                             2604
      DO 1410 N3=NANGMI,NANGMX                                          2605
      BFAC1R(MTII,MTFF,N3)=0.D0                                         2606
       BFAC2R(MTII,MTFF,N3)=0.D0                                        2606
      BFAC3R(MTII,MTFF,N3)=0.D0                                         2607
       BFAC4R(MTII,MTFF,N3)=0.D0                                        2607
      BFAC5R(MTII,MTFF,N3)=0.D0                                         2608
      BFAC1I(MTII,MTFF,N3)=0.D0                                         2609
       BFAC2I(MTII,MTFF,N3)=0.D0                                        2609
      BFAC3I(MTII,MTFF,N3)=0.D0                                         2610
       BFAC4I(MTII,MTFF,N3)=0.D0                                        2610
      BFAC5I(MTII,MTFF,N3)=0.D0                                         2611
1410  CONTINUE                                                          2612
      DO 1700 K14R=1,K14RPT                                             2613
      LTRUMI=8*(K14R-1)                                                 2614
        LTRUMX=LTRUMI+7                                                 2614
       LTRUMX= MINO (K14,LTRUMX)                                        2614
      LWRTMX=LTRUMX-LTRUMI+1                                            2615
      MMCH2=ISTRTW+IIREAD(1)+IIREAD(I1)+1-KTRL(1)                       2616
      DO 1450 N3=NANGMI,NANGMX                                          2617
      N5=N3+N5INC                                                       2618
        TH=THETA(N5)                                                    2618
        CO=DCOS( TH)                                                    2618
      SI=1.D0/DSIN(TH)                                                  2618
      CT=2.D0*CO*SI                                                     2619
      IF(K14R-1) 1427,1425,1427                                         2620
1425  P(1,1,N3)=1.D0                                                    2621
       P(2,1,N3)=CO                                                     2621
       P(1,2,N3)=0.D0                                                   2621
       FL=0.D0                                                          2621
       GO TO 1430                                                       2621
1427  FL=LTRUMI                                                         2622
        FLP1=FL+1.D0                                                    2622
        TWLP1=FL+FLP1                                                   2622
      DO 1428 M=1,MMCH2                                                 2623
1428  P(1,M,N3)=P(9,M,N3)                                               2624
      P(2,1,N3)=(TWLP1*CO*P(1,1,N3)-FL*P(8,1,N3))/FLP1                  2625
1430  NMAX=LWRTMX+2                                                     2626
      DO 1445 N=3,NMAX                                                  2627
      FL=FL+1.D0                                                        2627
        FLP1=FL+1.D0                                                    2627
        TWLP1=FL+FLP1                                                   2628
        NM1=N-1                                                         2628
       NM2=N-2                                                          2628
      PN1         =(TWLP1*CO*P(NM1,1,N3)-FL*P(NM2,1,N3))/FLP1           2629
      IF(N-NMAX) 1432,1431,1432                                         2630
1431  P(NM1,2,N3)= FLP1*SI*(CO*P(NM1,1,N3)-PN1)                         2631
        GO TO 1433                                                      2631
1432  P(N,1,N3)=PN1                                                     2632
      P(NM1,2,N3)= FLP1*SI*(CO*P(NM1,1,N3)-P(N,1,N3))                   2633
1433  MMCH1=NM1+LTRUMI                                                  2634
        MMAX= MINO (MMCH1,MMCH2)                                        2634
        FM=0.D0                                                         2634
      DO 1435 M=3,MMAX                                                  2635
        FMP1=FM+1.D0                                                    2635
      P(NM1,M,N3)= CT*FMP1*P(NM1,M-1,N3)-(FL-FM)*(FL+FMP1)*P(NM1,M-2,N3)  2636
1435  FM=FM+1.D0                                                        2637
1445  CONTINUE                                                          2638
1450  CONTINUE                                                          2639
      DO 1600 L1=1,LWRTMX                                               2640
       L1TRP1=LTRUMI+L1                                                 2640
```

```
      DO 1500 LIN=1,LINMAX
      MSFF=((LIN-1)/ISMULT)+1
        MSII=LIN-ISMULT*(MSFF-1)
      MSITTW=ISTRTW+2-2*MSII
        MSFTTW=ISTRTW+2-2*MSFF
      READ (9)     ((CMMMR(MTII,MTFF),CMMMI(MTII,MTFF),
     1               MTFF=1,MULTPO),MTII=1,MULT1Z)
       IF(KTLOUT(22)) 4110,4190,4110
 4110 WRITE(6,4120) L1,LIN,MSITTW,MSFTTW
 4120 FORMAT(12H04100-BFCTOR,10I5)
      WRITE(6,4125)  ((CMMMR(MTII,MTFF),CMMMI(MTII,MTFF),
     1                 MTFF=1,MULTPO),MTII=1,MULT1Z)
 4125 FORMAT ((4(2H (,E14.7,1H,,E14.7,1H))))
 4190 CONTINUE
      DO 1500 MTII=1,MULT1Z
        MTITTW=2*MTII-IIMULT(1)-1
      DO 1495 MTFF=1,MULTPO
      MTFTTW=2*MTFF-IIMULT(I1)-1
       MELTW=MSITTW+MTITTW-MSFTTW-MTFTTW
      MELP1=(IABS( MELTW)/2)+1
        IF(L1TRP1-MELP1) 1495,1470,1470
 1470 DO 1490 N3=NANGMI,NANGMX
        PFACT=P(L1,MELP1,N3)
      TR=PFACT*CMMMR(MTII,MTFF)
        TI=PFACT*CMMMI(MTII,MTFF)
      GO TO ( 1471,1473,1475,1477,1479 ),LIN
 1471 BFAC1R(MTII,MTFF,N3)=BFAC1R(MTII,MTFF,N3)+TR
      BFAC1I(MTII,MTFF,N3)=BFAC1I(MTII,MTFF,N3)+TI
        GO TO 1490
 1473 BFAC2R(MTII,MTFF,N3)=BFAC2R(MTII,MTFF,N3)+TR
      BFAC2I(MTII,MTFF,N3)=BFAC2I(MTII,MTFF,N3)+TI
       GO TO 1490
 1475 BFAC3R(MTII,MTFF,N3)=BFAC3R(MTII,MTFF,N3)+TR
      BFAC3I(MTII,MTFF,N3)=BFAC3I(MTII,MTFF,N3)+TI
        GO TO 1490
 1477 BFAC4R(MTII,MTFF,N3)=BFAC4R(MTII,MTFF,N3)+TR
      BFAC4I(MTII,MTFF,N3)=BFAC4I(MTII,MTFF,N3)+TI
        GO TO 1490
 1479 BFAC5R(MTII,MTFF,N3)=BFAC5R(MTII,MTFF,N3)+TR
      BFAC5I(MTII,MTFF,N3)=BFAC5I(MTII,MTFF,N3)+TI
 1490 CONTINUE
 1495 CONTINUE
 1500 CONTINUE
      IF(KTLOUT(22)) 4310,1600,4310
 4310 WRITE(6,4320) L1
 4320 FORMAT(12H04300-BFCTOR,10I5)
      WRITE(6,4125) (((BFAC1R(MTII,MTFF,N3),BFAC1I(MTII,MTFF,N3),
     1MTII=1,2),MTFF=1,2),N3=1,2)
      WRITE(6,4125) (((BFAC2R(MTII,MTFF,N3),BFAC2I(MTII,MTFF,N3),
     1MTII=1,2),MTFF=1,2),N3=1,2)
      WRITE(6,4125) (((BFAC3R(MTII,MTFF,N3),BFAC3I(MTII,MTFF,N3),
     1MTII=1,2),MTFF=1,2),N3=1,2)
 1600 CONTINUE
 1700 CONTINUE
 2000 RETURN
      END
```

```
C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JQ
C     SEARCH VERSION
      SUBROUTINE OUTPUT                                                  2689
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                         KA2690
      COMPLEX*16 TTR,TTI,ZERO                                           KA2690
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9      KA2691
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)              2692
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD         KA2693
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),  2694
     1             ECM(10),                                                2695
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),   2696
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),  2697
     4             WN(10),WNINI(10),WC(10)                                 2698
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,       2699
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,         2700
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,   2701
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,            2702
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,     2703
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                         2704
CCCCCC      ******       COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES   *****
      COMMON       EXTRA4(11652),EXTRA5(530)                         KA2707
      COMMON       MULT1Z,MULTPO,MULTP1,MULTP2,NANGMI,NANGMX,N5INC,        2708
     1             NAGR12,I1OUT,KQNOTW,CLEBCH,FMULFC,WNFAC                2709
      COMMON       AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),       2710
     1             NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,      2711
     2             NPOLST                                                  2712
      DIMENSION    FCR(35),FCI(35),SGMAC(35),POLTHN(35,2,3),               2713
     1             SGMTHN(35,2,3),FCR5(100),FCI5(100),SGMAC5(100),         2714
     2             POLTH5(100),SGMTH5(100)                                 2715
      EQUIVALENCE (EXTRA5(    1),FCR (1)),(EXTRA5(  36),FCI(1)),           2716
     1            (EXTRA5(   71),SGMAC(1)),(EXTRA5( 106),POLTHN(1)),       2717
     2            (EXTRA5(  316),SGMTHN(1)),                               2718
     3            (EXTRA5(    1),FCR5(1)),(EXTRA5( 101),FCI5(1)),          2719
     4            (EXTRA5(  201),SGMAC5(1)),(EXTRA5( 301),POLTH5(1)),      2720
     5            (EXTRA5(  401),SGMTH5(1))                                2721
      DATA S11/5H (+) /,S12/5H (-) /,S13/5H/2(+)/,S14/5H/2(-)/              2722
      COMMON /VAO/FV                                                 KA 2722
      REAL*4 FV(600)                                                 KA 2722
      IF(KTRL(5)) 500,504,500                                        KA 2722
  500 IF(I1OUT.GT.IIXPLT) GO TO 502                                  KA 2722
      I1=NANGLR*(I1OUT-1)                                            KA 2722
      DO 501 I=1,NANGLR                                              KA 2722
  501 FV(I+I1)=(SGMEXP(I,I1OUT)-SGMTH5(I))/(.1D0*SGMEXP(I,I1OUT))    KA 2722
  502 IF(I1OUT.GT.IIPPLT) RETURN                                     KA 2722
      I1=NANGLR*(IIXPLT+I1OUT-1)                                     KA 2722
      DO 503 I=1,NANGLR                                              KA 2722
  503 FV(I+I1)=1.D2*(POLEXP(I,I1OUT)-POLTH5(I))                      KA 2722
      RETURN                                                         KA 2722
 4000 FORMAT(1H1)                                                        2723
  504 CALL DOTEST(2724,NPOLST,3)
      I1=I1OUT                                                            2724
        I2=I1-MAXO(  IIXPLT,IIPPLT)                                       2724
        IF(I2) 510,510,505                                                2724
  505 IF(NFAI+NPOLST-2) 510,507,510                                       2725
  507 IF(I2-2*(I2/2)) 510,520,510                                         2726
```

```
  510 WRITE(6,4000)                                                          2727
  520 DO 1000 NPS=1,NPOLST                                                   2728
      DO 900 N4=1,NFAI                                                       2729
      FAIDEG=FAI(N4)*18.D1/3.141592653589793                                KA2730
        II1=IIREAD(I1)                                                       2730
      QV=QVALUE(I1)                                                          2731
        KP=KPRITR(I1)                                                        2731
        IF(KTRL(1)) 605,601,605                                              2731
  601 IIW=II1                                                                2732
        IF(KP-1) 603,602,603                                                 2732
  602 PARIK1=S11                                                             2733
        GO TO 610                                                            2733
  603 PARIK1=S12                                                             2734
        GO TO 610                                                            2734
  605 IIW=II1+II1-1                                                          2735
        IF(KP-1) 607,606,607                                                 2735
  606 PARIK1=S13                                                             2736
        GO TO 610                                                            2736
  607 PARIK1=S14                                                             2737
  610 WRITE(6,620) IIW,PARIK1,QV,FAIDEG,NPS                                  2738
  620 FORMAT(1H0//16X,5H*****,5X,15H SCATTERING TO I2,A5,10H STATE AT ,      2739
     1   F6.3,4H MEV,5X,5H*****,3X,5H(FAI=F6.2,8H DEGREE),5H NPS=I1/)        2740
      WRITE(6,740)                                                           2742
  740 FORMAT(3(5X,5HANGLE,6X,5HSGMTH,9X,5HPOLTH,3X)/)                        2743
      IF(KTRL(8)) 745,747,745                                                2745
  745 WRITE(6,750)(ANGLER(N5),SGMTHN(N5,N4,NPS),POLTHN(N5,N4,NPS),N5=1,     KA2746
     1            NANGLR)                                                  KA2747
      GO TO 760                                                              2749
  747 WRITE(6,750)(ANGLER(N5),SGMTH5(N5),POLTH5(N5),N5=1,NANGLR)             KA2750
  750 FORMAT(3(F10.1,E15.5,F10.3,3X))                                        2753
  760 IF(I1+NPS+NFAI-3) 890,770,890                                          2755
  770 IF(CHARGE) 772,890,772                                                 2756
  772 WRITE(6,775)                                                           2757
  775 FORMAT(//48X,24HRUTHERFORD CROSS SECTION/)                             2758
      IF(KTRL(8)) 777,779,777                                                2761
  777 WRITE(6,780)(ANGLER(N5),SGMAC (N5),N5=1,NANGLR)                        KA2762
      GO TO 890                                                              2764
  779 WRITE(6,780)(ANGLER(N5),SGMAC5(N5),N5=1,NANGLR)                        KA2765
  780 FORMAT(3(F16.1,E14.5))                                                 KA2767
  890 CALL PLOTER                                                            2769
  900 CONTINUE                                                               2770
 1000 CONTINUE                                                               2771
      RETURN                                                                 2772
      END                                                                    2773
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=SG36JR
      SUBROUTINE PLOTER                                                      2774
CCCCCC      ******   COMMON STATEMENTS THAT ARE COMMON TO ALL THE ROUTINES   ***
      IMPLICIT REAL*8 (A-H,O-Z)                                             KA2775
      COMPLEX*16 TTR,TTI,ZERO                                               KA2775
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9          KA2776
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)                  2777
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD             KA2778
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),    2779
     1             ECM(10),                                                  2780
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),     2781
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),    2782
     4             WN(10),WNINI(10),WC(10)                                   2783
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,         2784
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,           2785
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,     2786
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,              2787
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR,       2788
     5             XMES1,XMES2,WNUNIT,TTR,TTI,ZERO                           2789
CCCCCC      ******      COMMON FIELDS USED IN COMMON BY SEVERAL ROUTINES    *****
      COMMON       EXTRA4(11652),EXTRA5(530)                                KA2792
      COMMON       MULTIZ,MULTP0,MULTP1,MULTP2,NANGMI,NANGMX,N5INC,          2793
     1             NAGR12,I1OUT,KQNOTW,CLEBCH,FMULFC,WNFAC                  2794
      COMMON       AMS(3,3,3),BMTR(10,10,3),BMTI(10,10,3),NENSBP(3),         2795
     1             NENSBT(3),SGMEXP(100,6),POLEXP(100,2),FAI(4),NFAI,        2796
     2             NPOLST                                                    2797
      DIMENSION    FCR(35),FCI(35),SGMAC(35),POLTHN(35,2,3),                 2798
     1             SGMTHN(35,2,3),FCR5(100),FCI5(100),SGMAC5(100),           2799
     2             POLTH5(100),SGMTH5(100)                                   2800
      EQUIVALENCE (EXTRA5(    1),FCR(1)),(EXTRA5(  36),FCI(1)),               2801
     1            (EXTRA5(   71),SGMAC(1)) ,(EXTRA5( 106),POLTHN(1)),       2802
     2            (EXTRA5(  316),SGMTHN(1)),                                 2803
     3            (EXTRA5(    1),FCR5(1)),(EXTRA5( 101),FCI5(1)),            2804
     4            (EXTRA5(  201),SGMAC5(1)),(EXTRA5( 301),POLTH5(1)),        2805
     5            (EXTRA5(  401),SGMTH5(1))                                  2806
CCCCCC      ******      DIMENSIONS CHARACTERISTIC TO THE PRESENT ROUTINE     *****
      DIMENSION    PLOT(103),POINT1(100),POINT2(100)                         2808
      EQUIVALENCE (EXTRA4(6051),PLOT(1)),                                    2809
     1            (EXTRA4(6154),POINT1(1)),(EXTRA4(6254),POINT2(1))         2810
      INTEGER*2 PLOT,M11/1H /,M12/1H*/,M13/1HT/,M14/1HE/                    KA 2811
  801 FORMAT(1H )                                                            2812
  850 FORMAT(11X,103A1)                                                      2813
  851 FORMAT(1H ,F6.2, 4H DEG,103A1)                                         2814
      CALL DOTEST(2815,NPOLST,3)
      NTMAS=TMAS+0.1 DO                                                      2815
        NPMAS=PMAS+0.1DO                                                     2815
        NZZ  =CHARGE+0.1DO                                                   2815
      DO 500 IPL=1,2                                                         2816
        IPLCHK=IIXPLT*(2-IPL)+IIPPLT*(IPL-1)                                 2816
      IF(I1OUT-IPLCHK) 155,155,500                                           2817
  155 DO 170 NA=1,NANGLR                                                     2818
        IF(IPL-1) 165,160,165                                                2818
  160 POINT1(NA)=DLOG10(SGMTH5(NA))                                          2819
      POINT2(NA)=DLOG10(SGMEXP(NA,I1OUT))                                    2819
        GO TO 170                                                            2820
  165 POINT1(NA)=POLTH5(NA)*10.DO                                            2821
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      POINT2(NA)=POLEXP(NA,I1OUT)*10.D0                                 2822
  170 CONTINUE                                                          2823
      CO1=DMAX1(POINT1(1),POINT2(1))                                    2824
      CO2=DMIN1(POINT1(1),POINT2(1))                                    2825
      DO 230 NA=1,NANGLR                                                2826
      CO1=DMAX1(CO1,POINT1(NA),POINT2(NA))                              2827
      CO2=DMIN1(CO2,POINT1(NA),POINT2(NA))                              2828
  230 CONTINUE                                                          2829
      NCO1=CO1-(1.D0-DSIGN(1.D0,CO1)) *0.5D0                            2830
      NCO1=NCO1+1                                                       2831
      NCO2=CO2-(1.D0-DSIGN(1.D0,CO2)) *0.5D0                            2832
      NCYCLE=NCO1-NCO2                                                  2833
        NSPACE=100/NCYCLE                                               2833
      IF(IPL-1) 310,305,310                                             2834
  305 WRITE(6,307) NCO2,NCO1                                            2835
  307 FORMAT(47H1PLOT OF XSEC. LOWEST AND HIGHEST * ARE FOR 10EI2,9H  AN 2836
     1D 10EI2)                                                          2837
      GO TO 320                                                         2838
  310 FNCO2=NCO2                                                        2839
        FNCO1=NCO1                                                      2839
        FNCO2=FNCO2*0.1D0                                               2839
        FNCO1=FNCO1*0.1D0                                               2839
      WRITE(6,312) FNCO2,FNCO1                                          2840
  312 FORMAT(52H1PLOT OF POLARIZATION. LOWEST AND HIGHEST * ARE FOR F4.1 2841
     1,6H  AND F4.1)                                                    2842
  320 WRITE(6,330) NTMAS,NPMAS,NZZ,ELAB,ISTRTW,I1OUT,IIREAD(I1OUT),     2843
     1             KPRITR(I1OUT)                                        2844
  330 FORMAT(3H A=I3,3H P=I2,4H ZZ=I3,6H ELAB=F6.2,4H 2S=I1,4H II=I1,4H  2845
     1IR=I1,3H K=I1)                                                    2846
      WRITE(6,331) VSX,WSX,WSF,VSO,DFN,DFNW,DFNS,DFNSP,RZERO,RZEROW,    2847
     1             RZEROS,RZROSP,RZEROC,(WC(N),N=1,6),(VCOUPL(N),N=1,10) 2848
  331 FORMAT(8H VSX ETC,13F8.3/4H WC=6F6.3,8H VCOUPL=10F6.3)            2849
      NSTAR=0                                                           2850
  340 WRITE(6,801)                                                      2851
      DO 350 I=1,103                                                    2852
  350 PLOT(I)=M11                                                       2853
      DO 355 I=2,102,NSPACE                                             2854
  355 PLOT(I)=M12                                                       2855
      WRITE(6,850) (PLOT(I),I=1,103)                                KA 2856
      IF(NSTAR) 500,357,500                                             2857
  357 DO 365 I=1,103                                                    2858
  365 PLOT(I)=M11                                                       2859
      WRITE(6,801)                                                      2860
        FNPOWR=NCO2                                                     2860
        FSPACE=NSPACE                                                   2860
      DO 400 NA=1,NANGLR                                                2861
      NCOW1=(POINT1(NA)-FNPOWR)*FSPACE+2.1D0                            2862
      NCOW2=(POINT2(NA)-FNPOWR)*FSPACE+2.1D0                            2863
      PLOT(NCOW1)=M13                                                   2864
      PLOT(NCOW2)=M14                                                   2864
      IF(NANGLR-20) 371,371,375                                         2865
  371 WRITE(6,801)                                                      2866
  375 WRITE(6,851) ANGLER(NA),(PLOT(I),I=1,103)                     KA 2867
      PLOT(NCOW1)=M11                                                   2868
      PLOT(NCOW2)=M11                                                   2868
  400 CONTINUE                                                          2869
      NSTAR=1                                                           2870
        GO TO 340                                                       2870
  500 CONTINUE                                                          2871
      RETURN                                                            2872
      END                                                               2873
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C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JS
C     RACAH COEFFICIENT
      SUBROUTINE RAC7                                                   2874
      IMPLICIT REAL*8 (A-H,O-Z)                                        KA2873
      COMMON FACLOG(500),RAC,IA,IB,IC,ID,IE,IF                          2875
        DIMENSION LT(6)                                                 2875
      K1=IA+IB-IE                                                       2876
        K3=IC+ID-IE                                                     2876
        K5=IA+IC-IF                                                     2876
        K7=IB+ID-IF                                                     2876
      K2=IE-IABS( IA-IB)                                                2877
        K4=IE-IABS( IC-ID)                                              2877
        K6=IF-IABS( IA-IC)                                              2877
      K8=IF-IABS( IB-ID)                                                2878
        K9= MINO (K1,K2,K3,K4,K5,K6,K7,K8)                              2878
      RAC=0.D0                                                          2879
        IF (K9) 4000,20,20                                              2879
   20 K2=MOD(K1,2)                                                     KA2880
      K4=MOD(K3,2)                                                     KA2880
      K6=MOD(K5,2)                                                     KA2880
      K8=MOD(K7,2)                                                     KA2880
        IF(MAX0(  K2,K4,K6,K8)) 4000,25,4000                            2881
   25 LTMIN= MINO (IA,IB,IC,ID,IE,IF)                                   2882
        IF(LTMIN) 4000,30,150                                           2882
   30 LT(1)=IA                                                          2883
       LT(2)=IB                                                         2883
       LT(3)=IC                                                         2883
       LT(4)=ID                                                         2883
       LT(5)=IE                                                         2883
       LT(6)=IF                                                         2883
      LTMIN=LT(1)                                                       2884
        KMIN=1                                                          2884
        DO 40 N=2,6                                                     2884
        IF(LT(N)-LTMIN)35,40,40                                         2884
   35 LTMIN=LT(N)                                                       2885
        KMIN=N                                                          2885
   40 CONTINUE                                                          2886
      S1=1.D0                                                           2887
        F1=IE                                                           2887
        F2=IF                                                           2887
        GO TO (55,55,55,55,45,50),KMIN                                  2887
   45 F1=IA                                                             2888
        F2=IC                                                           2888
        S1=(-1.D0)**MOD((K5/2),2)                                      KA2888
        GO TO 55                                                        2888
   50 F1=IA                                                             2889
        F2=IB                                                           2889
        S1=(-1.D0)**MOD((K1/2),2)                                      KA2889
   55 RAC=S1/DSQRT( (F1+1.D0)*(F2+1.D0))                                2890
        GO TO 4000                                                      2890
  150 IABEP=(IA+IB+IE)/2+1                                              2891
        ICDEP=(IC+ID+IE)/2+1                                            2891
      IACFP=(IA+IC+IF)/2+1                                              2892
        IBDFP=(IB+ID+IF)/2+1                                            2892
      IABE=IABEP-IE                                                     2893
        IEAB=IABEP-IB                                                   2893
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        IBEA=IABEP-IA                                                    2893
      ICDE=ICDEP-IE                                                      2894
        IECD=ICDEP-ID                                                    2894
        IDEC=ICDEP-IC                                                    2894
      IACF=IACFP-IF                                                      2895
        IFAC=IACFP-IC                                                    2895
        ICFA=IACFP-IA                                                    2895
      IBDF=IBDFP-IF                                                      2896
        IFBD=IBDFP-ID                                                    2896
        IDFB=IBDFP-IB                                                    2896
      NZMAX= MINO (IABE,ICDE,IACF,IBDF)                                  2897
        IABCD1=(IA+IB+IC+ID+4)/2                                         2897
      IEFMAD=(IE+IF-IA-ID)/2                                             2898
        IEFMBC=(IE+IF-IB-IC)/2                                           2898
      NZMI1=-IEFMAD                                                      2899
        NZMI2=-IEFMBC                                                    2899
        NZMIN=MAXO(  0,NZMI1,NZMI2)+1                                    2899
      SQLOG=0.5D0*(FACLOG(IABE)+FACLOG(IEAB)+FACLOG(IBEA)+FACLOG(ICDE)   2900
     1           +FACLOG(IECD)+FACLOG(IDEC)+FACLOG(IACF)+FACLOG(IFAC)   2901
     2           +FACLOG(ICFA)+FACLOG(IBDF)+FACLOG(IFBD)+FACLOG(IDFB)   2902
     3 -FACLOG(IABEP+1)-FACLOG(ICDEP+1)-FACLOG(IACFP+1)-FACLOG(IBDFP+1)) 2903
      S1=(-1.D0)**MOD(NZMIN,2)                                          KA2904
      DO 200 NZ=NZMIN,NZMAX                                              2904
        NZM1=NZ-1                                                        2904
      K1=IABCD1-NZM1                                                     2905
        K2=IABE-NZM1                                                     2905
        K3=ICDE-NZM1                                                     2905
        K4=IACF-NZM1                                                     2905
      K5=IBDF-NZM1                                                       2906
        K6=NZ                                                            2906
        K7=IEFMAD+NZ                                                     2906
        K8=IEFMBC+NZ                                                     2906
      SSLOG=SQLOG+FACLOG(K1)-FACLOG(K2)-FACLOG(K3)-FACLOG(K4)            2907
     1           -FACLOG(K5)-FACLOG(K6)-FACLOG(K7)-FACLOG(K8)           2908
      S1=-S1                                                            KA2909
      RAC=RAC+S1*DEXP(SSLOG)                                            KA2909
  200 CONTINUE                                                           2910
 4000 RETURN                                                             2911
      END                                                                2912
```

```
C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JT                               KA2913
C     CLEBSCH GORDAN COEFFICIENTS                                       KA2914
C     FUNCTION W3JS COMPUTES WIGNER 3 J SYMBOLS                           2915
      SUBROUTINE CLEB                                                   KA2916
      REAL*4 J1,J2,J3,M1,M2,M3                                          KA2917
      REAL*8 FACLOG,RAC,W3JS                                            KA2918
      COMMON FACLOG(500),RAC,IA,IB,IC,ID,IE,IF                          KA2919
      J1=FLOAT(IA)/2.                                                   KA2920
      J2=FLOAT(IB)/2.                                                   KA2921
      J3=FLOAT(IC)/2.                                                   KA2922
      M1=FLOAT(ID)/2.                                                   KA2923
      M2=FLOAT(IE)/2.                                                   KA2924
      M3=FLOAT(-IF)/2.                                                  KA2925
      RAC=((-1.D0)**MOD((IB-IA-IF)/2,2))*DSQRT(DFLOAT(IABS(IC)+1))     KA2926
      RAC=RAC*W3JS(J1,J2,J3,M1,M2,M3)                                   KA2927
      RETURN                                                            KA2928
      END
```

```
C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JU
      SUBROUTINE DOTEST ( NR, N1, N2 )
      IF( N1) 100,100, 2
  100 WRITE (6,110) NR,N1, N2
    2 IF(N2-N1) 101,3,3
  101 WRITE (6,110) NR,N1, N2
    3 RETURN
  110 FORMAT ('0DOTEST FAILS FOR NR,N1 AND N2 ='3110/)
      END
```

```
C     PROGRAM ON LIB=LOAD.ZYK,NAME=S036JV
C     ANPASSUNGSROUTINE
      SUBROUTINE ANPASS
      COMMON /VAO/F(600)
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)
      INTEGER INDEX(30),KTL(30)
      REAL X(10),E(10)
      REAL*8 W(6775),FACLOG,RAC,U9,EXTCOM
      READ(5,1) M,N,MA,IP,ES
    1 FORMAT(4I5,E7.1)
      WRITE(6,4) M,N,MA,IP,ES
      READ(5,2) (INDEX(I),E(I),I=1,N)
    2 FORMAT(8(I3,E7.1))
      WRITE(6,5) (INDEX(I),E(I),I=1,N)
    4 FORMAT('0M, N, MA, IP, ES ',4I5,1PE8.1)
    5 FORMAT(' INDEX ',8(I3,1PE8.1))
      DO 6 I=1,30
      KTL(I)=KTLOUT(I)
    6 KTLOUT(I)=0
      CALL VARIAB(1,N,INDEX,X)
      CALL VAO1A(M,N,F,X,E,ES,IP,MA,W,INDEX)
      CALL VARIAB(2,N,INDEX,X)
      DO 7 I=1,30
    7 KTLOUT(I)=KTL(I)
      KTRL(5)=0
      RETURN
      END
```

```
C     UMSPEICHERUNG DER VARIABLEN
      SUBROUTINE VARIAB(K,N,INDEX,X)
      IMPLICIT REAL*8 (A-H,O-Z)
      INTEGER INDEX(N)
      REAL*4 X(N)
      COMMON       FACLOG(500),RAC,IA,IB,IC,ID,IE,IF,L9(9),LMAX,U9
      COMMON       KTRL(30),KEXCOM(50),EXTCOM(50),KTLOUT(30)
      COMMON       F(71),G(71),FD(70),GD(70),ETA,SIGMAZ,RHOMX,RD
      COMMON       ANGLER(100),AR(70),AI(70),BR(70),BI(70),CE(10),DR(10),
     1             ECM(10),
     2             IIMULT(10),IIREAD(10),KPRITR(10),JJROW(30),LLROW(30),
     3             NNROW(30),QVALUE(10),SGMAZZ(10),THETA(100),VCOUPL(20),
     4             WN(10),WNINI(10),WC(10)
      COMMON       ISTRTW,IICPLE,INTYPE,INTMAX,IIXCAL,IIXPLT,IIPCAL,
     1             IIPPLT,JJJMAX,MXROW,NXMAX,NXCPLE,NANGLR,NDFMES,
     2             AMUPMU,CHARGE,CFUNIT,DFN,DFNS,DFNW,DFNSP,ELAB,ETUNIT,
     3             PMAS,RMAS,RZERO,RZEROC,RZEROS,RZEROW,RZROSP,
     4             RMAX,RBAR,SGMAR,TMAS,VSX,VSF,VSO,WSX,WSF,XMAX,XBAR
      GO TO (1,3),K
    1 DO 2 I=1,N
      IF(INDEX(I).EQ.1)  X(I)=VSX
      IF(INDEX(I).EQ.2)  X(I)=WSX
      IF(INDEX(I).EQ.3)  X(I)=WSF
      IF(INDEX(I).EQ.4)  X(I)=VSO
      IF(INDEX(I).EQ.5)  X(I)=DFN
      IF(INDEX(I).EQ.6)  X(I)=DFNW
      IF(INDEX(I).EQ.7)  X(I)=DFNS
      IF(INDEX(I).EQ.8)  X(I)=DFNSP
      IF(INDEX(I).EQ.9)  X(I)=RZERO
      IF(INDEX(I).EQ.10) X(I)=RZEROW
      IF(INDEX(I).EQ.11) X(I)=RZEROS
      IF(INDEX(I).EQ.12) X(I)=RZROSP
      IF(INDEX(I).EQ.13) X(I)=RZEROC
      IF(INDEX(I).GE.14.AND.INDEX(I).LE.19) X(I)=WC(INDEX(I)-13)
      IF(INDEX(I).GE.20.AND.INDEX(I).LE.29) X(I)=VCOUPL(INDEX(I)-19)
    2 CONTINUE
      RETURN
    3 DO 4 I=1,N
      IF(INDEX(I).EQ.1)  VSX=X(I)
      IF(INDEX(I).EQ.2)  WSX=X(I)
      IF(INDEX(I).EQ.3)  WSF=X(I)
      IF(INDEX(I).EQ.4)  VSO=X(I)
      IF(INDEX(I).EQ.5)  DFN=X(I)
      IF(INDEX(I).EQ.6)  DFNW=X(I)
      IF(INDEX(I).EQ.7)  DFNS=X(I)
      IF(INDEX(I).EQ.8)  DFNSP=X(I)
      IF(INDEX(I).EQ.9)  RZERO=X(I)
      IF(INDEX(I).EQ.10)  RZEROW=X(I)
      IF(INDEX(I).EQ.11)  RZEROS=X(I)
      IF(INDEX(I).EQ.12)  RZROSP=X(I)
      IF(INDEX(I).EQ.13)  RZEROC=X(I)
      IF(INDEX(I).GE.14.AND.INDEX(I).LE.19) WC(INDEX(I)-13)=X(I)
      IF(INDEX(I).GE.20.AND.INDEX(I).LE.29) VCOUPL(INDEX(I)-19)=X(I)
    4 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CALFUN(M,N,F,X,INDEX)
      INTEGER INDEX(N)
      REAL F(M),X(N)
      CALL VARIAB(2,N,INDEX,X)
      CALL CCCTRL
      RETURN
      END
```

```
C     CUBIC ROOT
      REAL FUNCTION DCBRT*8(X)
      REAL*8 X
      DCBRT=DSIGN((DABS(X))**(1.D0/3.D0),X)
      RETURN
      END
```

```
C  LOGARITMUS DER GAMMA-FUNKTION FUER KOMPLEXE ARGUMENTE
C     PROGRAMMBESCHREIBUNG NR. 189 VON G. W. SCHWEIMER
      COMPLEX FUNCTION CDLGAM*16(Z)
C  REZ = REALTEIL VON Z
C  IMZ = IMAGINAERTEIL VON Z
      COMPLEX*16 Z,ZM2,CDL,LSIN
      REAL REZ,IMZ
C  REALTEIL VON Z: REZ >= 1/2, IR = 0;  REZ < 1/2, IR = 1 UND Z = 1-Z
      REZ=Z
      IMZ=Z*(0.,-1.)
      IR=0
      IF(REZ-.5)1,2,2
    1 IR=1
      Z=1.-Z
C  BETRAG VON Z: |Z| >= 8, MOD = 0; |Z| < 8, MOD = SQRT(64-IMZ**2)-REZ
C                                          UND Z = Z+MOD
    2 MOD=0
      A=64.-IMZ*IMZ
      IF(A-REZ*REZ)4,4,3
    3 MOD=1+INT(SQRT(A)-REZ)
      Z=Z+DFLOAT(MOD)
C  LOGARITMUS DER GAMMA-FUNKTION MIT EINEM FEHLER < .03/Z**15
    4 ZM2=1./(Z*Z)
      CDL=.9189385332046726-Z+(Z-.5)*CDLOG(Z)+(.08333333333333333+ZM2*(-
     1.00277777777777778+ZM2*(7.936507936507936D-4+ZM2*( -5.9523809523
     280952D-4+ZM2*(8.417508417508418D-4+ZM2*(-1.917526917526918D-3+ZM2
     3*.0064102564102564))))))/Z
C  ZURUECKRECHNUNG IN DEN BEREICH |Z| < 8
      IF(MOD)7,7,5
    5 DO 6 I=1,MOD
      Z=Z-1.
    6 CDL=CDL-CDLOG(Z)
C  ZURUECKRECHNUNG IN DEN BEREICH REZ < 1/2
    7 IF(IR)17,17,8
    8 IF(IMZ)9,9,10
    9 IR=0
      Z=DCONJG(Z)
   10 ZM2=(0.D0,3.1415926535897931)*Z
      LSIN=0.
      REZ=ZM2
      IF(REZ-10.)11,11,12
   11 LSIN=CDLOG(1.-CDEXP(-2.*ZM2))
      GO TO 14
   12 IF(REZ-30.)13,13,14
   13 LSIN=-CDEXP(-2.*ZM2)
   14 LSIN=(0.D0,-1.570796326794897)+ZM2+LSIN
      IF(IR)15,15,16
   15 Z=DCONJG(Z)
      LSIN=DCONJG(LSIN)
   16 Z=1.-Z
      CDL=1.837877066409345-CDL-LSIN
   17 CDLGAM=CDL
      RETURN
      END
```

```
CHISQUARE MINIMISING SUBROUTINE WITHOUT DERIVATIVES
C     PROGRAMMBESCHREIBUNG NR. 202 VON G. W. SCHWEIMER
C     STORAGE PLACES OF W: MAX(M+(N*(5+2*M+3*N))/2,2+M+N*(4*N+7))
      SUBROUTINE VA01A (M,N,F,X,E,ESCALE,IPRINT,MAXFUN,W,P)
      REAL*8 W(3),ACC,B,BB,CHANGE,DM,FA,FC,FF,FMIN,FSEC,SUM,XC,XL,XSTEP,
     1AV,AW
      DIMENSION F(3),X(3),E(3),P(3)
      MA=MAXFUN
      IF(MA.EQ.0) RETURN
      IG=ISIGN(1,MAXFUN)
    1 ITC=0
      MC=0
      IF(N-1)152,2,5
    2 XSTEP=ESCALE*E(1)
      IF(M.LE.0) RETURN
      ACC=E(1)
      B=0.
      W(1)=0.
      IE=4
      II=IABS(MAXFUN)-1
      ISS=2
    4 XC=X(1)
      CALL VD01A(ISS,XC,FF,II,ACC,B,XSTEP)
      X(1)=XC
      GO TO 50
    5 ISS=1
      IF(M.LE.1) RETURN
      MPLUSN=M+N
      KST=N+MPLUSN
      NPLUS=N+1
      KINV=NPLUS*(MPLUSN+1)
      KSTORE=KINV-MPLUSN-1
      IE=1
      GO TO 50
    6 NN=N+N
      K=NN
      DO 7 I=1,M
      K=K+1
    7 W(K)=F(I)
      GO TO (8,30),ISS
    8 IINV=2
      K=KST
      I=1
    9 IF(IG.EQ.0) GO TO 11
      XC=X(I)
      X(I)=X(I)+E(I)
      IE=2
      GO TO 50
   10 X(I)=XC
      GO TO (11,30),ISS
   11 DO 12 J=1,N
      K=K+1
      W(K)=0.
   12 W(J)=0.
      SUM=0.
      KK=NN
```

```
      IL=(I*(I-1))/2
      DO 13 J=1,M
      KK=KK+1
      F(J)=F(J)-W(KK)
      DM=F(J)*F(J)
      JL=IL+J
      IF(J.GT.I) JL=I+(J*(J-1))/2
      IF(IG.EQ.0) DM=W(I2+JL)**2*AV/W(I2+(J*(J+1))/2)
   13 SUM=SUM+DM
      IF(SUM) 85,85,14
   14 SUM=1./DSQRT(SUM)
      J=K-N+I
      W(J)=SUM*E(I)
      IF(IG.EQ.0) W(J)=SUM
      DO 17 J=1,M
      K=K+1
      DM=F(J)
      JL=IL+J
      IF(J.GT.I) JL=I+(J*(J-1))/2
      IF(IG.EQ.0) DM=W(I2+JL)*DSQRT(AV/W(I2+(J*(J+1))/2))
      W(K)=SUM*DM
      KK=NN+J
      DO 17 II=1,I
      KK=KK+MPLUSN
      W(II)=W(II)+W(KK)*W(K)
      IF(J-M) 17,15,15
   15 IF(I-II) 17,17,16
   16 IF(W(II)-1.) 17,87,87
   17 CONTINUE
      ILESS=I-1
      IGAMAX=N+I-1
      INCINV=N-ILESS
      INCINP=INCINV+1
      IF(ILESS) 18,18,19
   18 W(KINV)=1.
      GO TO 27
   19 B=1.
      DO 20 J=NPLUS,IGAMAX
   20 W(J)=0.
      KK=KINV
      DO 24 II=1,ILESS
      IIP=II+N
      W(IIP)=W(IIP)+W(KK)*W(II)
      JL=II+1
      IF(JL-ILESS) 21,21,23
   21 DO 22 JJ=JL,ILESS
      KK=KK+1
      JJP=JJ+N
      W(IIP)=W(IIP)+W(KK)*W(JJ)
   22 W(JJP)=W(JJP)+W(KK)*W(II)
   23 B=B-W(II)*W(IIP)
   24 KK=KK+INCINP
      B=1./B
      KK=KINV
      DO 26 II=NPLUS,IGAMAX
      BB=-B*W(II)
      DO 25 JJ=II,IGAMAX
      W(KK)=W(KK)-BB*W(JJ)
   25 KK=KK+1
      W(KK)=BB
   26 KK=KK+INCINV
      W(KK)=B
   27 GO TO (96,28),IINV
   28 I=I+1
      IF(I-N) 9,9,29
   29 IINV=1
   30 FF=0.
      KL=NN
      DO 31 I=1,M
      KL=KL+1
      F(I)=W(KL)
   31 FF=FF+W(KL)*W(KL)
      GO TO (95,106),ISS
COUNTER FOR THE ITERATIONS: ITC
   32 ITC=ITC+1
      K=N
      KK=KST
      DO 33 I=1,N
      K=K+1
      W(K)=0.
      KK=KK+N
      W(I)=0.
      DO 33 J=1,M
      KK=KK+1
   33 W(I)=W(I)+W(KK)*DBLE(F(J))
      DM=0.
      K=KINV
      DO 38 II=1,N
      IIP=II+N
      W(IIP)=W(IIP)+W(K)*W(II)
      JL=II+1
      IF(JL-N) 34,34,36
   34 DO 35 JJ=JL,N
      JJP=JJ+N
      K=K+1
      W(IIP)=W(IIP)+W(K)*W(JJ)
   35 W(JJP)=W(JJP)+W(K)*W(II)
      K=K+1
   36 IF (DM-DABS(W(II)*W(IIP))) 37,37,38
   37 DM=DABS(W(II)*W(IIP))
      KL=II
   38 CONTINUE
      II=N+MPLUSN*KL
      CHANGE=.1D0
      DO 41 I=1,N
      JL=N+I
      W(I)=0.
      DO 39 J=NPLUS,NN
      JL=JL+MPLUSN
   39 W(I)=W(I)+W(J)*W(JL)
      II=II+1
      W(II)=W(JL)
      W(JL)=X(I)
      IF(DABS(DBLE(E(I))*CHANGE)-DABS(W(I))) 40,40,41
   40 CHANGE=DABS(W(I)/DBLE(E(I)))
   41 CONTINUE
```

```
      IF(1.-CHANGE) 43,43,42
   42 ICONT=2
   43 DO 44 I=1,M
      II=II+1
      JL=JL+1
      W(II)=W(JL)
   44 W(JL)=F(I)
      FC=FF
      ACC=.1D0/CHANGE
      IE=3
      IS=3
      IT=3
      XC=0.
      XL=0.
      XSTEP=-DABS(DBLE(ESCALE)/CHANGE)
      IF(.5D0+XSTEP)45,46,46
   45 XSTEP=-.5D0
   46 CALL VD01A(IT,XC,FC,20,ACC,.1D0,XSTEP)
      GO TO (47,67,93,93),IT
   47 GO TO (48,67),ISS
   48 XL=XC-XL
      DO 49 J=1,N
   49 X(J)=DBLE(X(J))+XL*W(J)
      XL=XC
CCUNTER FOR THE CALLS OF CALFUN: MC
   50 MC=MC+1
      IF(IG.EQ.0) GO TO 132
      CALL CALFUN (M,N,F,X,P)
      IF(M) 90,152,51
   51 IF(MC-IABS(MAXFUN))52,91,91
   52 GO TO(6,10,53,104,122),IE
   53 FC=0.
      DO 54 J=1,M
      B=F(J)
   54 FC=FC+B*B
      IF(FC.EQ.0.D0) GO TO 103
      GO TO (58,58,55),IS
   55 K=N
      IF(FC-FF)56,46,57
   56 IS=2
      FMIN=FC
      FSEC=FF
      GO TO 64
   57 IS=1
      FMIN=FF
      FSEC=FC
      GO TO 64
   58 IF(FC-FSEC) 59,46,46
   59 K=KSTORE
      GO TO (60,61),IS
   60 K=N
   61 IF(FC-FMIN)63,46,62
   62 FSEC=FC
      GO TO 64
   63 IS=3-IS
      FSEC=FMIN
      FMIN=FC
   64 DO 65 J=1,N
      K=K+1
   65 W(K)=X(J)
      DO 66 J=1,M
      K=K+1
   66 W(K)=F(J)
      GO TO 46
   67 K=KSTORE
      KK=N
      GO TO (69,68,69),IS
   68 K=N
      KK=KSTORE
   69 SUM=0.
      DM=0.
      JJ=KSTORE
      DO 70 J=1,N
      K=K+1
      KK=KK+1
      JJ=JJ+1
      X(J)=W(K)
   70 W(JJ)=W(K)-W(KK)
      DO 71 J=1,M
      K=K+1
      KK=KK+1
      JJ=JJ+1
      F(J)=W(K)
      W(JJ)=W(K)-W(KK)
      SUM=SUM+W(JJ)*W(JJ)
   71 DM=DM+W(JJ)*DBLE(F(J))
      GO TO (72,104),ISS
   72 J=KINV
      KK=NPLUS-KL
      DO 73 I=1,KL
      K=J+KL-I
      J=K+KK
      W(I)=W(K)
   73 W(K)=W(J-1)
      IF(KL-N) 74,76,76
   74 KL=KL+1
      JJ=K
      DO 75 I=KL,N
      K=K+1
      J=J+NPLUS-I
      W(I)=W(K)
   75 W(K)=W(J-1)
      W(JJ)=W(K)
      B=1./W(KL-1)
      W(KL-1)=W(N)
      GO TO 77
   76 B=1./W(N)
   77 K=KINV
      DO 79 I=1,ILESS
      BB=B*W(I)
      DO 78 J=I,ILESS
      W(K)=W(K)-BB*W(J)
   78 K=K+1
   79 K=K+1
      IF(FF-FMIN) 82,82,80
   80 FF=FMIN
```

```
      CHANGE=DABS(XC)*CHANGE
      IF(CHANGE-1.) 82,82,81
   81 ICONT=1
   82 XL=-DM/FMIN
      SUM=1./DSQRT(SUM+DM*XL)
      K=KSTORE
      DO 83 I=1,N
      K=K+1
      W(K)=SUM*W(K)
   83 W(I)=0.
      DO 84 I=1,M
      K=K+1
      W(K)=SUM*(W(K)+XL*DBLE(F(I)))
      KK=NN+I
      DO 84 J=1,N
      KK=KK+MPLUSN
   84 W(J)=W(J)+W(KK)*W(K)
      GO TO 19
   85 WRITE(6,86)I,I
   86 FORMAT(9HOVA01A E(,I2,57H) UNREASONABLY SMALL OR THE FUNCTIONS DO
     1NOT DEPEND ON X(I2,1H))
      W(1)=1.
      GO TO 89
   87 WRITE(6,88)II,I
   88 FORMAT(39HOVA01A FUNCTIONAL DEPENDENCE BETWEEN X(I2,8H) AND X(I2,1
     1H))
      W(1)=2.
   89 IG=1
      ISS=2
      GO TO 30
   90 M=-M
      MC=-MC
      IG=1
   91 WRITE(6,92)MC
   92 FORMAT(6HOVA01A,I6,16H CALLS OF CALFUN)
      W(1)=3.
      ISS=2
      GO TO 52
   93 WRITE(6,94)
   94 FORMAT(73HOVA01A ROUNDING ERRORS IN CALFUN OR ONE OF THE E(I) IS U
     1NREASONABLY SMALL)
      W(1)=4.
      ISS=2
      GO TO 67
   95 ICONT=1
      IPP=IABS(IPRINT)*(IABS(IPRINT)-1)
      IPS=1
      IPC=0
   96 IPC=IPC-IABS(IPRINT)
      IF(IPC) 97,102,102
   97 WRITE(6,98) ITC,MC,FF
   98 FORMAT(10HOITERATIONI4,I9,16H CALLS OF CALFUN5X,11HCHISQUARE =1PD
     112.5)
      WRITE(6,99) (X(I),I=1,N)
   99 FORMAT(10H VARIABLES/(1P10E13.5))
      IF(IPRINT.LT.0.AND.ITC*(2-IPS).NE.0) GO TO 101
      WRITE(6,100) (F(I),I=1,M)
  100 FORMAT(10H FUNCTIONS/(1P10E13.5))
  101 IPC=IPP
      GO TO (102,109),IPS
  102 GO TO (32,103),ICONT
  103 W(1)=0.
      ISS=2
  104 FF=0.
      DO 105 J=1,M
  105 FF=FF+DBLE(F(J))*DBLE(F(J))
      GO TO (4,106,106,106),ISS
  106 IF(IPRINT) 107,109,107
  107 WRITE(6,108)
  108 FORMAT(46HOVA01A FINAL VALUES OF FUNCTIONS AND VARIABLES)
      IPS=2
      GO TO 97
  109 IF(MA.LT.0.AND.MAXFUN.GT.0) IG=0
      IF(IG) 110,135,152
CAMMA MATRIX AND VARIABLE ERRORS
  110 DO 111 I=1,M
      K=N+I
  111 W(K)=F(I)
      DO 114 I=1,N
      XC=X(I)
      X(I)=X(I)+E(I)
      MC=MC+1
      CALL CALFUN(M,N,F,X,P)
      X(I)=XC
      IF(M) 112,152,113
  112 IE=5
      GO TO 90
  113 DO 114 J=1,M
      K=K+1
  114 W(K)=(DBLE(F(J))-W(J+N))/DBLE(E(I))
      IF(IPRINT) 117,117,115
  115 WRITE(6,116) MC
  116 FORMAT(13HOGAMMA MATRIXI10,16H CALLS OF CALFUN)
  117 DO 121 I=1,N
      II=K+1
      IL=N+I*M
      DO 118 J=1,I
      JL=N+J*M
      K=K+1
      W(K)=0.
      DO 118 L=1,M
  118 W(K)=W(K)+W(L+IL)*W(L+JL)
      IF(IPRINT) 121,121,119
  119 WRITE(6,120) (W(L),L=II,K)
  120 FORMAT(1P10D13.5)
  121 CONTINUE
  122 DO 123 I=1,M
  123 F(I)=W(N+I)
      IF(IE.EQ.5)  GO TO 152
      IG=0
      I=M+N+M*N
      IL=(N*(5*N+11))/2+M+2
      I2=IL
      JL=I-IL
      K=(N*(N+1))/2
      IF(JL) 124,127,125
```

```
  124 IL=IL+K+1
  125 II=ISIGN(1,JL)
      DO 126 I=1,K
      IL=IL+II
  126 W(IL)=W(IL+JL)
  127 K=I2-M-N-N
      W(K-1)=W(1)
      W(K)=FF
      AW=0.
      DO 128 I=1,M
      K=K+1
      AW=AW+F(I)
  128 W(K)=F(I)
      AW=(FF-AW*AW/M)/AMAXO(M-N,1)
      DO 129 I=1,N
      K=K+1
      W(K)=X(I)
  129 W(K+N)=E(I)
      ES=ESCALE
      ESCALE=1.E6
      IP=IPRINT
      IPRINT=0
      IF(MA.EQ.-111111) IPRINT=1
      MAXFUN=100+10*N
      MV=M
      M=N
      I1=0
  130 I1=I1+1
      AV=W(I2+(I1*(I1+1))/2)
      DO 131 I=1,N
      X(I)=0.
  131 E(I)=.5/DSQRT(AV*W(I2+(I*(I+1))/2))
      GO TO 1
CALFUN ERROR ENHANCEMENT
  132 DO 134 J=1,N
      SUM=0.
      JL=(J*(J-1))/2
      DO 133 I=1,N
      IL=I+JL
      IF(I.GT.J) IL=J+(I*(I-1))/2
  133 SUM=SUM+X(I)*W(I2+IL)
      IF(J.EQ.I1) SUM=SUM-1.
  134 F(J)=SUM*DSQRT(AV/W(I2+(J*(J+1))/2))
      GO TO 51
C
  135 K=N*(3*N+6)+MV+2
      IF(X(I1)) 136,138,138
  136 DO 137 I=1,N
  137 X(I)=-X(I)
  138 W(K+I1)=DSQRT(X(I1)*AV)
      IF(X(I1).EQ.0.) GO TO 140
      FA=DSQRT(AW/X(I1))
      DO 139 I=1,N
  139 W(K+N*I1+I)=FA*X(I)
  140 IF(I1-N) 130,141,141
  141 M=MV
      K=N*(3*N+6)+M+2
      IF(IP) 146,149,142
  142 WRITE(6,143)
  143 FORMAT(18HOTANGENTIAL POINTS)
      DO 144 I=1,N
  144 WRITE(6,120) (W(K+I*N+J),J=1,N)
  146 I=MAXO(M-N,1)
      WRITE(6,147) I,(W(K+I*N+I),I=1,N)
  147 FORMAT(42HOSTANDARD ERRORS OF THE VARIABLES ASSUMING,I5,19H DEGREE
     1S OF FREEDOM/(1P10D13.5))
      WRITE(6,148) (W(K+I),I=1,N)
  148 FORMAT(19HOERROR ENHANCEMENTS/(1P10D13.5))
  149 W(3)=I2
      W(4)=K
      K=I2-M-N-N
      W(1)=W(K-1)
      FF=W(K)
      DO 150 I=1,M
      K=K+1
  150 F(I)=W(K)
      DO 151 I=1,N
      K=K+1
      X(I)=W(K)
  151 E(I)=W(N+K)
      ESCALE=ES
      IPRINT=IP
      MAXFUN=MA
  152 W(2)=FF
      RETURN
      END
```

```
C     MINIMISATION OF A FUNCTION OF ONE VARIABLE
C     PROGRAMMBESCHREIBUNG NR. 202 VON G. W. SCHWEIMER
      SUBROUTINE VD01A (ITEST,X,F,MAXFUN,ABSACC,RELACC,XSTEP)
      IMPLICIT REAL*8(A-H,O-Z)
      GO TO (7,1,1),ITEST
    1 IS=6-ITEST
      ITEST=1
      IINC=1
      XINC=XSTEP+XSTEP
      MC=IS-3
      IF(MC)9,9,6
    2 MC=MC+1
      IF(MAXFUN-MC)3,6,6
    3 ITEST=4
    4 X=DB
      F=FB
      IF(FB-FC)6,6,5
    5 X=DC
      F=FC
    6 RETURN
    7 GO TO (17,15,10,8),IS
    8 IS=3
    9 DC=X
      FC=F
      X=X+XSTEP
      GO TO 2
   10 IF(FC-F)12,11,13
   11 X=X+XINC
      XINC=XINC+XINC
      GO TO 2
   12 DB=X
      FB=F
      XINC=-XINC
      GO TO 14
   13 DB=DC
      FB=FC
      DC=X
      FC=F
   14 X=DC+DC-DB
      IS=2
      GO TO 2
   15 DA=DB
      DB=DC
      FA=FB
      FB=FC
   16 DC=X
      FC=F
      GO TO 27
   17 IF(FB-FC)21,18,18
   18 IF(F-FB)19,16,16
   19 FA=FB
      DA=DB
   20 FB=F
      DB=X
      GO TO 27
   21 IF(FA-FC)23,23,22
   22 XINC=FA
      FA=FC
      FC=XINC
      XINC=DA
      DA=DC
      DC=XINC
   23 XINC=DC
      IF((D-DB)*(D-DC))16,24,24
   24 IF(F-FA)25,26,26
   25 FC=FB
      DC=DB
      GO TO 20
   26 FA=F
      DA=X
   27 IF(FB-FC)28,28,29
   28 IINC=2
      XINC=DC
      IF(FB-FC)29,45,29
   29 IF((DA-DB)*(DA-DC))30,31,30
   30 D=(FA-FB)/(DA-DB)-(FA-FC)/(DA-DC)
      IF(D)34,31,34
   31 X=4.
      IF(FB-FC)33,32,32
   32 X=-4.
   33 X=DB-X*(DC-DB)
      IS=2
      ITEST=1
      GO TO 2
   34 IF(D*(DB-DC))41,35,35
   35 D=0.5*(DB+DC-(FB-FC)/D)
      IF(DABS(D-X)-DABS(ABSACC))37,37,36
   36 IF(DABS(D-X)-DABS(D*RELACC))37,37,38
   37 ITEST=2
      GO TO 4
   38 IS=1
      X=D
      IF((DA-DC)*(DC-D))2,46,39
   39 IS=2
      GO TO (40,43),IINC
   40 IF(DABS(XINC)-DABS(DC-D))42,2,2
   41 IS=2
      GO TO (42,44),IINC
   42 X=DC
      GO TO 11
   43 IF(DABS(XINC-X)-DABS(X-DC))44,44,2
   44 X=0.5*(XINC+DC)
      IF((XINC-X)*(X-DC))46,46,2
   45 X=0.5*(DB+DC)
      IF((DB-X)*(X-DC))46,46,2
   46 ITEST=3
      GO TO 4
      END
```

```
C
C
C     BERECHNUNG VON WIGNER 3-J-SYMBOLEN
C     ----------------------------------
C     DR. SPECHT, ZYKLOTRON
C     PROGRAMMBESCHREIBUNG NR. 214
C
C     J1+J2+J3=MAXIMAL 400
C     ARGUMENTE REAL*4, ERGEBNIS REAL*8
C
      REAL FUNCTION W3JS*8(J1,J2,J3,M1,M2,M3)
      REAL*4 J1,J2,J3,M1,M2,M3,J(3),M(3)
      REAL*8 W3J,H8,FF,S,LF(402),
     A    LF1(57),LF2(57),LF3(57),LF4(57),LF5(57),LF6(57),LF7(57),LF8(3)
      DIMENSION A(10),N(10)
      EQUIVALENCE  (LF(  1),LF1(1)),(LF( 58),LF2(1)),
     A             (LF(115),LF3(1)),(LF(172),LF4(1)),
     A             (LF(229),LF5(1)),(LF(286),LF6(1)),
     A             (LF(343),LF7(1)),(LF(400),LF8(1))
C
      DATA  LF1/
     A    0.0                ,    0.0                ,   0.693147180559945,    1
     A    1.791759469228054,      3.178053830347945,     4.787491742782045,    2
     A    6.579251212010100,      8.525161361065416,    10.604602902745240,    3
     A   12.801827480081460,     15.104412573075510,    17.502307845873880,    4
     A   19.987214495661880,     22.552163853123410,    25.191221182738670,    5
     A   27.899271383840880,     30.671860106080670,    33.505073450136880,    6
     A   36.395445208033040,     39.339884187199480,    42.335616460753480,    7
     A   45.380138898476900,     48.471181351835220,    51.606675567764360,    8
     A   54.784729398112310,     58.003605222980510,    61.261701761001990,    9
     A   64.557538627006320,     67.889743137181520,    71.257038967168000,   10
     A   74.658236348830150,     78.092223553315310,    81.557959456115030,   11
     A   85.054467017581510,     88.580827542197670,    92.136175603687080,   12
     A   95.719694542143190,     99.330612454787420,   102.968198614513700,   13
     A  106.631760260643400,    110.320639714757300,   114.034211781461600,   14
     A  117.771881399745000,    121.533081515438500,   125.317271149356800,   15
     A  129.123933639127200,    132.952575035616200,   136.802722637326300,   16
     A  140.673923648234200,    144.565743946344800,   148.477766951772900,   17
     A  152.409592584497300,    156.360836303078700,   160.331128216630800,   18
     A  164.320112263195100,    168.327445448427600,   172.352797139162700/   19
      DATA  LF2/
     A  176.395848406997200,    180.456291417543700,   184.533828861449400,   20
     A  188.628173423671500,    192.739047287844800,   196.866181672889900,   21
     A  201.009316399281400,    205.168199482641100,   209.342586752536700,   22
     A  213.532241494563100,    217.736934113954100,   221.956441819130200,   23
     A  226.190548323727500,    230.439043565776800,   234.701723442818200,   24
     A  238.978389561834200,    243.268849002982600,   247.572914096186800,   25
     A  251.890402209723100,    256.221135550009400,   260.564940971863100,   26
     A  264.921649798552700,    269.291097651019700,   273.673124285693600,   27
     A  278.067573440366000,    282.474292687630300,   286.893133295426900,   28
     A  291.323950094270200,    295.766601350760500,   300.220948647014000,   29
     A  304.686856765668600,    309.164193580146900,   313.652829949878900,   30
     A  318.152639620209200,    322.663499126726100,   327.185287703775100,   31
     A  331.717887196928400,    336.261181979198300,   340.815058870798900,   32
     A  345.379407062266700,    349.954118040770100,   354.539085519440700,   33
     A  359.134205369575300,    363.739375555563400,   368.354496072404600,   34
     A  372.979468885688900,    377.614197873918500,   382.258588773060000,   35
     A  386.912549123217400,    391.575988217329500,   396.248817051791400,   36
     A  400.930948278915600,    405.622296161144800,   410.322776526937200,   37
     A  415.032306728249500,    419.750805599544600,   424.478193418257000/   38
      DATA  LF3/
     A  429.214391866651500,    433.959323995014600,   438.712914186121100,   39
     A  443.475088120918800,    448.245772745384500,   453.024896238495900,   40
     A  457.812387981278100,    462.608178526874800,   467.412199571608100,   41
     A  472.224383926980500,    477.044665492585500,   481.872979229887800,   42
     A  486.709261136839300,    491.553448223297900,   496.405478487217500,   43
     A  501.265290891579100,    506.132825342034800,   511.008022665235900,   44
     A  515.890824587822200,    520.781173716044000,   525.679013515994900,   45
     A  530.584288294433400,    535.496943180169400,   540.416924105997500,   46
     A  545.344177791154800,    550.278651724285400,   555.220294146894700,   47
     A  560.169054037272900,    565.124881094874200,   570.087725725134100,   48
     A  575.057539024710100,    580.034272767130700,   585.017879388838900,   49
     A  590.008311975617700,    595.005524249381800,   600.009470555327200,   50
     A  605.020105849423500,    610.037385686238500,   615.061266207084700,   51
     A  620.091704128477200,    625.128656730890800,   630.172081847810100,   52
     A  635.221937855059600,    640.278183660407900,   645.340778693434900,   53
     A  650.409682895655100,    655.484856710889000,   660.566261075873300,   54
     A  665.653857411105800,    670.747607611912500,   675.847474039736800,   55
     A  680.953419513637400,    686.065407301993900,   691.183401114410600,   56
     A  696.307365093813900,    701.437263808736900,   706.573062245787200/   57
      DATA  LF4/
     A  711.714725802289900,    716.862220279103300,   722.015511873601100,   58
     A  727.174567172815600,    732.339353146739100,   737.509837141777300,   59
     A  742.685986874351100,    747.867770424643200,   753.055156230483900,   60
     A  758.248113081374200,    763.446610112640000,   768.650616799716800,   61
     A  773.860102952558300,    779.075038710167200,   784.295394535245600,   62
     A  789.521141208958700,    794.752249825813300,   799.988691788643300,   63
     A  805.230438803702900,    810.477462875863500,   815.729736303910100,   64
     A  820.987231675937800,    826.249921864842700,   831.517780023906000,   65
     A  836.790779582469800,    842.068894241700300,   847.352097970438300,   66
     A  852.640365001132800,    857.933669825857300,   863.231987192405400,   67
     A  868.535292100464400,    873.843559797865700,   879.156765776907400,   68
     A  884.474885770751700,    889.797895749890100,   895.125771918679700,   69
     A  900.458490711945000,    905.796028791646300,   911.138363043611200,   70
     A  916.485470574328600,    921.837328707804700,   927.193914982476700,   71
     A  932.555207148186100,    937.921183163208000,   943.291821191335600,   72
     A  948.667099599019800,    954.046996952560300,   959.431492015349300,   73
     A  964.820563745165800,    970.214191291518200,   975.612353993035900,   74
     A  981.015031374908200,    986.422203146368400,   991.833849198223400,   75
     A  997.249949600427900,   1002.670484599699000,  1008.095434617181000/   76
      DATA  LF5/
     A 1013.524780246135000,   1018.958502249689000,  1024.396581558613000,   77
     A 1029.838999269135000,   1035.285736640801000,  1040.736775094366000,   78
     A 1046.192096209724000,   1051.651681723868000,  1057.115513528894000,   79
     A 1062.583573670029000,   1068.055844343700000,  1073.532307895632000,   80
     A 1079.012946818974000,   1084.497743752464000,  1089.986681478621000,   81
     A 1095.479742921962000,   1100.976911147255000,  1106.478169357800000,   82
     A 1111.983500893732000,   1117.492889230360000,  1123.006317976525000,   83
     A 1128.523770872990000,   1134.045231790852000,  1139.570684729984000,   84
     A 1145.100113817495000,   1150.633503306223000,  1156.170837573241000,   85
     A 1161.712101118400000,   1167.257278562879000,  1172.806354647774000,   86
     A 1178.359314232696000,   1183.916142294396000,  1189.476823925411000,   87
     A 1195.041344332734000,   1200.609688836495000,  1206.181842868673000,   88
     A 1211.757791971819000,   1217.337521797805000,  1222.921018106587000,   89
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     A 1228.508266764987000, 1234.099253745498000, 1239.693965125100000,      90
     A 1245.292387084098000, 1250.894505904978000, 1256.500307971274000,      91
     A 1262.109779766459000, 1267.722907872847000, 1273.339678970514000,      92
     A 1278.960079836231000, 1284.584097342418000, 1290.211718456109000,      93
     A 1295.842930237930000, 1301.477719841099000, 1307.116074510433000,      94
     A 1312.757981581371000, 1318.403428479015000, 1324.052402717176000/      95
      DATA  LF6/
     A 1329.704891897444000, 1335.360883708264000, 1341.020365924024000,      96
     A 1346.683326404160000, 1352.349753092272000, 1358.019634015253000,      97
     A 1363.692957282424000, 1369.369711084692000, 1375.049883693709000,      98
     A 1380.733463461048000, 1386.420438817388000, 1392.110798271712000,      99
     A 1397.804530410515000, 1403.501623897020000, 1409.202067470411000,     100
     A 1414.905849945067000, 1420.612960209816000, 1426.323387227191000,     101
     A 1432.037120032700000, 1437.754147734106000, 1443.474459510714000,     102
     A 1449.198044612666000, 1454.924892360253000, 1460.654992143227000,     103
     A 1466.388333420125000, 1472.124905717604000, 1477.864698629783000,     104
     A 1483.607701817593000, 1489.353905008133000, 1495.103297994041000,     105
     A 1500.855870632867000, 1506.611612846453000, 1512.370514620331000,     106
     A 1518.132566003111000, 1523.897757105896000, 1529.666078101690000,     107
     A 1535.437519224820000, 1541.212070770364000, 1546.989723093587000,     108
     A 1552.770466609379000, 1558.554291791709000, 1564.341189173076000,     109
     A 1570.131149343973000, 1575.924162952357000, 1581.720220703122000,     110
     A 1587.519313575830000, 1593.321431732960000, 1599.126566701876000,     111
     A 1604.934709191857000, 1610.745850184833000, 1616.559980716658000,     112
     A 1622.377091876622000, 1628.197174806974000, 1634.020220702457000,     113
     A 1639.846220809838000, 1645.675166427448000, 1651.507048904731000/     114
      DATA  LF7/
     A 1657.341859641794000, 1663.179590088960000, 1669.020231746333000,     115
     A 1674.863776163364000, 1680.710214938422000, 1686.559539718369000,     116
     A 1692.411742198144000, 1698.266814120346000, 1704.124747274829000,     117
     A 1709.985533498296000, 1715.849164673893000, 1721.715632730827000,     118
     A 1727.584929643961000, 1733.457047433436000, 1739.331978164288000,     119
     A 1745.209713946068000, 1751.090246932468000, 1756.973569320957000,     120
     A 1762.859673352407000, 1768.748551310740000, 1774.640195522566000,     121
     A 1780.534598356830000, 1786.431752224467000, 1792.331649578050000,     122
     A 1798.234282911451000, 1804.139644759506000, 1810.047727697674000,     123
     A 1815.958524341715000, 1821.872027347353000, 1827.788229409961000,     124
     A 1833.707123264234000, 1839.628701683877000, 1845.552957481292000,     125
     A 1851.479883507263000, 1857.409472650652000, 1863.341717838100000,     126
     A 1869.276612033720000, 1875.214148238803000, 1881.154319491523000,     127
     A 1887.097118866650000, 1893.042539475256000, 1898.990574464437000,     128
     A 1904.941217017024000, 1910.894460351312000, 1916.850297720777000,     129
     A 1922.808722413807000, 1928.769727753430000, 1934.733307097049000,     130
     A 1940.699453836172000, 1946.668161396158000, 1952.639423235948000,     131
     A 1958.613232847817000, 1964.589583757115000, 1970.568469522017000,     132
     A 1976.549883733271000, 1982.533820013958000, 1988.520272019243000/     133
      DATA  LF8/
     A 1994.509233436132000, 2000.500697983240000, 2006.494659410547000/     134
C
    2 W3JS=0.
      W3J=0.
      IF((J1.LT.0.).OR.(J2.LT.0.).OR.(J3.LT.0.)) RETURN
      IF((J3.GT.(J1+J2)).OR.(J3.LT.ABS(J1-J2)))  RETURN
      IF((J1+J2+J3).GT.40.)                      RETURN
      IF((M1.NE.0.).OR.(M2.NE.0.).OR.(M3.NE.0.)) GO TO 3
      IF((AMOD(J1,1.).NE.0.).OR.(AMOD(J2,1.).NE.0.)
     1                      .OR.(AMOD(J3,1.).NE.0.)) RETURN
      IF(AMOD(J1+J2+J3,2.).NE.0.)                RETURN
      J10=J1
      J20=J2
      J30=J3
      I=J10+J20+J30+1
      JH=(I-1)/2+1
      W3J=(LF(I-2*J10)+LF(I-2*J20)+LF(I-2*J30)-LF(I+1))/2.
      W3J=W3J+LF(JH)-LF(JH-J10)-LF(JH-J20)-LF(JH-J30)
      W3J=DEXP(W3J)
      IF(MOD(JH,2).EQ.0) W3J=-W3J
      W3JS=W3J
      RETURN
C
    3 J(1)=J1
      J(2)=J2
      J(3)=J3
      M(1)=M1
      M(2)=M2
      M(3)=M3
      IF((M1+M2+M3).NE.0.) RETURN
      DO 4 I=1,3
      IF((AMOD(J(I),.5).NE.0.).OR.(ABS(M(I)).GT.J(I))
     1                      .OR.(AMOD(J(I)+M(I),1.).NE.0.)) RETURN
    4 CONTINUE
      A(1)=J1+J2-J3
      A(2)=J1-M1
      A(3)=J2+M2
      A(4)=J1-J2+J3
      A(5)=J2+J3-J1
      A(6)=J1+M1
      A(7)=J2-M2
      A(8)=J3+M3
      A(9)=J3-M3
      A(10)=J1+J2+J3+1.
      DO 5 I=1,10
    5 N(I)=A(I)
      FF=0.
      DO 6 I=1,9
    6 FF=FF+LF(N(I)+1)
      FF=(FF-LF(N(10)+1))/2.
C
      N(4)=0
      N(5)=J3-J2+M1
      N(6)=J3-J1-M2
      KMAX=MIN0(N(1),N(2),N(3))
      KMIN=MAX0(0,-N(5),-N(6))
      KD=KMAX-KMIN
      IF(KD.LT.0) RETURN
      IF(KD.EQ.0) GO TO 9
C
      KF=KMAX-1
      N(4)=1
      N(5)=N(5)+1
      N(6)=N(6)+1
      A(4)=N(4)
      A(5)=N(5)
      A(6)=N(6)
      DO 8 K=KMIN,KF,2
      AK=K
```

```
      P1=1.
      P2=1.
      S=FF
      DO 7 I=1,3
      P1=P1*(A(I)-AK)
      P2=P2*(A(I+3)+AK)
    7 S=S-LF(N(I)-K+1)-LF(N(I+3)+K+1)
      H8=P2-P1
      S=H8*DEXP(S)
    8 W3J=W3J+S
      IF(MOD(KD,2).NE.0) GO TO 11
      N(4)=0
      N(5)=N(5)-1
      N(6)=N(6)-1
C
    9 S=FF
      DO 10 I=1,3
   10 S=S-LF(N(I)-KMAX+1)-LF(N(I+3)+KMAX+1)
      W3J=W3J+DEXP(S)
C
   11 K=J1-J2-M3
      K=K+KMIN
      IF(MOD(K,2).NE.0) W3J=-W3J
      W3JS=W3J
      RETURN
      END
```