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GNASH:

**A Preequilibrium, Statistical Nuclear-Model Code for
Calculation of Cross Sections and Emission Spectra**

P. G. Young
E. D. Arthur

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GNASH: A PREEQUILIBRIUM, STATISTICAL NUCLEAR-MODEL CODE
FOR CALCULATION OF CROSS SECTIONS AND EMISSION SPECTRA

P. G. Young and E. D. Arthur

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I. INTRODUCTION

I

Figure 1 illustrates input data used in GNASH calculations and provides a summary of the major output features. The input includes cards that specify the reaction chains to be followed, the incident energies to be included, and the model and parameter options to be used in the calculation. Optical-model transmission coefficients are input for all particle types included, and the energy levels, spins, parities, and branching ratios are provided for all residual nuclei in the calculation.

A complex decay sequence involving multiparticle and gamma-ray emission, typical of the ones that can be handled in a single calculation, is shown in Fig. 2. The sequence is for neutrons incident on ^{59}Co with sufficient energy to cause (n,5n) reactions to occur, and has been used to calculate proton- and alpha-production cross sections for neutrons up to 40 MeV in energy.² The heavy arrows in Fig. 2 indicate the main reaction chains that were followed. A part of this calculation is included in this report as a sample problem. Other examples of calculations with GNASH appear in Refs. 3-8.

The GNASH code, developed for a Control Data Corp. (CDC) 7600 computer, uses 49 000 words of storage and up to 290 000 words of extended-core memory (depending on the problem) for storage of parameters used in a calculation. As an option, the code can use auxiliary files of transmission coefficient and energy-level data or obtain these data directly from cards.

Included in this report are descriptions of the theoretical expressions used in the calculations (Sec. II), mechanics of the calculation and important sub-

Fig. 1.
Input and output features of the
GNASH code.

Fig. 2.
Sample decay chain for $n + ^{59}\text{Co}$
calculations.

routines (Sec. III), input parameters and options for streamlined setup (Sec. IV), supplemental data or files needed (Sec. V), and output produced by the code (Sec. VI). Section VII contains a summary discussion, and the code listing and a sample problem are given in Appendixes A-E.

II. THEORETICAL BACKGROUND

A. Calculational Expressions

The statistical portion of the code includes angular-momentum and parity effects explicitly and generally follows the formalism of Uhl.⁹ In this section, we give a brief description of the expressions used in the calculation. Reference 9 should be consulted for more detail.

For the calculations of complex reactions involving several particles and compound nuclei, we assume that the reaction proceeds in stages with only one particle emitted at each step. Each newly formed intermediate nucleus, produced by particle decay of the previous compound nucleus, then disintegrates (if energetically possible) with probabilities determined from Hauser-Feshbach theory for binary reactions.¹

The composition of nuclei involved in a calculation is as follows. At low excitation energies, discrete levels of energy E , total angular momentum J , and parity π are included. Generally, experimentally determined values of E , J^π , and branching ratios are used for these levels. For higher excitation energies where discrete-level information may be lacking, a continuum level-density expression is used. For this purpose, the continuum region is divided into energy bins of width ΔE .

The population of continuum bins $P^{(n+1)}(UJ\pi)$ in the $(n+1)$ th compound nucleus, formed by particle disintegration of the n th compound nucleus, is given by

$$P^{(n+1)}(UJ\pi) = \int dU' \sum_{J'\pi'} \hat{P}^{(n)}(U'J'\pi') \frac{\Gamma_a^{(n)}(U'J'\pi', UJ\pi)}{\Gamma(U'J'\pi')} \rho^{(n+1)}(UJ\pi) \quad , \quad (1)$$

where $\hat{P}^{(n)}(U'J'\pi')$ is the population of continuum energy bins in the n th compound nucleus after gamma-ray cascades have been considered, U is the excitation energy, ρ is the level density, and a defines the type of radiation emitted by the n th compound nucleus to form the $(n+1)$ th nucleus. The population of the first compound nucleus is determined from its formation cross section, which can be found

from the appropriate sum over transmission coefficients taken at the c.m. energy ϵ of the incident particles,

$$P^{(1)}(UJ\pi) = \frac{\pi}{k^2} \frac{(2J+1)}{(2I+1)(2i+1)} \sum_s \sum_{\ell} T_{\ell}(\epsilon) f_{\ell} \delta(U - B) \quad (2)$$

Here k is the relative-motion wave number, $I(\pi_T)$ and $i(\pi_p)$ are the spins (parity) of the target nucleus and projectile, and $J(\pi)$ is the total angular momentum (parity) of the compound system. The quantity f_{ℓ} is a parity operator given by $f_{\ell} = 1/2 |\pi + (-1)^{\ell} \pi_T \pi_p|$, $T_{\ell}(\epsilon)$ is the transmission coefficient having orbital angular momentum ℓ , s is the channel spin, and B is the binding energy of the incident particle in the compound nucleus. The partial decay widths used in Eq. (1) for reaction channel a have the general form

$$\Gamma_a^{(n)}(U'J'\pi', UJ\pi) = \frac{1}{2\pi\rho(U'J'\pi')} \sum_s \sum_{\ell} T_{\ell}(U' - U - B_a) f_{\ell} \quad (3)$$

for widths involving transitions from continuum bins in the compound nucleus to continuum bins in the residual nucleus. Here the parity operator f_{ℓ} has the form $f_{\ell} = 1/2 |\pi\pi' + (-1)^{\ell} \pi_a|$, where π_a is the parity of the emitted particle, and B_a is the binding energy of the emitted particle.

Similar expressions hold for the population of discrete levels:

$$P^{(n+1)}(E_{\lambda}J_{\lambda}\pi_{\lambda}) = \int dU' \sum_{J'\pi'} \hat{P}^{(n)}(U'J'\pi') \frac{\Gamma_a^{(n)}(U'J'\pi', E_{\lambda}J_{\lambda}\pi_{\lambda})}{\Gamma(U'J'\pi')} \quad (4)$$

where the partial width for continuum to discrete level transitions has the form

$$\Gamma_a(U'J'\pi', E_{\lambda}J_{\lambda}\pi_{\lambda}) = \sum_s \sum_{\ell} T_{\ell}(U' - E_{\lambda} - B_a) f_{\ell} \quad (5)$$

Here the sums are taken over channel spin s and orbital angular momentum ℓ .

The total width appearing in the denominators of Eqs. (1) and (4) is then the sum over continuum bins $(UJ\pi)$ or discrete levels $(E_{\lambda}J_{\lambda}\pi_{\lambda})$ of the appropriate partial width $\Gamma_a(U'J'\pi', UJ\pi)$ or $\Gamma_a(U'J'\pi', E_{\lambda}J_{\lambda}\pi_{\lambda})$ for each reaction channel a .

For many calculations of interest, nonstatistical or preequilibrium effects become important; therefore, a simplified preequilibrium expression formulated by Braga-Marcazzan¹⁰ and based upon the exciton model of Griffin¹¹ and Blann¹² has

been used to correct reaction and level-excitation cross sections as well as spectra for preequilibrium effects:

$$\left(\frac{d\sigma}{dE}\right)_{\text{preq}} \propto \frac{\sigma_{\text{inv}}(\epsilon) m \epsilon \sigma_R}{|M|^2 g^4 E^3} \sum_{n=3}^{\bar{n}} (U/E)^{n-2} (n+1)^2 (n-1) \quad . \quad (6)$$

In this expression E and U are the excitation energies of the compound and residual nuclei, respectively; σ_R is the incident-particle reaction cross section; m , ϵ , and $\sigma_{\text{inv}}(\epsilon)$ are the mass, kinetic energy, and inverse cross section for the outgoing particle; g is the average single-particle level spacing from the Fermi-gas model; and n is the number of particles and holes ($n = p + h$) in the compound nucleus. The sum extends from the initial exciton number 3 to $\bar{n}$, the limiting value attained when equilibrium is reached.

We assumed that the absolute square of the average matrix element of residual two-body interactions had the form $|M|^2 = KA^{-3}E^{-1}$ (A is the mass of the nucleus involved), determined by Kalbach-Cline.¹³ The normalization constant K was obtained from fits to various sets of data, including both spectra and integrated cross sections (for example, see Refs. 14 and 15). The code evaluates the normalization factor using the expression

$$\alpha = \frac{|M|^2 g^4}{A} \quad . \quad (7)$$

We determined the value of α for neutron- and proton-induced reactions to be 0.0005 ± 0.0001 , in agreement with the Braga-Marcazzan value of 0.00045 .¹⁰ Our result corresponds to $K = 150 \pm 30 \text{ MeV}^3$, which can be compared to the value of $100 \pm 35 \text{ MeV}^3$ obtained by Kalbach-Cline.¹³ To provide flexibility in the code for calculation of preequilibrium emission, we made the normalization factor dependent on the type of particle emitted. Thus, effects such as the possible existence of preformed particles can be included. When the outgoing particles are neutrons and protons, the α values are known fairly reliably, but those for outgoing alphas are less accurately known. Because of the lack of experimental data on d , t , and ${}^3\text{He}$ emission, even more uncertainty in α exists for these.

The total preequilibrium component, obtained by summing over each outgoing particle channel involved in the decay of the first compound nucleus, then determines a fraction by which the total compound-nucleus reaction cross section is reduced. Because the preequilibrium model used in the code does not include effects of spin and parity, we assumed that the preequilibrium component had the same spin and parity distribution as the statistical population component.

B. Supplemental Quantities: Transmission Coefficients and Level Densities

To provide particle transmission coefficients, external optical model routines or codes must be used. GNASH accepts transmission coefficients in the COMNUC¹⁶ form (see Sec. V) as a function of total angular momentum J and converts them to T_ℓ using the expression

$$T_\ell(\epsilon) = \frac{1}{(2\ell + 1)} \left[(\ell + 1) T_{\ell, \ell+s} + \ell T_{\ell, \ell-s} \right] \quad (8)$$

To provide gamma-ray transmission coefficients, either the Weisskopf approximation¹⁷ or the Brink-Axel^{18,19} giant dipole resonance form can be used. Specifically, the Weisskopf approximation for E1 transitions yields

$$T^{E1}(U, U') = C_W^{E1} E_\gamma^3 \quad (9)$$

whereas the Brink-Axel form gives

$$T^{E1}(U, U') = C_{BA}^{E1} \frac{2}{\pi} \frac{1}{h^2 c^2} E_\gamma^2 \frac{0.013A}{\Gamma} \frac{E_\gamma^2 \Gamma^2}{(E_R^2 - E_\gamma^2)^2 + E_\gamma^2 \Gamma^2} \quad (10)$$

Here $E_\gamma = U - U'$, Γ is the giant dipole resonance width ($\Gamma = 5$ MeV), and E_R , the resonance energy in millions of electron volts, is given by $E_R = 80A^{-1/3}$. The normalization constants C_W^{E1} and C_{BA}^{E1} are obtained from the ratio of the average experimental gamma-ray width $\langle \Gamma_\gamma \rangle$ to the observed resonance spacing $\langle D \rangle$ for s-wave neutrons through evaluation of the expression (at the neutron binding energy E_B)

$$\left(\frac{\langle \Gamma_\gamma \rangle}{\langle D \rangle} \right)_{E_B} = \frac{1}{2\pi} \int_0^{E_B} \sum_{\ell, J'} T^{E1}(E_\gamma, U') \rho(U' J' \pi') dU' \quad (11)$$

where T^{E1} is computed using either the Weisskopf or Brink-Axel forms.

In the code, gamma-ray cascades through E2, E3, M1, M2, and M3 transitions are permitted also. Transmission coefficients for these are computed using the Weisskopf form ($\propto \epsilon_\gamma^{2\ell+1}$), and the ratios C^{E2}/C^{E1} , C^{E3}/C^{E1} , ..., C^{M3}/C^{E1} are determined from the Weisskopf estimate¹⁷ or are input directly during setup of the calculation.

The level-density expressions are those of Gilbert and Cameron²⁰ with the pairing and shell parameters of Cook.²¹ A Fermi-gas level-density form is used at higher excitation energies,

$$\rho(E, J\pi) = \frac{\sqrt{\pi}}{24} \frac{\exp(2\sqrt{aU})}{a^{1/4}U^{5/4}} \frac{(2J+1) \exp[-(J+1/2)^2/2\sigma^2]}{2\sqrt{2\pi} \sigma^3}, \quad (12)$$

and is matched to a constant temperature expression used for lower excitation energies

$$\rho(E, J\pi) = \frac{1}{2T} \exp[(E - E_0)/T] \frac{(2J+1) \exp[-J+1/2)^2/2\sigma^2]}{2\sqrt{2\pi} \sigma^3}. \quad (13)$$

The definitions for the quantities in Eqs. (12) and (13) are given in Ref. 20 and will not be repeated here. The experimentally determined number of levels up to a particular excitation energy are used (where possible) to determine parameters for the constant-temperature expression so that a good match is made. The level-density parameter a is either input directly into calculations or determined using the Gilbert-Cameron prescription

$$a/A = 0.00917 [S(Z) + S(N)] + C, \quad (14)$$

where $S(Z)$ and $S(N)$ are shell effect terms²¹ and C , a correction term, depends on whether the nucleus is deformed ($C = 0.120$) or spherical ($C = 0.142$).²⁰

III. CODE SUBROUTINES

To explain the workings of the GNASH code and to aid in its use, a short description of its subroutines is given here. The code listing is in Appendix A.

MAIN - The main control routine of the program. It reads in data describing incident-particle and target types, problem and decay chains involved, etc. (see Sec. IV), and calls subroutines LEVPREP, TCPREP, and SETUP for initial problem setup. At each energy for which a calculation occurs, SETUP2 and SPECTRA are called. After the calculation, DATAOUT is called to provide a summary of the results.

LCSPACE - Sets up extended-core-storage (ECS) locations, zeroes extended-core locations, determines parent reactions, and creates population-storage buffers.

CHAINS - Called if automatic setup of chains is desired.

- ENERGY - Determines masses, separation energies, and ground-state spins and parities from the GROUND2 data file (Appendix B).
- XMAGIC - Determines whether a nucleus is "odd" or "even," according to the Gilbert-Cameron²⁰ level-density prescription.
- LEVPREP - Prepares a binary level-data file ordered properly for the calculation from an input binary-coded decimal (BCD) level file or cards. Stores $J\pi$ data in extended-core arrays.
- TCPREP - Reads in transmission-coefficient data, eliminates J-dependence of spin 1/2 arrays, reorders spin 0 and spin 1 arrays, determines the number of nonzero coefficients, and stores transmission-coefficient data in ECS.
- SETUP - Provides general setup information by determining accumulated separation energies for the decaying nuclei, identifies incident particle as well as secondary particles and photons, determines whether a residual nucleus is even or odd, sets up $J\pi$ arrays, and initializes level densities and Gilbert-Cameron level-density parameters.
- SETUP2 - Provides setup information for each incident energy in a calculation. Sets up energies, determines integration end points, and generates incident-channel transmission coefficients.
- SPECTRA - The main subroutine of the program in which the widths (total and partial) and population increments used to compute the spectra are calculated for all compound nuclei and decay reactions occurring in a specified decay chain. Figure 3 illustrates the treatment of the decay sequence in which gamma rays and particles may be emitted from one or several compound nuclei. Through several nested DO loops, the entire reaction sequence is handled. The outermost loop sums over decaying compound nuclei involved in the reaction sequence. The second loop sums over energy bins in the decaying compound nucleus. The third loop provides flags that indicate whether total decay widths should be calculated (first execution) or whether populations of continuum-continuum or continuum-level transitions should be calculated (second execution). A fourth loop sums over reaction types occurring in the decay of a continuum bin in the compound nucleus. Thus, all decays (either gamma-ray or particle) are handled in the same manner. The decays to continuum bins or discrete levels in a particular residual nucleus are then obtained from sums over the fifth loop. If preequilibrium effects are to be included, PRECMP is called to modify the continuum and level populations computed above. The GRLINES subroutine is then called to compute discrete gamma-ray cross sections and to add these cross sections to the computed gamma-ray spectra.
- LEVDSSET - Provides pairing and shell corrections from the tables of Cook et al.²¹ to be used in the computation of level densities using the Gilbert-Cameron Fermi-gas level-density expression. Calls GILCAM to provide information for the Gilbert-Cameron constant-temperature level-density expression.
- GILCAM - Where possible, computes energy matching parameters for the Gilbert-Cameron constant-temperature expression using input data that describe the number of levels present up to a given excitation energy.

Fig. 3.
Schematic flow diagram for the SPECTRA subroutine.

LCMLOAD - Computes transmission coefficients, level-density values, and Yrast values on an integration energy mesh for each nucleus involved in a particular segment of the decay chain.

GAMSET - Sets up the gamma-ray cascade calculation, determines Weisskopf or Brink-Axel parameters, and computes gamma-ray transmission coefficients.

WEISSKF - Normalizes Weisskopf or Brink-Axel gamma-ray strength expressions to the input values of $(2\pi\langle\Gamma\rangle)/\langle D\rangle$ determined from s-wave neutron resonance data.

INCHSUM - Performs sums over s and ℓ of the incident channel for a given compound nucleus spin and parity.

SUMER - Adds computed population increase into spectra and level-population arrays.

GRLINES - Computes discrete gamma-ray cross sections; sums spectra to obtain integrated cross sections.

DATAOUT - Main output subroutine. Depending on which print options are selected, widths, individual and composite spectra, cross sections, discrete levels, gamma-ray data, and level-density parameters can be printed.

ISERCH - Determines the parameters necessary for the interpolation routine.

FRECOMP - Determines preequilibrium contribution, renormalizes compound-nucleus cross sections, adds preequilibrium contribution into calculated particle spectra, and modifies continuum and level populations to account for preequilibrium effects.

INTERP - Main interpolation routine.

IV. MAIN CODE INPUT PARAMETERS

We attempted to keep the GNASH input as simple as possible. Thus all masses, separation energies, and ground-state spins and parities are taken from a data file (GROUND2, listed in Appendix B), which accompanies the program. The masses in the file are either the 1971 adjusted experimental values of Wapstra,²² or interpolated or extrapolated values from fits to the measured masses using the semi-empirical relations of Garvey et al.²³ The ground-state spins and parities are based on experimental measurements.²⁴ If J or π is unknown, a value of 99. appears in the file. Unknown spins and parities are flagged during execution, and $J^\pi = 0^+$ (even A) or $J^\pi = 1/2^+$ (odd A) is used in the actual calculation.

The input parameters required for the main GNASH code are described in Table I, and a sample input is given in Appendix C. The following sequence of input data cards is used:

- (A) (2 cards) FORMAT (8A10): TITLE(N), N = 1, 16
- (B) (1 card) FORMAT (5I4): IPRTLEV, IPRTTC, IPRTWID, IPRTSP, IPRTGC
- (C) (1 card) FORMAT (5I4): INPOPT, KLIN, KTIN, NIBD, LMAXOPT
- (D) (1 card) FORMAT (5I4): NI, NMP, LGROPT, LPEQ, NJMAX, ICAPT
- (E) (1 card) FORMAT (4E10.3): ZAP, ZAT, DE, FSIGCN
- (F) (1 card) FORMAT (1I4): NELAB
- (G) (1-3 cards) FORMAT (8E10.3): ELABS(N), N = 1, NELAB
- (H) (0-70 cards) Reaction-chain data. The form and complexity of this segment depends on the particular input option chosen, as follows:
- (1) INPOPT = 1, 2, or 3 (0 cards)
Reaction chains are set up automatically.
 - (2) INPOPT = -1 (1-10 cards) (DO loop I = 1, NI)
FORMAT (8E10.3): ZACN(I), XNIP(I), SWS(I), [ZZA1(IP),
IP = 2, NIP]
 - (3) INPOPT = 0 (2-70 cards)
 - (a) Outer DO loop I = 1, NI
(1 card per I) FORMAT (5E10.3): ZACN(I), XNIP(I),
CNPI(I), CNPIP(I), SWS(I)
 - (b) Inner DO loop IP = 1, NIP
(1-6 cards per I) FORMAT (5E10.3): ZA1(IR), XNL(IR),
A(IR), XNLGC(IR), ECGC(IR), where IR is a running re-
action index that defines a unique I, IP for each re-
action sequence
- (I) (1-6 cards) (DO loop MP = 1, NMP)
FORMAT (8X, A1, I1, E10.3): LMGHOL(MP), LG, RE1(MP)
- (J) (0-1 cards) Input depends on LPEQ parameter, as follows:
- (1) LPEQ = 0 (0 cards)
 - (2) LPEQ = 1 (1 card)
FORMAT (6E10.3): [ALPHA1(IDX), IDX = 1, 6]

TABLE I

MAIN INPUT PARAMETERS FOR GNASH

<u>Parameter</u>	<u>Description</u>
TITLE	Two cards of Hollerith information to describe the problem being calculated.
IPRTLEV	Print control for discrete-level data. Set IPRTLEV = 0(1) to omit (include) print of discrete-level information.

TABLE I (cont)

<u>Parameter</u>	<u>Description</u>
IPRTTC	Print control for transmission coefficients. Set IPRTTC = 0(1) to omit (include) print of input transmission coefficients. Set IPRTTC > 1 to print input values and interpolated transmission coefficients at every (IPRTTC-1)th energy on the basic integration energy mesh.
IPRTWID	Print control for reaction decay widths. Set IPRTWID = 0(1) to omit (include) print of decay widths for each reaction channel on the basic integration energy mesh.
IPRTSP	Print control for calculated energy spectra, as follows: IPRTSP = 0 to omit print of all calculated energy spectra. = 1 to only print composite spectra for each radiation type in the calculation, that is, composite spectra for emitted gamma rays, neutrons, protons, etc. = 2 to print individual spectra from each decay process included in the calculation, omitting the composite spectra. = 3 to print both individual reaction and composite spectra.
IPRTGC	Print control for level-density information. Set IPRTGC = 0(1) to omit (include) print of level-density parameters for each residual nucleus in the calculation. Set IPRTGC > 1 to print parameters and computed level densities at every (IPRTGC-1)th energy on the basic integration energy mesh for each residual nucleus.
INPOPT	Input control for designating the input option chosen to specify the reaction chains followed in the calculation. The following options are available: INPOPT = 0 is the most general input option available for specifying the reaction chains and the various parameters associated with each chain. For example, it permits (but does not require) input of level-density parameters for each residual nucleus in a calculation. See description of card input for details of reaction-chain input. = -1 also permits general specification of reaction chains but uses automatic features to simplify input. With this option, the code uses a built-in level-density parameterization and automatically determines parentage of each decaying compound nucleus by assuming that all previous, unassigned reactions leading to a given compound nucleus contribute to its initial population of states.

TABLE I (cont)

<u>Parameter</u>	<u>Description</u>
	<p>= 1 to automatically follow the neutron chain from the initial compound nucleus. A total of NI (see card no. 5, Sec. IV-D) compound nuclei are included, and each is permitted to decay by emission of gamma rays and neutrons.</p> <p>= 2 same as INPOPT = 1 except each compound nucleus is permitted to decay by emission of gamma rays, neutrons, protons, and alpha particles.</p> <p>= 3 same as INPOPT = 2 except that the product nuclei that result from proton and alpha emission are themselves allowed to gamma decay.</p>
KLIN	Input fileset for discrete energy-level data (= 5 for card input, = blank or 8 for input on disk or tape file 8).
KTIN	Input fileset for transmission-coefficient data (= 5 for card input, = blank or 10 for input on disk or tape file 10).
NIBD	Number of large-core buffers set up for storing state populations in reaction products that will further decay. The default value for NIBD is 10, which is also the maximum dimension.
LMAXOPT	Control for limiting the number of transmission coefficients (T_ℓ) included in a calculation by requiring that $(2\ell + 1)T > T_0 * 10^{- LMAXOPT }$. The default value is LMAXOPT = 5.
NI	Number of compound nuclei that are permitted to decay in the reaction chain (maximum of 10).
NMP	Number of gamma-ray multipolarities permitted in radiative decays (maximum of 6).
LGROPT	Control for indicating the model desired for calculating gamma-ray transition probabilities, as follows: LGROPT = 1 for the Weisskopf approximation. = 2 for the Brink-Axel approximation.
LPEQ	Preequilibrium control. Set LPEQ = 0(1) to omit (include) pre-equilibrium processes in the calculation.
NJMAX	Maximum number of values of total angular momentum permitted in the calculation (dimensioned for 40, which is also the default value). For even-A cases, $J_{\max} = NJMAX - 1$; for odd-A cases, $J_{\max} = (2 * NJMAX - 1)/2$.

TABLE I (cont)

<u>Parameter</u>	<u>Description</u>
ICAPT	Gamma-ray cascade control for initial compound nucleus: ICAPT = 0 to omit full gamma-ray cascade calculation in the initial compound nucleus (all subsequent compound nuclei do include the full cascade). = 1 to include the full gamma-ray cascade in calculation in all compound nuclei.
ZAP	$1000 * Z + A$ for the incident particle or projectile, where Z is atomic number and A is the (integer) mass number.
ZAT	$1000 * Z + A$ for the target nucleus.
DE	Energy increment for the basic integration energy mesh (in millions of electron volts). A maximum of 200 energy steps is permitted. If the chosen value of DE is too small, the code automatically increases it to satisfy the 200-step limit.
FGSIGCN	Constant multiplier applied to all calculated quantities (default value is 1.0).
NELAB	Number of incident neutron energies included in the calculation (maximum of 20).
ELABS(N)	Incident particle energies in millions of electron volts for the calculation.
ZACN(I)	$1000 * Z + A$ for each compound nucleus that is permitted to decay (I is the index that specifies the decaying compound nucleus.)
XNIP(I)	Number of decay channels included for compound nucleus ZACN(I). The minimum value is 1., and the maximum is 6. The fixed-point value of XNIP(I) is NIP in the code, and the decay index IP runs from IP = 1 to NIP for each compound nucleus.
SWS(I)	Value of the gamma-ray strength function for s-wave neutrons, $2\pi\langle\Gamma_\gamma\rangle/\langle D\rangle$, that is used to normalize the gamma-ray transition probabilities. A negative value of SWS can be used to directly input a normalization factor of $ SWS(I) $. In the case of the Brink-Axel approximation, SWS(I) can be set equal to 0. to indicate use of a built-in, constant normalization factor.
ZZA1(IP)	$1000 * Z + A$ for the radiation emitted from ZACN(I) by decay into channel IP. Note that ZZA1(1) = 0. (gamma ray) is assumed in all cases. Other possible values are 1., 1001., 1002., 1003., 2003., and 2004. (maximum of IP = 6).
CNPI(I)	Parentage designator that indicates the previous compound nucleus index I_p whose decay leads to the formation of ZACN(I).

TABLE I (cont)

<u>Parameter</u>	<u>Description</u>
CNPIP(I)	Parentage designator that indicates the previous decay index IP_p that leads to the formation of ZACN(I).
ZA1(IR)	Same as ZZA1(IP) described above. Note that the running reaction index IR defines a unique I, IP for each reaction sequence.
XLN(IR)	Number of discrete levels to be included in the calculation for the residual nucleus formed in reaction IR. If XLN(IR) = 0., then the total number of levels input in the Level-Data File (described in Sec. V) is used.
A(IR)	Level-density parameter, a, for use in the Gilbert-Cameron ²⁰ formula for the residual nucleus formed by reaction IR. Set A(IR) = 0. to use built-in values [see Eq. (14)].
XLNGC(IR) and ECGC(IR)	Number of discrete levels, XLNGC(IR), at excitation energy ECGC(IR) that are matched in the code to the Gilbert-Cameron formula for the continuum level density. If both these parameters are set equal to 0., then the total number of levels input in the Level-Data File is used.
LMGHOL(MP)	Hollerith E or M to designate the MPth radiative transition as electric or magnetic.
LG	Multipole order of the MPth transition.
REL(MP)	Ratio of the strength of the MPth transition to the strength of the E1 transition. Set REL(MP) = 0. to use a built-in value.
ALPHA1(IDX)	Preequilibrium normalization constants [see Eq. (7)] for reactions involving emitted neutrons, protons, deuterons, tritons, ³ He, and ⁴ He for IDX = 1 through 6, respectively. Set ALPHA1(IDX) = 0. to use the built-in values.

V. ADDITIONAL INPUT PARAMETERS

A. Discrete-Level Data

Following the main input, a separate subroutine (LEVPREP) is called to input discrete-level data. These data can either be selected from a general data file on disk or magnetic tape (KLIN = 8) or they can be input directly on cards for the cases required (KLIN = 5). In either case, the overall ordering of the information must be for increasing ZA (1000Z + A). The discrete-level input parameters are described in Table II, and input for the sample problem of Appendix C is given in the first part of Appendix D (pp. D-1 through D-5). The following

sequence of cards (or card images) is required for each residual nucleus requiring level data:

- (A) (1 card) FORMAT (I8, I5, F12.6): ID, NL, F
- (B) Outer loop on levels (DO loop N = 1, NL)
 FORMAT (I6, F12.6, 2F6.1, E12.5, I6): NX, EL(N), AJ(N), AT(N), TAU, NT
- (C) Inner loop for each level (DO loop K = 1, NT)
 FORMAT (12X, I6, 2F12.6): NF, P, CP

TABLE II
 DISCRETE-LEVEL INPUT PARAMETERS

<u>Parameter</u>	<u>Description</u>
ID	1000 * Z + A of the nucleus whose levels are being input.
NL	Number of levels being input.
F	For card input, set F = -1. for the last nucleus (highest ID) for which level data is input. Otherwise, set F = 0.
NX	Level number (= N), that is, N = 1 for the ground state, N = 2 for the first excited state, etc.
EL(N)	Energy in million electron volts of the Nth level; that is, EL(1) = 0.
AJ(N)	Spin and parity of the Nth level. The sign of AJ(N) indicates the parity. For example, -0. is interpreted as a $J^\pi = 0^-$ state.
AT(N)	Isospin of the Nth level (if unknown, it is set equal to 99.0). AT(N) is not used in the calculation at present.
TAU	Half-life of the state in seconds (if unknown, it is set equal to 99.0 or 0.0). TAU is not used in the calculation.
NT	Number of gamma-ray branches from the Nth level to lower levels.
NF	Level number indicator for a level to which a gamma-ray transition is occurring.
P	Gamma-ray branching ratio for the transition defined by $N \rightarrow NF$. For bound states, $\sum_{NF} P(N \rightarrow NF) = 1$. For unbound states, $\sum_{NF} P(N \rightarrow NF) =$ the total probability for decays other than particle emission.
CP	Probability that the transitions characterized by $P(N \rightarrow NF)$ are gamma-ray transitions. If, for example, there is a 20% probability that electron conversion is the decay mechanism, then CP = 0.80.

TABLE III
TRANSMISSION-COEFFICIENT INPUT PARAMETERS

<u>Parameter</u>	<u>Description</u>
NPART	Number of particles for which transmission coefficients are input.
BCDTC(8)	Seventy-five columns of Hollerith descriptive information.
XBCD	Alphanumeric particle identifiers, as follows: _NEUTRON, _PROTON, _DEUTERON, _TRITON, _HE-3, _ALPHA; that is, a blank column precedes each identifier.
NE	Number of energies included in energy grid for transmission coefficients.
NN	Number of coefficients input at each energy in the COMNUC format.
K	Optional card counter. Can be used to check ordering of cards.
ETC(J,ID)	Energy grid for transmission coefficients. The index J specifies the energy and ID is an internal identifier that specifies the particle.
TDUM(L)	Transmission-coefficient array. The index L runs from 1 to NN for each energy on the grid. The coefficients are collapsed to remove J-dependence and are stored as functions of energy for each particle.

B. Transmission Coefficients

Transmission coefficients for the projectile and outgoing particles are input in the subroutine TCFREP, following the discrete-level data input. Again, these data can be provided on a disk or magnetic tape file (KTIN = 10), or directly from cards (KTIN = 5). We have adopted the format used by COMNUC¹⁶ for transmission coefficients, and data for the various particles can be input in any order. The input parameters are described in Table III, and transmission coefficients for the sample problem follows the level data in Appendix D (pp. D-6 through D-14). The following sequences of cards (or card images) is required:

(A) (1 card) FORMAT (I4, 1X, 7A10, A5): NPART, [BCDTC(I), I = 1, 8]

(B) Outer loop on particles (DO loop N = 1, NPART)

(1 card per N loop) FORMAT (42X, A10, 12X, 2I4, A8): XBCD, NE, NN, K

- (C) Input energy grid for particle N (internal identifier = ID). (DO loop I = 2, NE, 6)
 (1-5 cards per N loop) FORMAT (6E12.2, A6): [ETC(J,ID), J = I, I + 5], K
- (D) Input transmission coefficients for particle N. Outer loop on energy (DO loop I = 2, NE), inner loop on NN (DO loop J = 1, NN, 6)
 (1-7 cards per energy, depending on NN) FORMAT (6E12.2, A6): [TDUM(L), L = J, J + 5], K

VI. CODE OUTPUT

The code output from the sample problem described in Appendixes C and D is given in Appendix E. The amount of detail included in the output depends upon the values of the parameters IPRTLEV, IPRTTC, IPRTWID, IPRTSP, and IPRTGC, described in Table I. The problem output, the result of a typical setup used at the Los Alamos Scientific Laboratory, consists essentially of six parts:

- (1) Input data (pp. E-1 and E-2), including the parentage indicators, masses (*XMR*), separation energies (*S*), and buffering information automatically determined by the code. Note that the number of discrete levels (*NLEV*) and the level-density parameters (*A*, *NLGC*, and *ECGC*) have not been determined yet unless they were input directly into the calculation. Also note in the column at the far right that the number of population-storage buffers is the minimum possible (4) for this particular calculation. Buffer No. 1 is re-used in the decay of the $ZA = 27059$ nucleus for storage of the $ZA = 27058$ level populations. The buffer numbers set to zero indicate residual nuclei that are not allowed to further decay in the calculation.
- (2) Timing information (p. E-3), printed as the code progresses through the main computer loops in subroutine SPECTRA, and normalization constants for the gamma-ray transition strengths (input directly in the example).
- (3) Binary reaction cross sections (p. E-4).
- (4) Calculated cross sections, average energies, and secondary spectra of emitted radiation from individual reactions (pp. E-5 and E-6) and composite spectra for the various species of emitted radiation (p. E-7). Cross sections for reactions to discrete states, and gamma rays from de-excitation of excited states are included in the spectral listings. Above each spectral column appear the integrated level decay, level excitation, and total production cross sections and average emitted energy for the particular reaction. Multiparticle cross sections such as $\sigma_{n,2n}$ and $\sigma_{n,np}$ can be deduced from the integrated cross sections. The energies associated with the emission spectra are midpoint values from the integration energy bins. Both the spectral energies and cross sections are given in the c.m. system of the recoiling nucleus plus particle or gamma ray. For medium or heavy mass nuclei, the c.m.-to-laboratory transformation factors are essentially unity.
- (5) Discrete-level excitation and gamma-ray de-excitation cross sections (pp. E-8 through E-15). The gamma-ray de-excitation cross sections only appear

for the decaying compound nuclei and in those cases the level and gamma-ray production cross sections include cascade effects.

- (6) Summary of the parameters used in the Gilbert-Cameron level-density formulas (p. E-12). The quantities E_0 [E_0 in Eq. (13)] and E_{MATCH} [energy where Eqs. (12) and (13) are matched] are determined from the number of discrete levels at excitation energy E_{CUT} and the level-density parameter a . The neutron and proton pairing corrections (PN and PZ) and shell corrections (SN and SZ) are listed, together with the neutron-separation energies (S) for each residual nucleus. The quantity SAC is the "accumulated separation energy," that is, the energy of each decaying compound nucleus relative to the first compound nucleus.

VII. DISCUSSION

The transmission coefficients given in Appendix D, which were used for the sample problem, were calculated from the Wilmore-Hodgson²⁵ global optical parameters for neutrons, the Bechetti-Greenlees²⁶ parameters for protons, and the Igo²⁷ parameters for alphas. The gamma-ray strength normalizations, which were input directly for the sample problem, were originally determined by normalizing the calculations for each compound nucleus to values of $2\pi\langle\Gamma_\gamma\rangle/\langle D\rangle$ of approximately 25×10^{-4} for the Co isotopes and 2×10^{-3} and 3×10^{-4} for ^{56}Mn and ^{59}Fe . Note that the sample problem results are for illustrative purposes only. A tighter integration mesh and more careful selection of model parameters would be advisable for a serious calculation. Additional examples of $n + ^{59}\text{Co}$ reaction cross-section calculations are compared to experimental data in Figs. 4-7. These results were obtained with the global optical parameters described above, but with a tighter integration mesh in GNASH than the one in our sample problem.

Thus far the validation of the GNASH code²⁻⁸ has been for incident neutrons or protons with energies mainly below 25 MeV. At energies above 25-30 MeV, the binary reactions are dominated by the preequilibrium component, and calculations become increasingly sensitive to the accuracy of that approximation. At incident energies below ~ 100 keV, use of GNASH becomes inefficient because of restrictions on the integration step size. Caution should also be exercised in using global parameter sets for generating transmission coefficients; we think the discrepancy between calculated and measured values of the $^{59}\text{Co}(n,\alpha)$ cross section in Fig. 6 resulted in part from inadequate optical parameters for alpha particles.

For complicated reaction sequences or higher energy calculations, computational times can be excessive. Because computational times are very problem dependent, the following parameters, which are most important in determining the

Fig. 4.

Comparison of calculated nonelastic and inelastic neutron cross sections for ^{59}Co with various experimental data. The solid curves represent the GNASH calculations.

Fig. 5.

Calculated and measured values of the $^{59}\text{Co}(n,p)$ cross section. The solid curve represents the GNASH calculations.

Fig. 6.

Calculated and measured values of the $^{59}\text{Co}(n,\alpha)$ cross section. The solid curve represents the GNASH calculations.

times, should be chosen carefully: energy-bin width (DE), the maximum number of total angular momentum states in the compound nucleus (NJMAX), the criteria for limiting the number of transmission coefficients (LMAXOPT), and the number of decaying nuclei (NI) in the calculation. In addition, the gamma-ray cascade calculation for the initial compound nucleus should always be turned off (ICAPT = 0) unless the spectrum of capture gamma rays is specifically required. A summary of running times for $n + {}^{59}\text{Co}$ calculations to 40 MeV using the reaction chain of Fig. 2 is shown in Fig. 8. For these calculations, the following parameters were used: $\text{DE} = 1 \text{ MeV}$, $\text{NJMAX} = 40$, $\text{NI} = 5$, and $\text{ICAPT} = 0$. When they were performed, the option for limiting the number of transmission coefficients had not yet been implemented, so in effect the results were obtained with $\text{LMAXOPT} \approx 15$. The times given in Fig. 8 can therefore be significantly reduced ($\sim 35\%$) without accuracy loss by using the LMAXOPT parameter.

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Fig. 7.

Calculated and measured $(n,2n)$ and $(n,3n)$ cross sections for ${}^{59}\text{Co}$. The solid curves represent the GNASH calculations; the triangles indicate the $(n,3n)$ measurements.

Fig. 8.

CDC 7600 central-processor time for GNASH calculations of $n + {}^{59}\text{Co}$ reactions out to 40 MeV. These times can be further reduced by careful limitation of the maximum order of transmission coefficients used in the calculation. See text for details.

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APPENDIX A

PROGRAM LISTING

COPY3F 4 FILES FROM FSET1

LASL Identification No. LP-0778

PROGRAM GNASH(INP,FSET5=INP,OUT,FSET6=OUT,FSET8,FSET9,	MAIN	2
1 FSET10,FSET11,FSET12,FSET13)	APR07771	
GAMMA-RAY, NEUTRON, AND ASSORTED SPECTRA FROM HEAVY NUCLEI	MAIN	4
FSET8 = INPUT LEVEL DATA IF CARDS NOT USED	MAIN	5
FSET9 = INTERNAL BINARY LEVEL DATA FILE (KL)	MAIN	6
FSET10= INPUT TRANSMISSION COEFFICIENTS IF CARDS NOT USED	MAIN	8
FSET11= LEVEL SCRATCH FILE = AVAILABLE FOR PUNCH OR DISC O/P	MAIN	9
FSET13= INPUT GROUND-STATE MASS EXCESS, SPIN, AND PARITY	APR07772	10
IPRTLEV=0 TO OMIT PRINT OF DISCRETE LEVEL INFORMATION	MAIN	11
IPRTTC=0 TO OMIT PRINT OF ANY TRANSMISSION COEFFICIENTS	MAIN	12
IPRTTC=1 TO PRINT I/P TRANSMISSION COEFFICIENTS	MAIN	13
IPRTTC.GE.2 TO PRINT TRANSMISSION COEFFICIENTS AT EVERY (IPRTTC-1) TH ENERGY ON THE BASIC INTEGRATION ENERGY MESH	MAIN	14
IPRTWID=0 TO OMIT WIDTH PRINT	MAIN	15
IPRTSP=0 TO OMIT SPECTRA PRINT	MAIN	16
IPRTSP=1 TO PRINT COMPOSITE SPECTRA ONLY	MAIN	17
IPRTSP=2 TO PRINT INDIVIDUAL SPECTRA ONLY	MAIN	18
IPRTSP=3 TO PRINT COMPOSITE AND INDIVIDUAL SPECTRA	MAIN	19
IPRTGC=0 TO OMIT PRINT OF LEVEL DENSITY PARAMETERS	MAIN	20
IPRTGC=1 TO PRINT GILBERT-CAMERON LEVEL DENSITY PARAMETERS	MAIN	21
IPRTGC.GE.2 TO PRINT LEVEL DENSITIES AT EVERY (IPRTGC-1) TH ENERGY ON THE BASIC INTEGRATION ENERGY MESH	MAIN	22
INPOPT=-1 MANUALLY READ IN REACTION CHAINS BUT CODE AUTOMATICALLY ASSIGNS PARENTAGE, CNPI(I) AND CNPI(I) ARE ASSUMED TO BE ALL UNASSIGNED HIGHER REACTIONS THAT PRODUCE ZACN(I)	MAIN	23
INPOPT=0 MANUALLY I/P REACTION CHAINS AND PARENTAGE INDICATORS	MAIN	24
INPOPT=1 AUTOMATICALLY FOLLOW NEUTRON CHAIN WITH G,N DECAYS	MAIN	25
INPOPT=2 AUTOMATICALLY FOLLOW NEUTRON CHAIN WITH G,N,P,A DECAYS	MAIN	26
INPOPT=3 AUTOMATICALLY FOLLOW NEUTRON CHAIN WITH G,N,P,A DECAYS, AND PICK UP GAMMAS FROM P AND A DECAYS	MAIN	27
SWS(I) = + TO NORMALIZE S-WAVE STRENGTH TO SWS(I)	MAIN	28
SWS(I) = 0. TO USE UNNORMALIZED GAMMA RAY TRANSITION PROBABILITIES	MAIN	29
AS ADJUSTED BY RE1(I)	MAIN	30
SWS(I) = * TO MULTIPLY GAMMA TRANSITION PROBABILITIES BY ABS(SWS(I))	MAIN	31
FORMAT(20I4)	MAIN	32
FORMAT(1P,8E10.3)	MAIN	33
FORMAT(8A10)	MAIN	34
FORMAT(1H1,8A10,1H,8A10)	MAIN	35
FORMAT(8X,A1,I1,1P,7E10.3)	MAIN	36
6 FORMAT(1P,E10.3,10X,6E10.3)	MAIN	37
7 FORMAT(/ 9H IPRTLEV=I2,3X,7HIPRTTC=I2,3X, 9HIPRTWID=I2,3X, 7HIPRTSP=I2,3X,7HIPRTGC=I2)	MAIN	38
8 FORMAT(8H INPOPT=I2,3X,5HKLIN=I2,3X,5HKTIN=I2,3X,5HNI8D=I2,3X, 1 8HLMAXOPT=I2,3X)	JUL26771	39
9 FORMAT(/ 4H NI=I3,3X,4HNNP=I2,3X,7HLGROPT=I2,3X, 1 5HLEQ=I2,3X,6HNNJMAX=I3,3X,*ICAPT=I2)	JUL26772	40
10 FORMAT(/ 5H ZAP=F5.0,3X,4HZAT=F6.0,3X,3HDE=F6.3,4H MEV, 1 3X,4HXYMT=F10.5,4H AMU,3X,3HSP=F6.3,4H MEV,3X, 2 8HECUTOFF=F5.2,4H MEV)	MAIN	41
11 FORMAT(5H ACN=F7.3,5H /MEV,3X, 7HFSIGCN=I2,3X, 1=F7.3,3X,6HDEFN=F2.0,3X,7HSPINT=F5.1,3X,4HPIT=F3.0)	MAIN	42
12 FORMAT(/ * I ZACN NIP PARENT*,9X,*S=WAVE*,8X,*IP*,4X,*ZA1*,MAIN 1 4X*ZA2*,5X,*XMR*,8X,*9*,4X,*NLEV DEF A NLGC ECGC BUFMAIN 2FER/* == ***** I IP*,	MAIN	43
3 * STRENGTH, ENERGY == ***** *	MAIN	44

```

4 * ---- (AMU) (MEV) -- -- (/MEV) ---- (MEV) NUMMAIN 61
SER*) MAIN 62
13 FORMAT(13,F7.0,F4.0,F7.0,F6.0,2X,1PE10.3,0P,F7.3) MAIN 63
14 FORMAT(46X,15,F7.0,F8.0,F8.3,F10.3,2F5.0,F8.3,F5.0,F10.3,17) MAIN 64
15 FORMAT(/ 46H INDEX L PARITY MULTIPOLARITY RATIO TO E1) MAIN 65
16 FORMAT(14,2F6.0,9X,A1,I1,8X,G11,4) MAIN 66
17 FORMAT(/** WEISSKOPF APPROXIMATION USED FOR GAMMA-RAY TRANSMISSIONMAIN 67
1 COEFFICIENTS*) MAIN 68
18 FORMAT(/** * AXEL APPROXIMATION USED FOR GAMMA-RAY TRANSMISSIONMAIN 69
1 COEFFICIENTS*) MAIN 70
19 FORMAT(/ 26H INCIDENT ENERGIES (MEV) =,1P,10E10.3,/26X,10E10.3) MAIN 71
25 FORMAT(/**5X*COLLI=MILAZZO CLOSED FORM USED FOR ABSOLUTE CAL OF PREMAIN 72
1=EQUILIBRIUM CROSS SECTION **/,* PRE=EQUILIBRIUM NORMALIZATION CONMAIN 73
2STANTS ARE / *.6A10./39X,*(INPUT) *,1P,6E10.3,/39X,* (USED) *, MAIN 74
3 6E10.3) MAIN 75
C MAIN 76
30 FORMAT(/**25X* THE LAB ENERGY IS *G11.4* MEV **/) MAIN 77
33 FORMAT(20A4) MAIN 78
34 FORMAT(1X,20A4) MAIN 79
COMMON RMO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7) RHO 2
1,SPNGN(200),PL(50,6),G(200,6),RHOFT(40) RHO 3
COMMON/LCINDEX/IPBLCL,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC, LCNDEX 2
1 ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM, LCNDEX 3
2 NIDIM,NIPDIM LCNDEX 4
COMMON/TCOEFF/ETC(25,6),YC(25,30),BCD(7),XSPIN(7),NLDIM, TCOEF 2
1NPART,NEE(6),ND(6),NTC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25), TCOEF 3
2NLE(6,200),JRAST(200,6) TCOEF 4
COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM LEVEL1 2
1,EG(240),SG(240),NGRAYS(60) LEVEL1 3
COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60), BASIC1 2
1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60) BASIC1 3
COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10), BASIC2 2
1 CNPI(10),S(60),SAC(10),IDI(60),IDP,10E2(60),IRUP(6,10), BASIC2 3
2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60), BASIC2 4
3 NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, 10ECN(10),NKKCN(10),ECON,BASIC2 5
4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILL(30)BASIC2 6
5,ICAPT,PLBUF(50,10),INPORT,TKEEP BASIC2 7
COMMON/GAMMA/NMP,LGROPT,SWS(10),GML(6),GMP(6),RE1(6),LMGHOL(6), GAMMA 2
1 TGR(200,6),WKCON,CAXEL,GAXEL,ERAXEL,EXSWS(10),WKKNORM GAMMA 3
COMMON/PREQ/LPEQ,SIGR,PREQ1(6),CSIGI(6),NITT(6),ALPHA(6) PREQ 2
COMMON/PREQ1/EP SIG(200,6),NLEV,NPIT,NIT PREQ1 2
COMMON/FITTING/ACN,FSIGCN,SIGPEO FITTING2
COMMON/PRNTOUT/IPRTLEV,IPRTIC,IPRTMLD,IPRTWID,IPRTSP,IPRTGC PRNTOUT2
COMMON/LEV DEN/DEF(60),XNLGC(60),ECGC(60),UCUTOFF,DEFCN,TGC(60), LEVDEN 2
1 ECGC(60),EMATGC(60),PAIR(60),XMR3(60),XNLLN(60),SZ(100),SN(150), LEVDEN 3
2 PZ(100),PN(150) LEVDEN 4
COMMON /SPNPAR/ SPIN,PARITY,KGRD LEVDEN 5
C MAIN 92
DIMENSION ALPHA1(6) MAIN 93
DIMENSION ZZA1(6),ELABS(20) MAIN 94
DIMENSION ZINPU(20) MAIN 95
DATA BCD/10H NEUTRON ,10H PROTON ,10H DEUTERON ,10H TRITON , MAIN 96
1 10H HE-3 ,10H ALPHA ,10H GAMMA-RAY/ MAIN 97
DATA IZAID/1,1001,1002,1003,2003,2004,0/ MAIN 98
DATA KI,KL,K7,KGRD,IRHOLF,IRHOLM /5,9,7,13,1HE,1HM/ MAIN 99
DATA XMASS/1.008665,1.007825,2.014102,3.016050,3.016030,4.002603, MAIN 100
1 0./ MAIN 101
DATA XSPIN/0.5,0.5,1.0,0.5,0.5,0.0,0.0/ MAIN 102
DATA NKDIM,NJDIM,NEEDIM,NLDIM,NLEVDIM/200,40,25,30,50/ MAIN 103
DATA NIDIM,NIPDIM,NIBDIM,NGRDIM,NIDDIM/ MAIN 104
1 10, 6, 8, 240, 7 / MAIN 105
DATA ALPHA/5.0E-04,5.0E-04,3*1.0E-02,5E-03/ MAY77 1
DATA NITT/3,3,3,3,3,3/ MAIN 107

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C	EXACTM(ZA,EXMASS) = ZA*1000.*FLOAT(IFIX(ZA/1000.))+EXMASS/931.502	MAIN 100
C		MAIN 109
C		MAIN 110
C	TAPE 12 = BUFFER INPUT	MAIN 111
C		MAIN 112
	WRITE(6,32)	MAIN 113
32	FORMAT(1H1)	MAIN 114
33	READ(KI,33) ZINPU	MAIN 115
	IF(EOF,KI) 300,301	MAIN 116
301	WRITE(6,34) ZINPU	MAIN 117
	WRITE(12,33) ZINPU	MAIN 118
	GO TO 35	MAIN 119
300	CONTINUE	MAIN 120
C		MAIN 121
C	NOW TAPE 12 = INPUT	MAIN 122
C		MAIN 123
	KI=12	MAIN 124
	ENDFILE KI	MAIN 125
	REWIND KI	MAIN 126
C		MAIN 127
C	MAIN INPUT SECTION	MAIN 128
	EXMN = ENERGY(1,0)	MAIN 129
100	READ(KI,3) TITLE	MAIN 130
	IF(EOF,KI) 1000,101	MAIN 131
101	WRITE(6,4) TITLE	MAIN 132
	READ(KI,1) IPRTLEV,IPRTTC,IPRTWID,IPRTSP,IPRTGC	MAIN 133
	READ(KI,1) INPOPT,KLIN,KTIN,NIBD,LMAXOPT	MAIN 134
	IF(NIBD.GT.0) NIBDIM=NIBD	JUL26773
	IF(KLIN.LT.1) KLIN=0	MAIN 136
	IF(KTIN.LT.1) KTIN=10	MAIN 137
	IF(KLIN.NE.8) KLIN=12	MAIN 138
	IF(KTIN.NE.10) KTIN=12	APR07773
	WRITE(6,7) IPRTLEV,IPRTTC,IPRTWID,IPRTSP,IPRTGC	APR07774
	WRITE(6,8) INPOPT,KLIN,KTIN,NIBD,LMAXOPT	MAIN 139
	EPSILON=1.0E-9	JUL26774
	IF(LMAXOPT.GT.0) LMAXOPT=LMAXOPT	JUL26775
	IF(LMAXOPT.NE.0) EPSILON=10.**LMAXOPT	JUL26776
	READ(KI,1) NI,NMP,LGROPT,LPEQ,NJMAX,ICAPT	JUL26777
	IF(NJMAX.EQ.0) NJMAX=NJDIM	MAIN 141
	READ(KI,2) ZAP,ZAT,DE,FSIGCN	MAIN 142
	UCUTOFF = 0.1	MAIN 143
	READ(KI,1) NELAB	MAIN 144
	READ(KI,2) (ELABS(I),I=1,NELAB)	MAIN 145
	EXMT = ENERGY(ZAT)	MAIN 146
	XJT = SPIN	MAIN 147
	PIT = PARITY	MAIN 148
	XMT = EXACTM(ZAT,EXMT)	MAIN 149
	SIC = EXMT + ENERGY(ZAP) * ENERGY(ZAT+ZAP)	MAIN 150
	IF(FSIGCN.EQ.0.) FSIGCN=1.0	MAIN 151
	IR=0	MAIN 152
	DO 104 I=1,NI	MAIN 153
	IF(INPOPT.EQ.0) READ(KI,2) ZACN(I),XNIP(I),CNPI(I),CNPPI(I),SWS(I)	MAIN 154
	ZZA1(I)=0.	MAIN 155
	IF(INPOPT.LE.=1) READ(KI,2) ZACN(I),XNIP(I),SWS(I),(ZZA1(IP),IP=2,6)	MAIN 156
	IF(INPOPT.GE.1) CALL CHAINS(I,IR)	MAIN 157
	ZAC = ZACN(I)	MAIN 158
	EXMC = ENERGY(ZAC)	MAIN 159
	EXSWS(I) = ENERGY(ZAC*1.0) + EXMN * EXMC	MAIN 160
	NIP=XNIP(I)	MAIN 161
	DO 104 IP=1,NIP	MAIN 162
	IR=IR+1	MAIN 163
	LR(IP,I)=IR	MAIN 164
		MAIN 165

	XNL(IR)=0.	MAIN 166
	A(IR)=0.	MAIN 167
	XNLGC(IR)=0.	MAIN 168
	ECGC(IR)=0.	MAIN 169
	IF(INPOPT, EQ, 0) READ(KI, 2) ZA1(IR), XNL(IR), A(IR), XNLGC(IR), ECGC(IR)	MAIN 170
	IF(INPOPT, LE, -1) ZA1(IR)=Z ZA1(IP)	MAIN 171
	ZA2(IR) = ZACN(I)=ZA1(IR)	MAIN 172
	DEF(IR) = XMAGIC(ZA2(IR))	MAIN 173
	ZAR = ZA2(IR)	MAIN 174
	EXMR = ENERGY(ZAR)	MAIN 175
	XM2(IR) = EXACTM(ZAR, EXMR)	MAIN 176
	S(IR) = EXMR + ENERGY(ZA1(IR)) = EXMC	MAIN 177
104	CONTINUE	MAIN 178
	NIR=IR	MAIN 179
	CALL LCSPACE	MAIN 180
	ACN=A(1)	MAIN 181
	DEFN=DEF(1)	MAIN 182
	WRITE(6, 9) NI, NM0, LGROPT, LPEQ, NJMAX, ICAPT	MAIN 183
	WRITE(6, 10) ZAP, ZAT, DE, XMT, SIC, UCUTOFF	MAIN 184
	WRITE(6, 11) ACN, FSIGCN, DEFN, XJT, PIT	MAIN 185
	WRITE(6, 19) (ELABS(I), I=1, NELAB)	MAIN 186
	WRITE(6, 12)	MAIN 187
	DO 106 I=1, NI	MAIN 188
	WRITE(6, 13) I, ZACN(I), XNIP(I), CNPI(I), CNPIP(I), SWS(I), EXSWS(I)	MAIN 189
	NIP=XNIP(I)	MAIN 190
	DO 106 IP=1, NIP	MAIN 191
	IR=LR(IP, I)	MAIN 192
	IB=IBUF(IP, I)	MAIN 193
	IF(IB.GT.NIBDIM) IB=IB-NIBDIM	MAIN 194
106	WRITE(6, 14) IP, ZA1(IR), ZA2(IR), XM2(IR), S(IR), XNL(IR),	MAIN 195
	1 DEF(IR), A(IR), XNLGC(IR), ECGC(IR), IB	MAIN 196
	IF(LGROPT, EQ, 1) WRITE(6, 17)	MAIN 197
	IF(LGROPT, EQ, 2) WRITE(6, 18)	MAIN 198
	WRITE(6, 15)	MAIN 199
	DO 110 MP=1, NMP	MAIN 200
	READ(KI, 5) LMGHOL(MP), LG, RE1(MP)	MAIN 201
	IF(LMGHOL(MP), EQ, IHOLE) GMP(MP)=1.0	MAIN 202
	IF(LMGHOL(MP), EQ, IHOLM) GMP(MP)=1.0	MAIN 203
	IF((LMGHOL(MP), EQ, IHOLE).AND.(LG, EQ, 1).AND.(RE1(MP), EQ, 0.))	MAIN 204
	RE1(MP)=1.0	MAIN 205
	GML(MP)=LG	MAIN 206
110	WRITE(6, 16) MP, GML(MP), GMP(MP), LMGHOL(MP), LG, RE1(MP)	MAIN 207
	IF(LPEQ, EQ, 1) READ(KI, 2) ALPHA1	MAIN 208
	DO 201 IDX=1, 6	MAIN 209
	IF(ALPHA1(IDX), NE, 0.) 202, 201	MAIN 210
202	ALPHA(IDX)=ALPHA1(IDX)	MAIN 211
201	CONTINUE	MAIN 212
	IF(LPEQ, EQ, 1) WRITE(6, 25) (BCD(IDX), IDX=1, 6), ALPHA1, ALPHA	MAIN 213
C		MAIN 214
C	READ LEVEL INFORMATION	MAIN 215
	CALL LEVPREP(KLIN, KL)	MAIN 216
C		MAIN 217
C	READ TRANSMISSION COEFFICIENT DATA	MAIN 218
	CALL TCPREP(KTIN, EPSILON)	JUL26778
C		MAIN 220
C	SET UP FOR CALCULATION	MAIN 221
	CALL SETUP	MAIN 222
C		MAIN 223
C	INCIDENT ENERGY LOOP	MAIN 224
	DO 200 IELAB=1, NELAB	MAIN 225
	CALL SECOND(TKEEP)	MAIN 226
	ELAB=ELABS(IELAB)	MAIN 227
	CALL SETUP2	MAIN 228

C		MAIN 229
C	CALCULATE SPECTRA	MAIN 230
	CALL SPECTRA(ACN,FSIGCN)	MAIN 231
C		MAIN 232
C	PRINT AND WRITE OUTPUT RESULTS	MAIN 233
	CALL DATAOUT	MAIN 234
198	CONTINUE	MAIN 235
199	CONTINUE	MAIN 236
C		MAIN 237
200	CONTINUE	MAIN 238
	GO TO 100	MAIN 239
1000	STOP	MAIN 240
	END	MAIN 241
	SUBROUTINE LCSPACE	LCSPACE2
C		LCSPACE3
C	SET UP LCM STORAGE, ZERO ARRAY, AND VARIABLE STORAGE BUFFERS	LCSPACE4
C		LCSPACE5
	COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)	RHO 2
	1,SPNGN(200),PL(50,6),G(200,6),RHOFTR(40)	RHO 3
	COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	BASIC1 2
	1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 3
	COMMON/LCINDEX/IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,	LCINDEX 2
	1 ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,	LCINDEX 3
	2 NIDDIM,NIRDIM	LCINDEX 4
	COMMON/TCOEF/ETC(25,6),TC(25,30),BCD(7),XSPIN(7),NLDIM,	TCOEF 2
	1NPART,NEE(6),NO(6),NYC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25),	TCOEF 3
	2NLE(6,200),JRAST(200,6)	TCOEF 4
	COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM	LEVEL1 2
	1,EG(240),SG(240),NGRAVS(60)	LEVEL1 3
	COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
	1 CNPIP(10),S(60),SAC(10),ID1(60),IDP,IDE2(60),IBUF(6,10),	BASIC2 3
	2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCR(30),QMDP(40),A(60),A2(60),	BASIC2 4
	3 NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOFCN(10),NKKCN(10),ECON,BASIC2 5	
	4 JPI(40,2),XBP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILLL(30)	BASIC2 6
	5,ICAPT,PLBUF(50,10),INPOPT,KEEP	BASIC2 7
	DIMENSION SCBUF(4000),IJJ(10),IPJJ(10)	LCSPAC12
	EQUIVALENCE (SCBUF,RHO)	LCSPAC13
C		LCSPAC14
C	SET LCM STORAGE INDEXES	LCSPAC15
	NIRDIM=NIDIM*NIPDIM	LCSPAC16
	IPBLC=0	LCSPAC17
	IGLC=IPBLC+NJDIM*NKDIM*NIBDIM*2	LCSPAC18
	IZEROLC=IGLC+NKDIM*NIRDIM	LCSPAC19
	ISPLC=IZEROLC+8000	LCSPAC20
	IPLLC=ISPLC+NKDIM*NIRDIM	LCSPAC21
	IEGLC=IPLLC+NLEVDIM*NIRDIM	LCSPAC22
	ISGLC=IEGLC+NGRDIM*NIRDIM	LCSPAC23
	ITCLC=ISGLC+NGRDIM*NIRDIM	LCSPAC24
	IRHOLC=ITCLC+NEEDIM*NLDIM*(NIDDIM-1)	LCSPAC25
	ITLC=IRHOLC+NKDIM*NJDIM*NIPDIM	LCSPAC26
	IELLC=ITLC+NKDIM*NLDIM*NIPDIM	LCSPAC27
	IAJLC=IELLC+NLEVDIM*NIRDIM	LCSPAC28
	IATLC=IAJLC+NLEVDIM*NIRDIM	LCSPAC29
	LCMDIM=IATLC+NLEVDIM*NIRDIM	LCSPAC30
	WRITE(6,1) LCMDIM	LCSPAC31
	1 FORMAT(* LCM SPACE REQUIRED (EXCLUDING DISC BUFFERS) IS *,I7)	LCSPAC32
	WRITE(6,2) NIBDIM,NKDIM	LCSPAC33
2	FORMAT(* NUMBER OF LCM BUFFERS IS *,I2/* MAXIMUM NUMBER OF ENERG	LCSPAC34
	1Y BINS IS *,I4)	LCSPAC35
C		LCSPAC36
C	SET UP LCM ZERO ARRAY	LCSPAC37
	DO 10 K=1,1000	LCSPAC38
10	SCBUF(K)=0.	LCSPAC39

	INDEX=INDEX+NPTS	LCSPAC40
	CALL ECWR(SCBUF, INDEX, NPTS, IERR)	LCSPAC41
	INDEX=INDEX+NPTS	LCSPAC42
	CALL ECWR(SCBUF, INDEX, NPTS, IERR)	LCSPAC43
	INDEX=INDEX+NPTS	LCSPAC44
	CALL ECWR(SCBUF, INDEX, NPTS, IERR)	LCSPAC45
	INDEX=INDEX+NPTS	LCSPAC46
	CALL ECWR(SCBUF, INDEX, NPTS, IERR)	LCSPAC47
	CALL ECWR(SCBUF, INDEX, NPTS, IERR)	LCSPAC48
	CALL ECRD(SCBUF, IZEROLC, 4000, IERR)	LCSPAC49
	INDEX=INDEX+NPTS	LCSPAC50
	CALL ECWR(SCBUF, INDEX, 4000, IERR)	LCSPAC51
	IF(INPOP1, GE, 0) GO TO 420	LCSPAC52
C		LCSPAC53
C	DETERMINE PARENT REACTIONS	LCSPAC54
	LBUFFOPT=1	LCSPAC55
	CNPI(1)=1.	LCSPAC56
	CNPIP(1)=1.	LCSPAC57
	IF(NI, LT, 2) GO TO 420	LCSPAC58
	DO 410 I=2, NI	LCSPAC59
	CNPI(I)=0.	LCSPAC60
	CNPIP(I)=0.	LCSPAC61
	I1=I-1	LCSPAC62
	DO 409 IM=1, I1	LCSPAC63
	I1=I1-IM+1	LCSPAC64
	IF(ZACN(I), EQ, ZACN(I1)) GO TO 410	LCSPAC65
	NIP = XNIP(I1)	LCSPAC66
	IF(NIP, LT, 2) GO TO 409	LCSPAC67
	DO 408 IIP=2, NIP	LCSPAC68
	IR=LR(IIP, I1)	LCSPAC69
	IF(ZA2(IR), NE, ZACN(I)) GO TO 408	LCSPAC70
	CNPI(I) = I1 + 100.*CNPI(I1)	LCSPAC71
	CNPIP(I) = IIP+100.*CNPIP(I1)	LCSPAC72
	IF(LBUFFOPT, EQ, 2) GO TO 410	LCSPAC73
408	CONTINUE	LCSPAC74
409	CONTINUE	LCSPAC75
410	CONTINUE	LCSPAC76
420	CONTINUE	LCSPAC77
C		LCSPAC78
C	SET UP POPULATION STORAGE BUFFERS FOR LCM	LCSPAC79
	CALL ECRD(IBUF, IZEROLC, 60, IERR)	LCSPAC80
	CNPI(1)=1.	LCSPAC81
	CNPIP(1)=1.	LCSPAC82
	IB=0	LCSPAC83
	DO 70 J=1, NI	LCSPAC84
	IB=IB+1	LCSPAC85
	I1=CNPI(J)	LCSPAC86
	IIP=CNPIP(J)	LCSPAC87
	DO 62 JJ=1, 10	LCSPAC88
	JJX=10*(JJ+2)	LCSPAC89
	JJX2=JJX/100	LCSPAC90
	IJJ(JJ)=MOD(I1, JJX)/JJX2	LCSPAC91
	IPJJ(JJ)=MOD(IIP, JJX)/JJX2	LCSPAC92
	IF(I1/JJX, LT, 1) GO TO 64	LCSPAC93
62	CONTINUE	LCSPAC94
64	NJJ=JJ	LCSPAC95
	DO 68 I=1, J	LCSPAC96
	NIP=XNIP(I)	LCSPAC97
	DO 66 IP=1, NIP	LCSPAC98
	DO 66 JJ=1, NJJ	LCSPAC99
	IF((I, NE, IJJ(JJ)), OR, (IP, NE, IPJJ(JJ))) GO TO 66	LCSPA100
	IBUF(IP, I) = IB	LCSPA101
66	CONTINUE	LCSPA102

68	CONTINUE	LCSPA103
70	CONTINUE	LCSPA104
C		LCSPA105
C	EQUATE (N,G) REACTION BUFFERS TO PARENT NUCLEUS BUFFER	LCSPA106
	DO 72 I=1,NI	LCSPA107
	II=CNPI(I)	LCSPA108
	IIP=CNPIP(I)	LCSPA109
	II=MOD(II,100)	LCSPA110
	IIP=MOD(IIP,100)	LCSPA111
	IBUF(1,I)=IBUF(IIP,II)	LCSPA112
72	CONTINUE	LCSPA113
	RETURN	LCSPA114
	END	LCSPA115
	SUBROUTINE CHAINS(I,IRX)	CHAINS 2
C		CHAINS 3
C	CONSTRUCT OPTIONAL AUTOMATIC REACTION CHAIN SEQUENCES	CHAINS 4
C		CHAINS 5
	COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	BASIC1 2
	1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 3
	COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
	1 CNPIP(10),S(60),SAC(10),IDI(60),IDP,IOE2(60),IBUF(6,10),	BASIC2 3
	2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(10),	BASIC2 4
	3 NRHO(6),XJT, NPOPHAX,NTC2(6),NJDIM, IGCON(10),NKKCN(10),FCON,BASIC2	BASIC2 5
	4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILL(30)	BASIC2 6
	5,ICAPT,PLBUF(50,10),INPOPT,TKEEP	BASIC2 7
	COMMON/LEVLEN/DEF(60),XNLGC(60),ECGC(60),UCUTOFF,DEPCN,TGC(60),	LEVLEN 2
	1 ECGC(60),FMATGC(60),PAIR(60),XMR3(60),XNLLN(60),SZ(100),SN(150),	LEVLEN 3
	2 P7(100),PN(150)	LEVLEN 4
	COMMON /SPNPAR/ SPIN,PARITY,KGRD	LEVLEN 5
	COMMON/LEVFL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM	LEVFL1 2
	1,EG(240),SG(240),NGRAYS(60)	LEVFL1 3
	COMMON/GAMMA/NMP,LGROPT,SWS(10),GML(6),GMP(6),REI(6),LMGHOL(6),	GAMMA 2
	1 TGR(200,6),WKCON,GAXEL,GAXEL,ERAXEL,EXSWS(10),WKNNORM	GAMMA 3
	DIMENSION ZAX(4)	CHAINS11
	DATA ZAX/0.,1.,1001.,2004./	CHAINS12
	XI=1	CHAINS13
	ZATOT=ZAP+ZAT	CHAINS14
	SWS(1)=0.	CHAINS15
	IR=IRX	CHAINS16
	GO TO (11,12,13),INPOPT	CHAINS17
11	ZACN(I)=ZATOT-XI+1.0001	CHAINS18
	XNIP(I)=2.	CHAINS19
	CNPI(I)=XI=0.99999	CHAINS20
	CNPIP(I)=2.	CHAINS21
	GO TO 50	CHAINS22
12	ZACN(I)=ZATOT-XI+1.0001	CHAINS23
	XNIP(I)=4.	CHAINS24
	CNPI(I)=XI=0.99999	CHAINS25
	CNPIP(I)=2.	CHAINS26
	GO TO 50	CHAINS27
13	GO TO (21,22,23,21,22,23,21,22,23,21),I	CHAINS28
21	XII=(I-1)/3	CHAINS29
	ZACN(I)=ZATOT-XII	CHAINS30
	XNIP(I)=4.	CHAINS31
	CNPI(I)=I=3	CHAINS32
	CNPIP(I)=2.	CHAINS33
	GO TO 50	CHAINS34
22	ZACN(I)=ZACN(I=1)=ZAX(3)	CHAINS35
	CNPI(I)=I=1	CHAINS36
	CNPIP(I)=3.	CHAINS37
	XNIP(I)=1.	CHAINS38
	GO TO 50	CHAINS39
23	ZACN(I)=ZACN(I=2)=ZAX(4)	CHAINS40

	CNP(1)=1-2	CHAIN341
	CNP(1)=4	CHAIN342
	XNIP(1)=1	CHAIN343
50	NIP=XNIP(1)	CHAIN344
	IZA=ZACN(1)	CHAIN345
	ZACN(1)=IZA	CHAIN346
	DO 54 IP=1,NIP	CHAIN347
	IR=IR+1	CHAIN348
	ZAI(IR)=ZAX(IP)	CHAIN349
54	CONTINUE	CHAIN350
	RETURN	CHAIN351
	END	CHAIN352
	FUNCTION ENERGY(ZA)	ENERGY 2
C		ENERGY 3
C	***** ENERGY LOOKS UP VALUES OF GROUND-STATE MASS EXCESS (MEV),	**ENERGY 4
C	***** SPIN, AND PARITY, MISSING DATA PRODUCE A FATAL ERROR.	**ENERGY 5
C		ENERGY 6
	COMMON /SPNPAR/ SPIN,PARITY,KGRD	ENERGY 7
	DIMENSION I0(11),I1(11),I2(11),J0(11),J1(12),K0(12),ENER(2055)	ENERGY 8
	DIMENSION PAR(3)	ENERGY 9
	DIMENSION SPINPAR(2055)	BCDGRD 1
	DATA PAR /1H+,1H-,1H+/	ENERGY10
	DATA INPGRD/1/	BCDGRD 2
1	FORMAT(20H0***** GROUND-STATE DATA FOR 16,19H NOT IN TABLE *****)	ENERGY12
2	FORMAT(12,2H/2 A1)	ENERGY13
3	FORMAT(12, A1)	ENERGY14
4	FORMAT(2X, A1)	ENERGY15
5	FORMAT(5X+++++ GROUND STATE OF *F6.0* IS INCOMPLETELY DESCRIBED	BCDGRD 3
	X, SPIN,PARITY = *F6.2,2X,F6.2,2X+++++)	BCDGRD 4
6	FORMAT(5X+++++,20X,* ASSIGNMENTS CHANGED TO, SPIN,PARITY =	BCDGRD 5
	1*F6.2,2X,F6.2,2X+++++)	BCDGRD 6
C		ENERGY16
C	FIRST CALL CAUSES DATA TO BE READ IN	ENERGY19
	IF(INPGRD.EQ.12345) GO TO 10	ENERGY20
	READ (KGRD,100) I0,I1,I2,J0,J1,K0	BCDGRD 7
100	FORMAT(8I10)	BCDGRD 8
	READ(KGRD,101)ENER	BCDGRD 9
101	FORMAT(6E13.6)	BCDGRD10
	READ(KGRD,102)SPINPAR	BCDGRD11
102	FORMAT(8F10.3)	BCDGRD12
	REWIND KGRD	BCDGRD13
	INPGRD = 12345	ENERGY22
10	IF(ZA) 40,15,20	ENERGY23
C		ENERGY24
C	Z=0, A=0 IS CONSIDERED A PHOTON.	ENERGY25
15	ENERGY = SPIN = 0. \$ PARITY = +1. \$ RETURN	ENERGY26
C		ENERGY27
C	FIND REQUESTED NUCLEUS IN APPROPRIATE TABLE	ENERGY28
20	IZA = IFIX(ZA) \$ JZ = IZA/1000	ENERGY29
	IA = IZA - 1000*JZ \$ N = IA - JZ	ENERGY30
	NZ = N - JZ \$ NZ = NZ - JZ	ENERGY31
	DO 30 K=1,11 \$ IF(JZ.GE.J1(K+1)) GO TO 30	ENERGY32
	ND = I1(K) - 1 \$ I = NZ - ND	ENERGY33
	IF(I2(K).LT.0) I = NZ - ND	ENERGY34
	IK = I0(K) \$ J = JZ - J1(K) + 1	ENERGY35
	IN = K0(K) + I + (J-1)*IK	ENERGY36
	IF(I.GT.0.AND.I.LE.IK) GO TO 50 \$ GO TO 40	ENERGY37
30	CONTINUE	ENERGY38
C		ENERGY39
C	REQUESTED ISOTOPE IS NOT IN TABLES	ENERGY40
40	PRINT 1, IZA \$ STOP 7776	ENERGY41
C		ENERGY42
50	CONTINUE	BCDGRD14

	ENERGY=ENEP(IN)	BCDGRD15
	IF(SPINPAR(IN).GE.9900.)SPIN=SPINPAR(IN)-9900.	BCDGRD16
	IF(SPINPAR(IN).GE.9900.)PARITY=99.	BCDGRD17
	IF(SPINPAR(IN).GE.9900.)GO TO 200	BCDGRD18
	IF(SPINPAR(IN).GE.100.)PARITY=1.	BCDGRD19
	IF(SPINPAR(IN).GE.100.)SPIN=SPINPAR(IN)-100.	BCDGRD20
	IF(SPINPAR(IN).LT.0.)PARITY=-1.	BCDGRD21
	IF(SPINPAR(IN).LT.0.)SPIN=SPINPAR(IN)+100.	BCDGRD22
200	CONTINUE	BCDGRD23
	IF((PARITY.NE.99.).AND.(SPIN.NE.99.)) RETURN	BCDGRD24
	PRINT 5, ZA, SPIN, PARITY	BCDGRD25
	IF(PARITY.EQ.99.) PARITY=-1.	BCDGRD26
	IF(SPIN.EQ.99.) SPIN=0.25*(1.-(-1.)**IA)	BCDGRD27
	PRINT 6, SPIN, PARITY	BCDGRD28
	RETURN	BCDGRD29
	END	ENERGY50
	FUNCTION XMAGIC(ZA)	XMAGIC 2
	DIMENSION XMAG(10)	XMAGIC 3
	DATA NMAG/8/, XMAG/2.,0.,20.,20.,50.,62.,126.,186./	JUL29771
	I2=ZA/100. 3 Z=I2	XMAGIC 5
	A=ZA-Z*1000.	XMAGIC 6
	AN=A-Z	XMAGIC 7
	IF(Z.LT.54.)GO TO 15	JUL29772
	IF(AN.LT.86.)GO TO 15	JUL29773
	XMAGIC=1.	XMAGIC 8
	DO 10 N=5,8	JUL29774
	C1=ABS(XMAG(N)-Z)	XMAGIC10
	C2=ABS(XMAG(N)-AN)	XMAGIC11
10	IF((C1.LT.3.5).OR.(C2.LT.3.5)) GO TO 15	XMAGIC12
	CONTINUE	XMAGIC13
	RETURN	XMAGIC14
15	XMAGIC=0.	XMAGIC15
	RETURN	XMAGIC16
	END	XMAGIC17
	SUBROUTINE LEVPREP(K1,K2)	LEVPREP2
C		LEVPREP3
C	PREPARES BINARY LEVEL DATA FILE ON K2 FROM I/P BCD FILE K1. ALSO	LEVPREP4
C	STORES ENERGY AND J=PI DATA IN LCM ARRAYS ELLC(N,IP,I) AND	LEVPREP5
C	AJLC(N,IP,I)	LEVPREP6
1	FORMAT(10,I5,3F12.6,I8)	LEVPREP7
2	FORMAT(16,F12.6,2F6.1,F12.5,I6,24X,I8)	LEVPREP8
3	FORMAT(16X,216,2F12.6,E12.5,213,12X,I8)	LEVPREP9
4	FORMAT(// * LEVEL DATA FOR IZA=15, * NOT FOUND. USE GROUND STATE	LEVPRE10
	1ONLY. *)	LEVPRE11
C		LEVPRE12
	COMMON/SPNPAR/SPIN,PARITY,KGRD	LEVPRE13
	COMMON/LCINDEX/IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,	LEVPRE14
1	ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,	LCNDEX 2
2	NIDDIM,NIRDIM	LCNDEX 3
	COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM	LCNDEX 4
1	,EG(240),SG(240),NGRAYS(60)	LEVEL1 2
	COMMON/BASIC1/N1,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	LEVEL1 3
1	ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 2
	COMMON/PREQ1/EPSIG(200.6),NLEV,NPIT,NIT	BASIC1 3
	DIMENSION ZATAB(60),DUMMY(120)	PREQ1 2
C		APR07775
C	DETERMINE REQUIRED ZA TABLE	APR07776
	K3=11	APR07777
	DO 17 N=1,NIR	APR07778
17	ZATAB(N)=ZA2(N)	APR07779
	CALL SORT1(NIR,0,ZATAB,DUMMY)	APR07710
	NTAB = 1	APR07711
		APR07712

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CSTOT(1) = ZATAB(1)
IF(NIR.EQ.1) GO TO 16
DO 18 N=2,NIR
IF(ZATAB(N).EQ.ZATAB(N-1)) GO TO 18
NTAB = NTAB + 1
CSTOT(NTAB) = ZATAB(N)
18 CONTINUE
16 DO 19 N=1,NTAB
19 ZATAB(N) = CSTOT(N)
C
C SELECT LEVEL DATA FOR REQUIRED ZAS
IF(K1.EQ.8) REWIND K1
20 READ(K1,1) ID,NL,F,A,AE,LDATE
K1EOF = IOCHECK(K1,1)
IF(K1EOF.GT.4) GO TO 29
ISET = 2
DO 21 N=1,NTAB
IZA2 = ZATAB(N)
IF(ID.EQ.IZA2) ISET = 1
21 CONTINUE
GO TO (22,23), ISET
22 WRITE(K3,1) ID,NL,F,A,AE,LDATE
23 DO 28 N=1,NL
READ(K1,2) NX,EL(N),AJ(N),AT(N),TAU,NT,IS
GO TO (24,25), ISET
24 WRITE(K3,2) NX,EL(N),AJ(N),AT(N),TAU,NT,IS
25 IF(NT.LT.1) GO TO 28
DO 27 K=1,NT
READ(K1,3) LL,NF,P,CP,AMR,L1,L2,IS
GO TO (26,27), ISET
26 WRITE(K3,3) LL,NF,P,CP,AMR,L1,L2,IS
27 CONTINUE
28 CONTINUE
IF(F.GE.0.) GO TO 28
29 K1 = K3
REWIND K2
C
C DETERMINE BINARY FILE IN ORDER OF REACTION CHAIN
REWIND K2
DO 100 IR=1,NIR
IZA2 = ZA2(IR)
REWIND K1
30 READ(K1,1) ID,NL,F,A,AE,LDATE
K1EOF = IOCHECK(K1,1)
IF(K1EOF.LE.4) GO TO 50
WRITE(6,4) IZA2
XNL(IR) = 1.0
NLL = 1
EL(1) = 0.
AT(1) = 99.
TAU = 99.
NT = 0
LDATE = 0
EDUM = ENERGY(ZA2(IR))
AJ(1) = PARITY*SPIN
IF(ZA1(IR).NE.0.) GO TO 45
WRITE(K2) IZA2,NLL,LDATE
WRITE(K2) EL(1),AJ(1),AT(1),TAU,NT
GO TO 45
50 ISET=2
IF(ID.EQ.IZA2) ISET=1
GO TO (31,32), ISET
31 IF(XNL(IR).LT.0.5) XNL(IR)=NL

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APR07713
APR07714
APR07715
APR07716
APR07717
APR07718
APR07719
APR07720
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APR07740
APR07741
APR07742
APR07743
APR07744
APR07745
APR07746
APR07747
APR07748
APR07749
APR07750
LEVPRE20
LEVPRE21
LEVPRE22
LEVPRE24
LEVPRE25
LEVPRE26
LEVPRE27
LEVPRE28
LEVPRE29
LEVPRE30
LEVPRE31
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LEVPRE38
LEVPRE39
LEVPRE40
LEVPRE41
LEVPRE42
LEVPRE43
LEVPRE44
LEVPRE45

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	NLMAX=XNL(IR)	LEVPRE46
	NLL=MIN0(NL,NLMAX)	LEVPRE47
	XNL(IR) = NLL	LEVPRE48
	IF(ZA1(IR).NE.0.) GO TO 32	LEVPRE49
	WRITE(K2) ID,NLL,LDATE	LEVPRE50
32	DO 40 N=1,NL	LEVPRE51
	READ(K1,2) NX,EL(N),AJ(N),AT(N),TAU,NT,IS	LEVPRE52
	GO TO (35,36),ISET	LEVPRE53
35	IF((ZA1(IR).NE.0.).OR.(N.GT.NLL)) GO TO 36	LEVPRE54
	WRITE(K2) EL(N),AJ(N),AT(N),TAU,NT	LEVPRE55
36	IF(NT.LT.1) GO TO 40	LEVPRE56
	DO 38 K=1,NT	LEVPRE57
	READ(K1,3) LL,NF,P,CP,AMR,L1,L2,IS	LEVPRE58
	GO TO (37,38),ISET	LEVPRE59
37	IF(N.GT.NLL) GO TO 38	LEVPRE60
	IF(ZA1(IR).EQ.0.) WRITE(K2) NF,P,CP,AMR,L1,L2	LEVPRE61
38	CONTINUE	LEVPRE62
40	CONTINUE	LEVPRE63
	GO TO (45,30),ISET	LEVPRE64
45	INDEX=IELLC+(IR-1)*NLEVDIM	LEVPRE65
	CALL ECWR(EL,INDEX,NLL,IERR)	LEVPRE66
	INDEX=IAJLC+(IR-1)*NLEVDIM	LEVPRE67
	CALL ECWR(AJ,INDEX,NLL,IERR)	LEVPRE68
	INDEX=IATLC+(IR-1)*NLEVDIM	LEVPRE69
	CALL ECWR(AT,INDEX,NLL,IERR)	LEVPRE70
	ELMAX(IR)=EL(NLL)	LEVPRE71
100	CONTINUE	LEVPRE72
	END FILE K2	LEVPRE73
	REWIND K2	LEVPRE74
	RETURN	LEVPRE75
1000	WRITE(6,4) IZA2	LEVPRE76
	STOP	LEVPRE77
	END	LEVPRE78
	SUBROUTINE TCPREP(K1,EPSILON)	JUL26779
C		TCPREP 3
1	FORMAT(42X,A10,12X,2I4,A8)	TCPREP 4
2	FORMAT(1P,6E12.5,I8)	MAY77 2
3	FORMAT(14,1X,7A10,A5)	TCPREP 6
4	FORMAT(// 1X,A10,*TRANSMISSION COEFFICIENT DATA OUT OF ORDER, CARD	TCPREP 7
	1 NO* 16,* == ABORT JOB*)	TCPREP 8
5	FORMAT(//1X,*PARTICLE IDENTIFIER *A10,* NOT RECOGNIZED IN TRANSMIS	TCPREP 9
	SION COEFFICIENT DATA == ABORT JOB*)	TCPREP10
6	FORMAT(// * TRANSMISSION COEFFICIENT DATA * / 14,1X,7A10,A5)	TCPREP11
7	FORMAT(* ID=*12,3X,*NE=*13,3X,*NL=*13,3X,*PARTICLE *A15)	TCPREP12
8	FORMAT(* ENERGY =* F7.3,* MEV*)	TCPREP13
9	FORMAT(* TRANS.COEFFS. *,1P,10E12,5)	TCPREP14
10	FORMAT(* SPLINE DATA *,1P,10E12,5)	TCPREP15
C		TCPREP16
	COMMON/LCINDEX/IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,	LCNDEX 2
1	ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGROIM,	LCNDEX 3
2	NIDDIM,NIRDIM	LCNDEX 4
	COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM	LEVEL1 2
1	,EG(240),SG(240),NGRAYS(60)	LEVEL1 3
	COMMON/TCOEF/ETC(25,6),TC(25,30),BCD(7,,XSPIN(7),NLDIM,	TCOEF 2
1	NPART,NFE(6),NO(6),NTC(6),IZA>ID(7),XMASS(7),NEEDIM,NLEIN(6,25),	TCOEF 3
2	NLE(6,200),JRAST(200,6)	TCOEF 4
	COMMON/PRNTOUT,IPRTLEV,IPRTTC,IPRTMLD,IPRTWID,IPRTSP,IPRTGC	PRNTOUT2
	DIMENSION TDUM(62),BCDTC(8)	TCPREP21
C		TCPREP22
	MAIN PARTICLE LOOP	TCPREP23
	IF(K1.EQ.10)REWIND K1	TCPREP24
	READ(K1,3)NPART,BCDTC	TCPREP25
	WRITE(6,6) NPART,BCDTC	TCPREP26

DO 100 N=1,NPART	TCPRFP27
KP=2	TCPREP28
READ(X1,1) XBCD,NE,NN,K	TCPREP29
C	TCPREP30
C IDENTIFY I/P PARTICLE	TCPREP31
DO 20 ID=1,6	TCPREP32
IF(XBCD.EQ.BCD(ID)) GO TO 22	TCPREP33
20 CONTINUE	TCPREP34
WRITE(6,5) XBCD	TCPREP35
STOP	TCPREP36
22 NEE(ID)= NE	TCPREP37
C	TCPREP38
C	TCPREP39
C READ ENERGY ARRAY	TCPREP40
DO 30 I=2,NE,6	TCPREP41
KP=KP+1	TCPREP42
IU=I+5	TCPREP43
READ(K1,2)(ETC(J, ID),J=1,IU),K	TCPREP44
201 FORMAT(20X,6E12.5,A3)	TCPREP45
30 CONTINUE	TCPREP46
C	TCPREP47
C MAIN ENERGY LOOP	TCPREP48
DO 80 I=2,NE	TCPREP49
C	TCPREP50
C READ TRANSMISSION COEFFICIENT DATA	TCPREP51
DO 35 J=1,NN,6	TCPREP52
KP=KP+1	TCPREP53
JU=J+5	TCPREP54
READ(K1,2) (TDUM(L),L=J,JU),K	TCPREP55
DO 336 L=J,JU	TCPREP56
IF(TDUM(L).LE.2.E-14) TDUM(L)=0.	TCPREP57
334 CONTINUE	TCPREP58
35 CONTINUE	TCPREP59
IF((ID.EQ.3).OR.(ID.EQ.6)) GO TO 60	TCPREP60
C	TCPREP61
C ELIMINATE J-DEPENDENCE OF SPIN 1/2 ARRAYS	TCPREP62
TC(I,1) = TDUM(1)	TCPREP63
DO 50 J=2,NN,4	TCPREP64
XL = (J+1)/2 + MOD(J/2,2) - 1	TCPREP65
JJ=J-1	TCPREP66
DO 48 JL=1,2	TCPREP67
JJ=JJ+1	TCPREP68
IF(JJ.GT.NN) GO TO 70	TCPREP69
XL=XL+1,0	TCPREP70
LP=XL+1.001	TCPREP71
IF(LP.LE.NLDIM) GO TO 40	TCPREP72
LP=LP-1	TCPREP73
GO TO 70	TCPREP74
40 IF((JJ+2).LE.NN) GO TO 42	TCPREP75
TC(I,LP) = TDUM(JJ)	TCPREP76
GO TO 48	TCPREP77
42 TC(I,LP) = ((XL+1.)*TDUM(JJ+2) + XL*TDUM(JJ))/(2.*XL+1.)	TCPREP78
48 CONTINUE	TCPREP79
50 CONTINUE	TCPREP80
GO TO 70	TCPREP81
C	TCPREP82
C RE-ORDER SPIN 0 AND SPIN 1 ARRAYS	TCPREP83
60 DO 66 L=1,NN	TCPREP84
J = 2*L-MOD(L,2)	TCPREP85
IF(J.GT.NN) GO TO 70	TCPREP86
LP=L	TCPREP87
66 TC(I,LP) = TDUM(J)	TCPREP88
70 CONTINUE	TCPREP89

80	CONTINUE	TCPREP90
	NO(ID)=LP	TCPREP91
C	SET TC ARRAY TO ZERO FOR ZERO INCIDENT ENERGY	TCPREP92
	ETC(I,ID)=0.	TCPREP93
	DO 25 L=1,LP	TCPREP94
25	TC(I,L)=0.	TCPREP95
C		TCPREP96
	FIND NUMBER OF NON-ZERO COEFFICIENTS	TCPREP97
	DO 84 I=2,NE	TCPREP98
	I = NE-I+2	TCPREP99
	DO 82 LX=1,LP	TCPRE100
	L = LP-LX+1	TCPRE101
	IF(TC(I,L)) 82,82,83	JUL26710
83	XL=L	JUL26711
	RATIO= (2.*XL+1.)*TC(I,L)/TC(I,1)	JUL26712
	IF(RATIO.GT,EPSILON) GO TO 84	JUL26713
82	CONTINUE	TCPRE103
84	NLEIN(ID,I-1) = L	TCPRE104
	NLEIN(ID,NE) = NLEIN(ID,NE-1)	TCPRE105
C		TCPRE106
C	STORE TRANSMISSION COEFFICIENT DATA IN LCM	TCPRE107
	NPTS=LP*NFEDIM	TCPRE108
	NTC(ID)= NPTS	TCPRE109
	INDEX=ITCLC*(ID-1)+NEEDIM*NLDIM	TCPRE110
	CALL ECWR(TC,INDEX,NPTS,IERR)	TCPRE111
C		TCPRE112
C	PRINT OPTION	TCPRE113
	IF(IPRITC.LT.1) GO TO 100	TCPRE114
	DO 90 I=1,NE	TCPRE116
	WRITE(6,8) ETC(I,ID)	TCPRE117
	LP = NLEIN(ID,I)	TCPRE118
	WRITE(6,9) (TC(I,L),L=J,LP)	TCPRE119
90	CONTINUE	TCPRE120
100	CONTINUE	TCPRE121
	RETURN	TCPRE122
1000	WRITE(6,4) XBCD,KP	TCPRE123
	STOP	TCPRE124
	END	TCPRE125
	SUBROUTINE SETUP	SETUP 2
C		SETUP 3
I	FORMAT(// * PARTICLE WITH IZA=15, * NOT FOUND. ABORT JOB,*)	SETUP 4
C		SETUP 5
	COMMON/LCINDEX/IPBLC,IGLC,IXEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,LCNDEX	LCNDEX 2
1	ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,LCNDEX	LCNDEX 3
2	NIDDIM,NIBDIM	LCNDEX 4
	COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)	RHO 2
1	SPNGN(200),PL(50,6),G(200,6),RHOFT(40)	RHO 3
	COMMON/TCOEF/ETC(25,6),TC(25,30),BCD(7),XSPIN(7),NLDIM,	TCOEF 2
1	INPART,NEE(6),NO(6),NTC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25),	TCOEF 3
2	NLE(6,200),JRAST(200,6)	TCOEF 4
	COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM	LEVEL1 2
1	EG(240),SG(240),NGRAVS(60)	LEVEL1 3
	COMMON/BASIC1/NI,XNIP(10),NJR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	BASIC1 2
1	ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 3
	COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
1	CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOE2(60),IBUF(6,10),	BASIC2 3
2	ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60),	BASIC2 4
3	NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,	BASIC2 5
4	JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILL(30)	BASIC2 6
5	ICAPT,PLAUF(50,10),INOPT,TKEEP	BASIC2 7
	COMMON/LEVDEM/DEF(60),XNLGC(60),ECGC(60),UCUTOFF,DEFCN,TGC(60),	LEVDEM 2
1	ENGCC(60),EMATGC(60),PAJR(60),XMR3(60),XNLLN(60),SZ(100),SN(150),	LEVDEM 3
2	PZ(100),PN(150)	LEVDEM 4

	COMMON /SPNPAR/ SPIN,PARITY,KGRD	LEVDEN 5
C		SETUP 13
C	FIND ACCUMULATED SEPARATION ENERGIES FOR THE DECAYING NUCLEI	SETUP 14
	DO 15 I=1,NI	SETUP 15
15	SAC(I)=0.	SETUP 16
	DO 20 J=1,NI	SETUP 17
	II=I	SETUP 18
	DO 18 J=1,NI	SETUP 19
	IX=II	SETUP 20
	II=CNPI(IX)	SETUP 21
	IF(II.LT.1) GO TO 20	SETUP 22
	IIP=CNPIP(IX)	SETUP 23
16	IF(II.LT.100) GO TO 17	SETUP 24
	II=II/100	SETUP 25
	IIP=IIP/100	SETUP 26
	GO TO 16	SETUP 27
17	CONTINUE	SETUP 28
	IR=LR(IIP,II)	SETUP 29
18	SAC(I) = SAC(I) + 8(IR)	SETUP 30
20	CONTINUE	SETUP 31
C		SETUP 32
C	IDENTIFY INCIDENT PARTICLE	SETUP 33
	DO 30 ID=1,7	SETUP 34
	IZA = ZAP	SETUP 35
	IF(IZA.EQ. IZAID(ID)) GO TO 32	SETUP 36
30	CONTINUE	SETUP 37
	GO TO 1000	SETUP 38
32	IDP=ID	SETUP 39
	XJP=XSPIN(IDP)	SETUP 40
	XMP=XMASS(IDP)	SETUP 41
	CSL = ABS(XJT-XJP)+1.0	SETUP 42
	CSH = XJT+XJP+0.001	SETUP 43
C		SETUP 44
C	IDENTIFY SECONDARY REACTION PARTICLES AND PHOTONS	SETUP 45
	DO 36 ID=1,7	SETUP 46
36	IDSTAT(ID)=0	SETUP 47
	DO 40 IR=1,NIR	SETUP 48
	IZA= ZA1(IR)	SETUP 49
	DO 38 ID=1,7	SETUP 50
	IF(IZA.EQ. IZAID(ID)) GO TO 39	SETUP 51
38	CONTINUE	SETUP 52
	GO TO 1000	SETUP 53
39	IDSTAY(ID)=1	SETUP 54
40	ID1(IR)=ID	SETUP 55
C		SETUP 56
C	IDENTIFY RESIDUAL NUCLEI AS TO ODD OR EVEN A	SETUP 57
C	IOE2=1 FOR ODD, IOE2=2 FOR EVEN=A RESIDUAL NUCLEUS	SETUP 58
C		SETUP 59
	DO 50 IR=1,NIR	SETUP 60
	IZA= ZA2(IR)	SETUP 61
	IA= MOD(IZA,1000)	SETUP 62
50	IOE2(IR)= (3+(-1)**IA)/2	SETUP 63
C		SETUP 64
C	IDENTIFY DECAYING COMPOUND NUCLEI AS TO ODD OR EVEN	SETUP 65
	DO 60 I=1,NI	SETUP 66
	IZA= ZACN(I)	SETUP 67
	IA= MOD(IZA,1000)	SETUP 68
60	IOECN(I)= (3+(-1)**IA)/2	SETUP 69
C		SETUP 70
C	SET UP J=PI ARRAYS	SETUP 71
	JJ=0	SETUP 72
	DO 82 J=1,NJMAX	SETUP 73
	DO 82 IPI=1,2	SETUP 74

	JJ=JJ+1	SETUP 75
82	JPI(J,IP)=JJ	SETUP 76
	DO 84 L=1,NLDIM	SETUP 77
	LL=L-1	SETUP 78
84	PILL(L)=(-1)*LL	SETUP 79
C		SETUP 80
C	INITIALIZE LEVEL DENSITIES AND GIL-CAM PARAMETERS	SETUP 81
	DO 90 IR=1,NIR	SETUP 82
	A2(IR)= A(IR)	SETUP 83
	IF(XNLGC(IR).LE.0.) XNLGC(IR)=XNL(IR)	SETUP 84
	IF(ECGC(IR).LE.0.) ECGC(IR)= ELMAX(IR)	SETUP 85
	XNLLN(IR)=ALOG(XNLGC(IR))	SETUP 86
90	XMR3(IR)= XH2(IR)**0.33333333	SETUP 87
C		SETUP 88
	RETURN	SETUP 89
1000	WRITE(6,1) IZA	SETUP 90
	STOP	SETUP 91
	END	SETUP 92
	SUBROUTINE SETUP2	SETUP2 2
C		SETUP2 3
C	SET UP INCIDENT ENERGY DEPENDENT QUANTITIES	SETUP2 4
C		SETUP2 5
	COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XH2(60),	BASIC1 2
	1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 3
	COMMON/BASIC2/TITLE(16),ELAR,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
	1 CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOE2(60),IRUF(6,10),	BASIC2 3
	2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60),	BASIC2 4
	3 NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,	BASIC2 5
	4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,XL,IDSTAT(7),SIC,CSL,SSH,PILL(30)	BASIC2 6
	5,ICAPT,PLBUF(50,10),INPOPT,TKEEP	BASIC2 7
	COMMON/LCINDEX/IPBLC,IQLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,	LCNDEX 2
	1 ISTCLC,IRHCLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIRDIM,NGRDIM,	LCNDEX 3
	2 NIDDIM,NIRDIM	LCNDEX 4
	COMMON/TCOEFF/ETC(25,6),TC(25,30),BCD(7),XSPIN(7)*NLDIM,	TCOEFF 2
	1NPART,NFE(6),NO(6),NTC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25),	TCOEFF 3
	2NLE(6,200),JRAST(200,6)	TCOEFF 4
	COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM	LEVEL1 2
	1,EG(240),SG(240),NGRAYS(60)	LEVEL1 3
C		SETUP211
C	SET UP ENERGIES AND DETERMINE INTEGRATION END POINTS	SETUP212
	ECM= (XMT/(XMT+XMP))*ELAB	SETUP213
	EO = ECM+SIC	SETUP214
	XMU = XMT*XMP/(XMT+XMP)	SETUP215
	ECON = 0.650999/(XMU*ECM*(2.*XJP+1.)*(2.*XJT+1.0))	SETUP216
75	EKMAX=0.	SETUP217
	DO 77 I=1,NI	SETUP218
	NKKM(I)=0	SETUP219
	NIP = XNIP(I)	SETUP220
	DO 77 IP=1,NIP	SETUP221
	IR=LR(IP,I)	SETUP222
	NL= XNL(IR)	SETUP223
	INDEX=IELLC+(IR-1)*NLEVDIM	SETUP224
	CALL ECRD(EL,INDEX,NL,IERR)	SETUP225
	EK = UP=SAC(I)*S(IR)	SETUP226
	EKMAX = AMAX1(EK,EKMAX)	SETUP227
	NKK(IR)= (EK-EL(NL))/DE + 0.5	SETUP228
	NKKM(I)=MAX0(NKK(IR),NKKM(I))	SETUP229
	IF(IP.EQ.1) NKKCN(I)=NKK(IR)	SETUP230
77	CONTINUE	SETUP231
	NKMAX=EKMAX/DE + 0.5	SETUP232
	IF(NKMAX.LT.NKDIM) GO TO 79	SETUP233
	XDU=NKDIM-1	SETUP234
	DE = EKMAX/XDU	SETUP235


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GO TO 73
79 NPOPMAX=NKMAX+NJDIM*2
C
C GENERATE TRANSMISSION COEFFICIENTS FOR INCIDENT CHANNEL
NE=NEE(IDP)
NPTS=NTC(IDP)
INDEX=ITCLC+(IDP-1)*NEEDIM+NLDIM
CALL ECRD(TC,INDEX,NPTS,IERR)
K = ISERCH(ECM,ETC(1,IDP),NE,AA,A5,A6)
NLP=NLEIN(IDP,K+1)
XNLP=NLP+1
DO 85 J=1,NLP
CALL INTERP(ETC(1,IDP),TC(1,J),NE,2,ECM,YOUT)
IF (YOUT.LT.0.) YOUT=0.
85 TCP(J)=YOUT
RETURN
END
SUBROUTINE SPECTRA(ACN,FSIGCN)
C
COMMON/LCINDEX/IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,
1 ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,
2 NIJDIM,NIRDIM
COMMON/RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)
1,SPNGN(200),PL(50,6),G(200,6),RHOFTR(40)
COMMON/TCOEF/ETC(25,6),YC(25,30),BCD(7),XSPIN(7),NLDIM,
1NPART,NEE(6),NO(6),NTC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25),
2NLE(6,200),JRAST(200,6)
COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM
1,EG(240),SG(240),NGRAVS(60)
COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),
1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)
COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),
1 CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOE2(60),IRUF(6,10),
2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60),
3 NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,
4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILL(30)
5,ICAPT,PLBUF(50,10),INOPT,TKEEP
COMMON/GAMMA/NMP,LGROPT,SW5(10),GML(6),GMP(6),RE1(6),LMGHOL(6),
1 TGR(200,6),WKCON,CAXEL,GAXEL,ERAXEL,EXSWS(10),WKORM
COMMON/PREFQ/LPER,SIGR,PREFI(6),CSIGI(6),NITT(6),ALPHA(6)
COMMON/SUMBLK1/KP,KD,IP,ID,KNGN,JPI2,N,DP,IK
COMMON/SUMBLK2/XJCN,PICN,JPICN,ECONJ,MP,J2,L2,TGRL,TLEV,XJ2,
1 TTOT(80)
DIMENSION SCBUF(8000), HECON(2),XJINI(2),PI(3),SCBUF2(80)
EQUIVALENCE (SCBUF,RHO)
DIMENSION IBTAG(10),IBTAG2(10)
COMMON/TOTALS/SIGTOT(10)
C
DATA PIP,PI1/1.,1./,XJINI/=0.5,=1.0/,PI/+1.0,=1.0,+1.0/
DATA DECON/1.0,3.0/
C
SPLIN (B,C,D,E) = B*A5 + C*A6 + AA*(D*A5+E*A6+D+E)
CALL SECOND(TIME)
DIME=TIME-TKEEP
WRITE(6,3) DIME,TIME
3 FORMAT(1H1, *START OF SPECTRA SUBROUTINE.*,
1* TIME FROM START OF THIS ENERGY =*F9.3,* SECONDS, TOTAL ELAPSED TIME =*F9.3,* SECONDS.*)
C
SET UP LEVFL DENSITY PARAMETERS
CALL LEVDSET(ACN,A,A2)
C
ZERO LARGE- AND SMALL-CORE ARRAYS

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SETUP236
SETUP237
SETUP238
SETUP239
SETUP240
SETUP241
SETUP242
SETUP243
SETUP244
SETUP245
SETUP246
SETUP247
SETUP248
SETUP249
SETUP250
SETUP251
SETUP252
SPECTRA2
SPECTRA3
LCNDFX 2
LCNDFX 3
LCNDFX 4
RHO 2
RHO 3
TCOEF 2
TCOEF 3
TCOEF 4
LEVEL1 2
LEVFL1 3
BASIC1 2
BASIC1 3
BASIC2 2
BASIC2 3
BASIC2 4
BASIC2 5
BASIC2 6
BASIC2 7
GAMMA 2
GAMMA 3
PREFQ 2
SUMBLK12
SUMBLK22
SUMBLK23
SPECTR14
SPECTR15
SPECTR16
SPECTR17
SPECTR18
SPECTR19
SPECTR20
SPECTR21
SPECTR22
SPECTR23
SPECTR24
SPECTR25
JUL19771
SPECTR27
SPECTR28
SPECTR29
SPECTR30
SPECTR31
SPECTR32
SPECTR33

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	CALL ECWR(SCBUF, IZEROLC, 8000, IERR)	SPECTR34
	CALL ECWR(SCBUF, IPLLC, 3000, IERR)	SPECTR35
	CALL ECRO(SPP, IZEROLC, 1400, IERR)	SPECTR36
	CALL ECRO(SPNGN, IZEROLC, NKMAX, IERR)	SPECTR37
	N8000=NPOPMAX=8000	SPECTR38
	DO 51 N=1, NIDIM	SPECTR39
	NPTS=NKDIM*NIPDIM	SPECTR40
	INDEX=ISPLC+(N-1)*NPTS	SPECTR41
	CALL ECWR(SCBUF, INDEX, NPTS, IERR)	SPECTR42
	INDEX=IGLC+(N-1)*NPTS	SPECTR43
	CALL ECWR(SCBUF, INDEX, NPTS, IERR)	SPECTR44
5	CONTINUE	SPECTR45
	DO 45 IB=1, 10	SPECTR46
	IBTAG(IB)=0	SPECTR47
45	IBTAG2(IB)=0	SPECTR48
C		SPECTR49
C	MAIN LOOP TO SET UP DECAYING NUCLEI	SPECTR50
C		SPECTR51
	SIGR=0.	SPECTR52
	CALL ECRO(SIGTOT, IZEROLC, 10, IERR)	SPECTR53
	DO 500 I=1, NI	SPECTR54
	CALL SECOND(TIME)	SPECTR55
	OTIME=TIME-TKEEP	SPECTR56
	WRITE(6, 2) I, OTIME, TIME	SPECTR57
2	FORMAT(/ * START OF I=I2, * LOOP, *,	SPECTR58
	1 * TIME FROM START OF THIS ENERGY =F9.3, * SECONDS, TOTAL ELAPSED TIME =F9.3, * SECONDS. *)	SPECTR59
	JOECN=JOECN(I)	SPECTR60
	NKCN=NKCN(I)	SPECTR61
	IF(NKCN.LT.1) GO TO 60	SPECTR62
	IF((ICAPT.EQ.0).AND.(I.EQ.1)) NKCN=1	SPECTR63
60	IBCN=IBUF(1, I)	SPECTR64
	IF (IBCN.GT.NIBDIM) IBCN=IBCN-NIBDIM	SPECTR65
	NIP=XNIP(I)	SPECTR66
	NJDIM2=2*NJDIM	SPECTR67
	NJMAX2=2*NJMAX	SPECTR68
C		SPECTR69
C	ZERO ARRAYS AND CHECK BUFFERING	SPECTR70
	NPTS=NKDIM*NIP	SPECTR71
	INDEX=IZEROLC	SPECTR72
	CALL ECRO(SP, INDEX, NPTS, IERR)	SPECTR73
	CALL ECRO(G, INDEX, NPTS, IERR)	SPECTR74
	NPTS=NLEVDIM*NIPDIM	SPECTR75
	CALL ECRO(PL, INDEX, NPTS, IERR)	SPECTR76
	CALL ECRO(SCBUF, INDEX, 8000, IERR)	SPECTR77
	DO 64 IP=1, NIP	SPECTR78
	IB=IBUF(IP, I)	SPECTR79
	IF (IB.LT.1) GO TO 64	SPECTR80
	IF (IBTAG(IB).GT.0) GO TO 64	SPECTR81
	IBTAG(IB)=1	SPECTR82
	IF (IB.LE.NIBDIM) GO TO 62	SPECTR83
	IB=IB-NIBDIM	SPECTR84
	IF (IBTAG2(IB).GT.0) GO TO 62	SPECTR85
	WRITE(6, 1) I, IP, IB	SPECTR86
1	FORMAT(/ * ---THE REACTION I=I2, *, IP=I2, * IS ATTEMPTING TO REUSE BUFFER NUMBER IB=I2, * BEFORE THAT BUFFER HAS BEEN EMPTIED. */	SPECTR87
	2 * ---ABORT JOB. *)	SPECTR88
	STOP	SPECTR89
62	CONTINUE	SPECTR90
	INDEX=ISPLC+(IB-1)*NJDIM2+NKDIM	SPECTR91
	CALL ECWR(SCBUF, INDEX, 8000, IERR)	SPECTR92
	IF (N8000.LT.1) GO TO 64	SPECTR93
	INDEX=INDEX+8000	SPECTR94
		SPECTR95
		SPECTR96

	CALL ECHN(SCBUF,INDEX,N8000,IERR)	SPECT1097
64	CONTINUE	SPECT1098
	IBTAG2(IBCNI)=1	SPECT1099
66	IF (NKCNI,LT,1) GO TO 500	SPECT1100
C		SPECT1101
C	COMPUTE TRANSMISSION COEFFICIENTS AND LEVEL DENSITIES ON	SPECT1102
C	INTEGRATION ENERGY MESH AND LOAD INTO LCM	SPECT1103
	CALL LCMLOAD(I)	SPECT1104
C		SPECT1105
C	SET UP GAMMA-RAY CASCADE CALCULATION, DETERMINE WEISSKOPF OR AXEL	SPECT1106
C	PARAMETERS AND COMPUTE GAMMA RAY TRANSMISSION COEFFICIENTS	SPECT1107
	CALL GAMSET(I)	SPECT1108
C		SPECT1109
C	MAIN LOOP OVER INITIAL ENERGY OF DECAYING COMPOUND NUCLEUS	SPECT1110
C		SPECT1111
	UCN= UP=SAC(I)*DE	SPECT1112
	DO 400 K=1,NKCNI	SPECT1113
	UCN=UCN*DE	SPECT1114
	JMAXCN=JRAST(K,1)	SPECT1115
	CALL ECRD(TTOT,IZEROIC,NJMAX2,IERR)	SPECT1116
	IK=I+K	SPECT1117
C		SPECT1118
C	SET UP TRANSMISSION COEFFICIENT TO WIDTH CONVERSION FACTORS	SPECT1119
	INDEX=IRHOLC+(K-1)*NJDIM	SPECT1120
	CALL ECRD(RHOFTI,INDEX,NJMAX,IERR)	SPECT1121
	DO 101 JCN=1,JMAXCN	SPECT1122
101	RHOFTI(JCN)= 1./(RHOFTI(JCN)*6.29316531)	SPECT1123
C		SPECT1124
C	INITIALIZE POPULATION OF ALL STATES	SPECT1125
	INDEX=IPBLC+(K-1)*NJDIM*2+(IRCN=1)*NJDIM*2*NKDIM	SPECT1126
	CALL ECRD(PP,INDEX,NJDIM2,IERR)	SPECT1127
C		SPECT1128
C	WIDTH SUMMING LOOP	SPECT1129
	DO 300 M=1,2	SPECT1130
C		SPECT1131
C	LOOP OVER REACTION TYPES FOR THE DECAYS	SPECT1132
	DO 300 IP=1,NIP	SPECT1133
C		SPECT1134
	IR=LR(IP,1)	SPECT1135
	ID=ID1(IR)	SPECT1136
	KNGN=2	SPECT1137
	IF((K,NE,1).AND.(ID,EQ,1).AND.(I,EQ,1).AND.(ID1(1),EQ,7)) KNGN=1	SPECT1138
	JOE2= JOE2(IR)	SPECT1139
	XJ1=XSPIN(ID)	SPECT1140
C		SPECT1141
C	TRANSFER LEVEL DENSITIES, TRANSMISSION COEFFICIENTS, LEVEL	SPECT1142
C	ENERGIES, AND LEVEL SPINS TO SCH.	SPECT1143
	IF(ID,EQ,7) GO TO 102	SPECT1144
	NPTS= NTC(ID)	SPECT1145
	INDEX=ITCLC+(ID-1)*NLDIM*NJEDIM	SPECT1146
	CALL ECRD(TC,INDEX,NPTS,IERR)	SPECT1147
	IF(NKK(IR).LT,1) GO TO 102	SPECT1148
	NPTS=NTC2(IP)	SPECT1149
	INDEX=ITLC+NKDIM*NLDIM*(IP-1)	SPECT1150
	CALL ECRD(T,INDEX,NPTS,IERR)	SPECT1151
102	NK2= NKK(IR)	SPECT1152
	IF(NK2.LT,1) GO TO 103	SPECT1153
	NPTS= NRHO(IP)	SPECT1154
	INDEX=IRHOLC+NKDIM*NJDIM*(IP-1)	SPECT1155
	CALL ECRD(RHO,INDEX,NPTS,IERR)	SPECT1156
103	NLEV2=XNL(IR)	SPECT1157
	INDEX=IFLLC+(IR-1)*NLEVDIM	SPECT1158
	CALL ECRD(EL,INDEX,NLEV2,IERR)	SPECT1159

	INDEX=IAJLC+(IR-1)*NLEVDIM	SPECT160
	CALL ECRD(AJ,INDEX,NLEV2,IERR)	SPECT161
C		SPECT162
C	MAIN CONTINUUM-TO-CONTINUUM COMPUTATION SECTION -----	SPECT163
C		SPECT164
G	RESIDUAL NUCLEUS ENERGY LOC#	SPECT165
	KLOW=K+1	SPECT166
	IF(KLOW.GT.NK2) GO TO 200	SPECT167
	KD=0	SPECT168
	DO 195 KP=KLOW,NK2	SPECT169
	KD=KD+1	SPECT170
	XNLE = NLE(IP,KD)+1	SPECT171
	JMAX2=JRAST(KP,IP)	SPECT172
	XJMAX2=JMAX2	SPECT173
	XJMAX2=XJMAX2-0.25*(OECON(JOE2)+1.)*0.01	SPECT174
	XJCN= XJINI(JOECN)	SPECT175
	INCHKEY=I+K+M+IP+KP	SPECT176
C		SPECT177
C	ZERO INITIAL POPULATIONS IN RESIDUAL NUCLEI	SPECT178
	JMAX22=2*JMAX2	SPECT179
	IF (M.EQ.2) CALL ECRD(P,IZEROLC,JMAX22,IERR)	SPECT180
C		SPECT181
C	LOOP OVER DECAYING COMPOUND NUCLEUS SPIN,PARITY	SPECT182
	DO 180 JCN=1,JMAXCN	SPECT183
	XJCN=XJCN+1.0	SPECT184
	ECONJ= ECON*(2.*XJCN+1.0)*F9IGCN	SPECT185
	DO 180 IPICN=1,2	SPECT186
	PICN= PI(IPICN)	SPECT187
	PIPI = PI1*PICN	SPECT188
	JPICN=JPI(JCN,IPICN)	SPECT189
C		SPECT190
C	SET UP INITIAL POPULATIONS FOR LD=0 CASE	SPECT191
	IF(INCHKEY.GT.6) GO TO 117	SPECT192
	CALL INCHSUM(5)	SPECT193
	PP(JPICN)=DP	SPECT194
	SIGR=SIGR+DP	SPECT195
117	IF (PP(JPICN).LT.1.E-300) GO TO 180	SPECT196
	IF (ID.NE.7) GO TO 140	SPECT197
C		SPECT198
C	GAMMA RAY TRANSITION SECTION -- CONTINUUM TO CONTINUUM	SPECT199
	DO 130 MP=1,NMP	SPECT200
	LG= GML(MP)	SPECT201
	PIL=PILLL(LG+1)	SPECT202
	XJ2= ABS(XJCN-GML(MP))-1.0	SPECT203
	XJ2H=XJCN+GML(MP)+0.001	SPECT204
	XJ2H=AMIN1(XJ2H,XJMAX2)	SPECT205
	DO 128 JJ2=1,1000	SPECT206
	XJ2=XJ2+1.0	SPECT207
	PI2= PICN*GMP(MP)*PIL	SPECT208
	J2=XJ2+1.01	SPECT209
	IF(XJ2.GT.XJ2H) GO TO 130	SPECT210
	PI2 = 1.501-PI2/2.	SPECT211
	JPI2 = JPI(J2,PI2)	SPECT212
C		SPECT213
C	CHECK FOR 0 TO 0 TRANSITIONS	SPECT214
	IF(XJ2+XJCN.LT.0.1) GO TO 120	SPECT215
	GO TO (112,120) M	SPECT216
C		SPECT217
C	ADD CONTINUUM GAMMA WIDTH TO TOTAL WIDTH SUM	SPECT218
112	DT= TGR(KD,MP)*RHO(J2,KP)*DE	SPECT219
	TTOT(JPICN)=TTOT(JPICN)+DT	SPECT220
	G(K,IP)=G(K,IP)+DT*RHOFTG(JCN)	SPECT221
	GO TO 120	SPECT222

C		SPECT223
C	COMPUTE CONTINUUM GAMMA POPULATION INCREMENTS FOR LOOPS OTHER	SPECT224
C	THAN THE FIRST	SPECT225
120	DP = PP(JPICN)*TGR(KD,MP)*RHO(J2,KP)*DE/TTOT(JPICN)	SPECT226
126	CALL SUMER(1,DE)	SPECT227
128	CONTINUE	SPECT228
130	CONTINUE	SPECT229
	GO TO 180	SPECT230
C		SPECT231
C	PARTICLE TRANSITION SECTION == CONTINUUM TO CONTINUUM	SPECT232
140	XJ2= XJINI(JOE2)	SPECT233
	DO 170 J2=1,JMAX2	SPECT234
	XJ2=XJ2+1.0	SPECT235
	S2= ABS(XJ2-XJ1)+1.0	SPECT236
	S2H= XJ2+XJ1+0.001	SPECT237
	DO 168 IS2=1,1000	SPECT238
	S2= S2+1.0	SPECT239
	IF(S2.GT.S2H) GO TO 170	SPECT240
	L2L=ABS(XJCN+S2)+1.01	SPECT241
	L2H=XJCN+S2+1.01	SPECT242
	L2H=MIN0(L2H,NLE(IP,KD))	SPECT243
	IF(L2L.GT.L2H) GO TO 168	SPECT244
	DO 166 L2=L2L,L2H	SPECT245
	PI2=PIPI*P1LL(L2)	SPECT246
	IP12= 1.501-PI2/2.	SPECT247
	JP12= JPI(J2,IP12)	SPECT248
	GO TO (142,150) M	SPECT249
C		SPECT250
C	ADD CONTINUUM PARTICLE WIDTH TO TOTAL WIDTH SUM	SPECT251
142	DT= T(L2,KD)*RHO(J2,KP)*DE	SPECT252
	TTOT(JPICN)=TTOT(JPICN)+DT	SPECT253
	G(K,IP)=G(K,IP)+DT*RHOFT(R(JCN)	SPECT254
	GO TO 166	SPECT255
C		SPECT256
C	COMPUTE CONTINUUM PARTICLE POPULATION INCREMENTS FOR LOOPS OTHER	SPECT257
C	THAN THE FIRST	SPECT258
150	CONTINUE	MAR77 1
	IF(TTOT(JPICN),LE,0.)GO TO 166	MAR77 2
	DP=PP(JPICN)*T(L2,KD)*RHO(J2,KP)*DE/TTOT(JPICN)	MAR77 3
160	CALL SUMER(1,DE)	SPECT260
166	CONTINUE	SPECT261
168	CONTINUE	SPECT262
170	CONTINUE	SPECT263
180	CONTINUE	SPECT264
C	-----	SPECT265
C		SPECT266
C	TRANSFER ACCUMULATED POPULATION TO LCM BUFFER	SPECT267
	IF((M.EQ.1).OR.(IBUF(IP,1).EQ.0))GO TO 196	SPECT268
	IB=IBUF(IP,1)	SPECT269
	IF(IB.GT.NIBDIM)IB=IB-NIBDIM	SPECT270
	INDEX=IPBLC+(KP-1)*2*NJDIM+(IB-1)*2*NJDIM+NKDIM	SPECT271
	CALL ECRD(SCBUF2(1),INDEX,JMAX22,IERR)	SPECT272
	DO 190 J=1,JMAX22	SPECT273
190	SCBUF2(J) = SCBUF2(J) + P(J)	SPECT274
	CALL ECRD(SCBUF2(1),INDEX,JMAX22,IERR)	SPECT275
196	CONTINUE	SPECT276
198	CONTINUE	SPECT277
200	U2MAX= UCN=S(IR)	SPECT278
C		SPECT279
C	MAIN CONTINUUM-TO-LEVEL COMPUTATION SECTION -----	SPECT280
C		SPECT281
C	LOOP OVER DISCRETE STATES OF THE RESIDUAL NUCLEI	SPECT282
	DO 280 N=1,NLEV2	SPECT283

	XJ2=ABS(AJ(N))	SPECT284
	P12= SIGN(1,0,AJ(N))	SPECT285
	EC2 = U2MAX=EL(N)	SPECT286
	IF(EC2.LE,0.0) GO TO 288	SPECT287
	KD = EC2/DE + 0.5	SPECT288
	IF(KD.LT.1) KD=1	SPECT289
C		SPECT290
C	GAMMA RAY SECTION == CONTINUUM TO LEVELS	SPECT291
	IF(ID.NF.7) GO TO 240	SPECT292
	DO 230 MP=1,NMP	SPECT293
	LG = GML(MP)	SPECT294
	PIL=PILL(LG+1)	SPECT295
	PICN = PIL*GMP(MP)*P12	SPECT296
	IPICN = 1.501-PICN/2.	SPECT297
	XJCN = ABS(XJ2-GML(MP))-1.0	SPECT298
	XJCNH= XJ2+GML(MP)+0.001	SPECT299
	DO 228 JCN=1,1000	SPECT300
	XJCN = XJCN+1.0	SPECT301
	JCN=XJCN+1.01	SPECT302
	IF((JCN.GT.JMAXCN).OR.(XJCN.GT.XJCNH)) GO TO 230	SPECT303
	ECONJ=ECON*(2.*XJCN+1.0)*FSIGCN	SPECT304
	JPICN = JPI(JCN,IPICN)	SPECT305
	IF(XJCN+XJ2.LT.0.1) GO TO 228	SPECT306
	GO TO (204,206),LGROPT	SPECT307
204	TGRL=WKCON*WKNNORM*RE1(MP)*EC2**((2*LG+1)	SPECT308
	GO TO 210	SPECT309
206	TGRL = 1.634928E+3*CAXEL*RE1(MP)*GAXEL*EC2**4/((ERAXEL**2	SPECT310
1	=EC2**2)**2 + (EC2*GAXEL)**2)	SPECT311
	TGRL=TGRL*WKCON	SPECT312
210	IF (M.EQ.2) GO TO 220	SPECT313
C		SPECT314
C	ADD GAMMA WIDTH TO TOTAL WIDTH SUM	SPECT315
	DT=TGRL	SPECT316
	TTOT(JPICN)=TTOT(JPICN)+DT	SPECT317
	G(K,IP)=G(K,IP)+DT*RHOFFR(JCN)	SPECT318
	GO TO 228	SPECT319
C		SPECT320
C	COMPUTE LEVEL POPULATION INCREMENT FROM CONTINUUM=TO-LEVEL TRANSITIONS IN OTHER THAN THE FIRST LOOP	SPECT321
C		SPECT322
220	IF(TTOT(JPICN).EQ.0.) GO TO 228	SPECT323
	DP = PP(JPICN)*TGRL/TTOT(JPICN)	SPECT324
226	CALL SUMER(2,DE)	SPECT325
228	CONTINUE	SPECT326
230	CONTINUE	SPECT327
	GO TO 280	SPECT328
C		SPECT329
C	PARTICLE TRANSITION SECTION == CONTINUUM TO LEVEL	SPECT330
240	XJCN= XJINI(JOECN)	SPECT331
	KE = ISERCH(EC2,ETC(1,ID),NEE(ID),AA,A5,A6)	SPECT332
	XNLE = NLEIN(ID,KE+1)-1	SPECT333
	DO 270 JCN=1,JMAXCN	SPECT334
	XJCN= XJCN+1.0	SPECT335
	ECONJ=ECON*(2.*XJCN+1.0)*FSIGCN	SPECT336
	S2= ABS(XJ2-XJ1)-1.0	SPECT337
	S2H= XJ1+XJ2+0.001	SPECT338
	DO 268 IS=1,1000	SPECT339
	S2=S2+1.0	SPECT340
	IF(S2.GT.S2H)GO TO 270	SPECT341
	L2L=ABS(XJCN-S2)+1.01	SPECT342
	L2H=XJCN+S2+1.01	SPECT343
	L2H=MIN0(L2H,NLEIN(ID,KE+1))	SPECT344
	IF(L2L.GT.L2H) GO TO 268	SPECT345
	DO 266 L2=L2L,L2H	SPECT346

PICN=PI1*PI2*PI3LL(L2)	SPECT347
IPICN = 1.501-PICN/2.	SPECT348
JPICN = JPT(JCN,IPICN)	SPECT349
CALL INTERP(ETC(1,10),TC(1,L2),NEE(10),2,EC2,TLEV)	SPECT350
IF(TLEV,LT,0.)TLEV=0.	SPECT351
GO TO (242,250) M	SPECT352
C	SPECT353
C ADD PARTICLE WIDTH TO TOTAL WIDTH SUM	SPECT354
242 DT= TLEV	SPECT355
TTOT(JPICN)=TTOT(JPICN)+DT	SPECT356
G(K,IP)=G(K,IP)+DT*RHOFT(R(JCN)	SPECT357
GO TO 266	SPECT358
C	SPECT359
C COMPUTE POPULATION INCREMENTS FOR PARTICLE-LEVEL TRANSITIONS AFTER	SPECT360
C THE FIRST LOOP	SPECT361
250 IF(TTOT(JPICN).EQ,0.) GO TO 266	SPECT362
DP = PP(JPICN)*TLEV/TTOT(JPICN)	SPECT363
260 CALL SUMFR(2,DE)	SPECT364
266 CONTINUE	SPECT365
268 CONTINUE	SPECT366
270 CONTINUE	SPECT367
280 CONTINUE	SPECT368
C -----	SPECT369
285 CONTINUE	SPECT370
C	SPECT371
C CLOSE M AND IP LOOPS.	SPECT372
300 CONTINUE	SPECT373
C	SPECT374
C CLOSE K LOOP. TRANSFER SP AND PL TO LCM.	SPECT375
400 CONTINUE	SPECT376
NPTS= NKDIM*NIP	SPECT377
IF(I.EQ,1.AND,LPEQ.EQ,1)CALL PRECMP	SPECT378
INDEX=ISPLC+NKDIM*NIPDIM*(I-1)	SPECT379
CALL ECWR(SP,INDEX,NPTS,IERR)	SPECT380
INDEX=IGLC+(I-1)*NKDIM*NIPDIM	SPECT381
CALL ECWR(G,INDEX,NPTS,IERR)	SPECT382
NPTS=NIP*NLEVDIM	SPECT383
INDEX=IPLLC+(I-1)*NLEVDIM*NIPDIM	SPECT384
CALL ECWR(PL,INDEX,NPTS,IERR)	SPECT385
C	SPECT386
C CLOSE I LOOP	SPECT387
500 CONTINUE	SPECT388
CALL SECOND(TIME)	SPECT389
DTIME=TIME-TKEEP	SPECT390
WRITE(6,4) DTIME,TIME	SPECT391
4 FORMAT(/* END OF I LOOP IN SUBROUTINE SPECTRA.*/	SPECT392
1* TIME FROM START OF THIS ENERGY **F9.3,* SECONDS. TOTAL ELAPSED	SPECT393
2TIME **F9.3,* SECONDS.*)	SPECT394
C	SPECT395
C COMPUTE DISCRETE GAMMA-RAY CROSS SECTIONS AND ADD TO SPECTRA.	SPECT396
CALL GRLINES	SPECT397
C	SPECT398
RETURN	SPECT399
END	SPECT400
SUBROUTINE LEVDSET(ACN,A,A2)	LEVDSET2
C	LEVDSET3
COMMON/LEVDEH/DEP(60),XNLGC(60),ECGC(60),UCUTOFF,DEFCN,TGC(60),	LEVDEH 2
1 EQGC(60),FMATGC(60),PAIR(60),XMR3(60),XNLLN(60),SZ(100),SN(150),	LEVDEH 3
2 PZ(100),PN(150)	LEVDEH 4
COMMON /SPNPAR/ SPIN,PARITY,KGRD	LEVDEH 5
COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	BASIC1 2
1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVIO(8),EAV(60)	BASIC1 3
COMMON/LCINDEX/IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITELC,	LCINDEX 2

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1 1STCLC,1THOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NINDIM,NGRDIM,LCNDX 3
2 NIDDIM,NIPDIM, LEVDSE 4
DIMENSION DEFCON(2),A(1),A2(1) LEVDSE 7
DATA TABLES OF COOK ET. AL. AAEC/TM392 LEVDSE 10
DATA PZ/11*0.,.246,0.,.209,0.,.162,0.,.162,0.,.183,0.,.173, LEVDSE 11
1 0.,.135,0.,.154,0.,.128,0.,.26,0.88,0.19,1.35,-.03,1.52,-.09,1.17, LEVDSE 12
2 .04,1.24,0.29,1.09,.26,1.17,.23,1.15,-.08,1.35,0.34,1.05,.28,1.27 LEVDSE 13
3 0.,.105,0.,.11,.09,1.2,.2,1.4,.93,1.,-.2,1.19,.09,.97,.3,.92,.11, LEVDSE 14
4 .68,.05,.68,-.22,.79,.09,.69,.01,.72,0.,.4,16,.73,0.,.46,.17, LEVDSE 15
5 .89,0.,.79,0.,.89,0.,.81,-.06,.69,-.2,.71,-.12,.72,0.,.77,2*0./ LEVDSE 16
DATA PN/11*0.,.267,0.,.18,0.,.167,0.,.186,0.,.204,0.,.164,0.,.144, LEVDSE 17
1 0.,.154,0.,.13,0.,.127,0.,.129,.08,1.41,-.08,1.5,-.05,2.24,-.47, LEVDSE 18
2 1.43,-.15,1.44,.05,1.56,.25,1.57,.16,1.46,0.,.93,.01,.62,-.5, LEVDSE 19
3 1.42,.13,1.52,-.65,.8,-.08,1.29,-.47,1.25,-.44,.97,.08,1.65,-.11, LEVDSE 20
4 1.26,-.46,1.06,0.22,1.55,-.07,1.37,0.,.1,1.2,-.27,.92,-.35,1.19,0., LEVDSE 21
5 1.05,-.25,1.63,-.21,.9,-.21,.74,-.38,.72,-.34,.92,-.26,.94,.01, LEVDSE 22
6 .65,-.36,.83,.11,.67,.05,1.,.51,1.04,.33,.68,-.27,.81,.09,.78, LEVDSE 23
7 .17,.06,.14,1.1,-.22,.84,-.47,.48,.02,.88,.24,.52,.27,.41,-.05/ LEVDSE 24
DATA (PN(IL),IL=126,150)/ LEVDSE 25
X .38,.15,.67,0.,.61,0.,.78,0.,.67,0.,.67,0.,.79, LEVDSE 26
1 0.,.66,0.4,.64,-.06,.45,.03,.26,-.22,.39,0.0,.39/ LEVDSE 27
DATA SZ/10*0.,-.2,91,-.5,72,-7.8,-8.97,-9.7,-10.1,-10.7,-11.38 LEVDSE 28
1 -12.07,-12.55,-13.24,-13.93,-14.71,-15.53,-16.37,-17.36,-18.6, LEVDSE 29
2 -18.7,-18.01,-17.87,-17.08,-16.6,-16.75,-16.5,-16.35,-16.22, LEVDSE 30
3 -16.41,-16.89,-16.43,-16.68,-16.73,-17.45,-17.29,-17.44,-17.82, LEVDSE 31
4 -18.62,-18.27,-19.39,-19.91,-19.14,-18.26,-17.4,-16.42,-15.77, LEVDSE 32
5 -14.37,-13.91,-13.1,-13.11,-11.43,-10.89,-10.75,-10.62,-10.41, LEVDSE 33
6 -10.21,-9.85,-9.47,-9.03,-8.61,-8.13,-7.46,-7.48,-7.2,-7.13,-7.06 LEVDSE 34
7 -6.78,-6.64,-6.64,-7.69,-7.89,-8.41,-8.49,-7.88,-6.3,-5.47,-4.78 LEVDSE 35
8 -4.37,-4.17,-4.13,-4.32,-4.55,-5.04,-5.28,-6.06,-6.28,-6.87, LEVDSE 36
9 -7.20,-7.74,2*0./ LEVDSE 37
DATA SN/10*0.,.6,8,7.53,7.55,7.21,7.44,8.07,8.94,9.81,10.6,11.39, LEVDSE 38
1 12.54,13.68,14.34,14.19,13.83,13.5,13.12,13.12,13.26,14.13, LEVDSE 39
2 14.82,15.52,16.38,17.16,17.55,18.03,17.59,19.03,18.71,18.8,18.99, LEVDSE 40
3 18.46,18.25,17.76,17.38,16.72,15.62,14.38,12.88,13.23,13.81,14.9, LEVDSE 41
4 14.86,15.76,16.2,17.62,17.73,18.16,18.67,19.69,19.51,20.17,19.48, LEVDSE 42
5 19.98,19.83,20.2,19.72,19.87,19.24,18.44,17.61,17.1,16.16,15.9, LEVDSE 43
6 15.33,14.76,13.54,12.63,10.65,10.,.1,8.89,10.29,9.79,11.39,11.72, LEVDSE 44
7 12.43,12.96,13.43,13.37,12.96,12.11,11.92,11.,.10.8,10.42,10.39, LEVDSE 45
8 9.69,9.27,8.93,8.57,8.02,7.59,7.33,7.23,7.05,7.42,6.75,6.6,6.38/ LEVDSE 46
DATA (SN(IL),IL=111,150)/ LEVDSE 47
X 6.36,6.49,6.25,5.85,5.48,4.53,4.3,3.39,2.35,.66,.81, LEVDSE 48
1 0.46,-.96,-1.69,-2.53,-3.16,-1.87,-.41,.71,1.66,2.62,3.22,3.76, LEVDSE 49
2 4.1,4.46,4.83,5.09,5.18,5.17,5.15,5.01,4.97,5.09,5.03,4.93,5.28, LEVDSE 50
3 5.49,5.50,5.37,5.30/ LEVDSE 51
DATA DEFCON/0.142,0.120/ LEVDSE 52
LEVDSE 53
COMPUTE EACH LEVEL DENSITY RELATIVE TO ACN USING GILBERT-CAMERON LEVDSE 54
FORMULAS FOR LEVEL DENSITY LEVDSE 55
IDEFCN= DEFCON*1.01 LEVDSE 57
IZACN= ZACN(1) LEVDSE 58
IACN=MOD(IZACN,1000) LEVDSE 59
IZCN= IZACN/1000 LEVDSE 60
INCN= IACN-IZCN LEVDSE 61
XACN= IACN LEVDSE 62
ACNGC= XACN*(0.00917*(32*(IZCN)+SN(INCN)) + DEFCON(IDEFCN)) LEVDSE 63
IF(ACN.EQ.0.) ACN=ACNGC LEVDSE 64
A2(1)=ACN LEVDSE 65
DO 60 IR=1,NIR LEVDSE 66
IDEF = DEF(IR)*1.01 LEVDSE 67

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      IZA = ZA2(IR)
      IA = MOD(IZA,1000)
      IZ = IZA/1000
      IN = IA-IZ
      XA = IA
      IF((A(IR).GT.0.).OR.(IR.EQ.1)) GO TO 50
      AGC = XA*(0.0091*(SZ(IZ)+SN(IN)) + DEFCON(IDEF))
      DAGC = AGC*ACN50
      A2(IR) = ACN*DAGC
50    PAIR(IR) = PZ(IZ)+PN(IN)
60    CALL GILCAM(A2(IR),IR)
      CONTINUE
      RETURN
      END
      SUBROUTINE GILCAM (A,LR)
C
      COMMON/LEVDEN/DEF(60),XNLGC(60),ECGC(60),UCUTOFF,DEFCON,TGC(60),
1    EMGC(60),EMATGC(60),PAIR(60),XMR3(60),XNLLN(60),SZ(100),SN(150),
2    PZ(100),PN(150)
      COMMON /SPNPAR/ SPIN,PARITY,KGRD
      DIMENSION DE(4)
C
      DATA NDE,DE/4,1.,0.1,0.01,0.001/
      EC=ECGC(LR)
      CONST = 5.0571*XMR3(LR)
      E = 0.1+PAIR(LR)+2.25/A
      DO 50 I=1,NDE
      DO 40 J=1,500
      U = E-PAIR(LR)
      T = 1./((SQRT(A/U))-1.5/U)
      E01 = EC-T*XNLLN(LR)
      E02 = E+T*(ALOG(CONST*SQRT(A*U**3)/T)-2.*SQRT(A*U))
      DEL2 = E01-E02
      IF(I*J.EQ.1) SIGN0 = SIGN(1.,DEL2)
      SIGN2 = SIGN(1.,DEL2)
      IF(SIGN2.NE.SIGN0) GO TO 45
      DEL1 = DEL2
      E = E + DE(I)
40    CONTINUE
45    E = E-DE(I)
50    CONTINUE
      DELA=ABS(DEL1-DEL2)
      IF(DELA.GT.1.0E-300) GO TO 100
      E=0.1+PAIR(LR)+2.25/A
      EMATCH=E
      U=E-PAIR(LR)
      T=1./((SQRT(A/U))-1.5/U)
      PRINT 1,LR
1    FORMAT(/* ++++ GILCAM SUBROUTINE UNABLE TO MATCH DISCRETE LEVELS WJUL19773
11TH LEVEL DENSITY FUNCTION FOR RESIDUAL NUCLEUS IN REACTION IR **,JUL19774
2 I3,* +++++/)
      GO TO 101
100  EMATCH = E + DE(NDE)*(DEL1/(DEL1-DEL2))
      U = EMATCH - PAIR(LR)
      T = 1./((SQRT(A/U))-1.5/U)
      E0 = EC - T*XNLLN(LR)
      EMATGC(LR)=EMATCH
      TGC(LR)=T  S  F0GC(LR)=E0
      RETURN
      END
      SUBROUTINE LCMLOAD(I)
C
C  COMPUTE TRANSMISSION COEFFICIENTS AND LEVEL DENSITIES ON

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      LEVDSE66
      LEVDSE69
      LEVDSE70
      LEVDSE71
      LEVDSE72
      LEVDSE73
      LEVDSE74
      LEVDSE75
      LEVDSE76
      LEVDSE77
      LEVDSE78
      LEVDSE79
      LEVDSE80
      LEVDSE81
      GILCAM 2
      GILCAM 3
      LEVDEN 2
      LEVDEN 3
      LEVDEN 4
      LEVDEN 5
      GILCAM 5
      GILCAM 6
      GILCAM 7
      GILCAM 8
      GILCAM 9
      GILCAM10
      GILCAM11
      GILCAM12
      GILCAM13
      GILCAM14
      GILCAM15
      GILCAM16
      GILCAM17
      GILCAM18
      GILCAM19
      GILCAM20
      GILCAM21
      GILCAM22
      GILCAM23
      GILCAM24
      GILCAM25
      GILCAM26
      GILCAM27
      GILCAM28
      GILCAM29
      GILCAM30
      GILCAM31
      JUL19772
      JUL19773
      JUL19774
      JUL19775
      GILCAM35
      GILCAM36
      GILCAM37
      GILCAM38
      GILCAM39
      GILCAM40
      GILCAM41
      GILCAM42
      GILCAM43
      LCMLOAD2
      LCMLOAD3
      LCMLOAD4

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C      INTEGRATION ENERGY MESH AND LOAD INTO LCM                                LCMLOAD5
C                                                                                   LCMLOAD6
1  FORMAT(// * TRANSMISSION COEFFICIENTS ON SUBSET OF INTEGRATION ENERLCMLOAD7
   1GY GRID*)                                LCMLOAD8
2  FORMAT(// * ID=*I2,3X,*PARTICLE =*A10,3X,*I=*I2,3X,*IP=*I2,3X,    LCMLOAD9
   1 *IP=*I3,3X,*NK=*I4,3X,*NL=*I3)                                LCMLOA10
3  FORMAT(// * ENERGY =* F7.3,* MEV*,5X,*JMAX INDEX =*I3)          LCMLOA11
4  FORMAT(1P,10E12.5)                                LCMLOA12
5  FORMAT(// * LEVEL DENSITIES ON SUBSET OF INTEGRATION ENERGY GRID*) LCMLOA13
6  FORMAT(// * ID=*I2,3X,*PARTICLE =*A10,3X,*I=*I2,3X,*IP=*I2,3X,    LCMLOA14
   1 *IR=*I3,3X,*NK=*I4,3X,*NJMAX=*I3)                                LCMLOA15
7  FORMAT(// * ENERGY =*F7.3,* MEV*,5X,*LMAX INDEX =*I3)            LCMLOA16
C                                                                                   LCMLOA17
   COMMON/LCINDEX/ IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IFGLC,ISGLC,ITCLC,    LCNDex 2
   1 ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,    LCNDex 3
   2 NIDDIM,NIRDIM                                LCNDex 4
   COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)    RHO 2
   1,SPNGN(200),PL(50,6),G(200,6),RHOFT(40)                                RHO 3
   COMMON/TCOFF/ETC(25,6),TC(25,30),BCD(7),XSPIN(7),NLDIM,            TCOEF 2
   1NPART,NEE(6),NO(6),NTC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25),    TCOEF 3
   2NLE(6,200),JRAST(200,6)                                TCOEF 4
   COMMON/LEVFL1/FL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM        LEVEL1 2
   1,EG(200),SG(200),NGRAYS(60)                                LEVFL1 3
   COMMON/BASIC1/NY,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),    BASIC1 2
   1 ZACN(10),CSGR(60),CSTOT(60),CSLFV(60),CSID(8),EAVID(8),EAV(60)    BASIC1 3
   COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),    BASIC2 2
   1 CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOE2(60),IBUF(6,10),          BASIC2 3
   2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60),    BASIC2 4
   3 NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,    BASIC2 5
   4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILLL(30) BASIC2 6
   5,ICAPT,PLRUF(50,10),INPOPT,TKEEP                                BASIC2 7
   COMMON/LEVDEM/DEF(60),XNLGC(60),ECGC(60),UCUTOFF,DEFCN,TGC(60),    LEVDEN 2
   1 ENGC(60),EMATGC(60),PAIR(60),XMR3(60),XNLLN(60),SZ(100),SN(150),    LEVDEN 3
   2 PZ(100),PN(150)                                LEVDEN 4
   COMMON /SPNPAR/ SPIN,PARITY,KGRD                                LEVDEN 5
   COMMON/PREQ1/EPSIG(200,6),NLEV,NPIT,NIT                                PREQ1 2
   COMMON/PRNTOUT/IPRTLEV,IPRTTC,IPRTMLD,IPRTWID,IPRTSP,IPRTGC        PRNTOUT2
C                                                                                   LCMLOA27
   SPLIN (B,C,D,E) = B*A5 + C*A6 - AA*(D*A5+E*A6+D+E)                LCMLOA28
C                                                                                   LCMLOA29
   NIP=XNIP(I)                                LCMLOA30
   DO 100 IP=1,NIP                                LCMLOA31
   IP=LR(IP,I)                                LCMLOA32
   IPRT=1                                LCMLOA33
   NK=NKK(IR)                                LCMLOA34
   IF(NK.LT.1) GO TO 100                                LCMLOA35
   ID= ID1(IR)                                LCMLOA36
   OE=0.5                                LCMLOA37
   IF(IOE2(IR).GT.1) OE=1.0                                LCMLOA38
   IF(ID.GT.6) GO TO 50                                LCMLOA39
C                                                                                   LCMLOA40
C      COMPUTE AND STORE TRANSMISSION COEFFICIENTS                                LCMLOA41
C                                                                                   LCMLOA42
   NL= NO(ID)                                LCMLOA43
   NE= NEE(ID)                                LCMLOA44
   NPTS= NTC(ID)                                LCMLOA45
   INDEX=ITCLC+(ID-1)*NEEDIM*NLDIM                                LCMLOA46
   CALL ECRD(TC,INDEX,NPTS,IERR)                                LCMLOA47
   EK= 0.                                LCMLOA48
   DO 44 K=1,NK                                LCMLOA49
   EK= EK+DE                                LCMLOA50
   KE= ISERCH(EK,ETC(1,ID),NE,AA,A5,A6)                                LCMLOA51
   NL = NLEIN(ID,KE+1)                                LCMLOA52
   NLE(IP,K)=NL

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      DO 44 L=1,NL
      CALL INTERP(ETC(1,ID),TC(1,L),NE,2,EK,YOUT)
      T(L,K)=YOUT
      IF(T(L,K).GE.1.)T(L,K)=1.
      IF(T(L,K).LE.0.)T(L,K)=0.
44    CONTINUE
C
      IF(I.EQ.1.AND.ID.LE.6)45,55
45    KLM=(JP-SAC(1)-S(IR))/DE+0.5
      EK=0.
      DO 51 K=1,KLM
      EPSIG(K,ID)=0.
      EK=EK+DE
      KE=ISERCH(EK,ETC(1,ID),NE,AA,AS,A6)
      NL=NLEIN(ID,KE+1)
      DO 52 L=1,NL
      CALL INTERP(ETC(1,ID),TC(1,L),NE,2,EK,YOUT)
      T(L,K)=YOUT
      IF(T(L,K).GE.1.)T(L,K)=1.
      IF(T(L,K).LE.0.)T(L,K)=0.
      EPSIG(K,ID)=EPSIG(K,ID)+(2.*(L-1)+1.)*T(L,K)
52    CONTINUE
51    CONTINUE
55    CONTINUE
C    TRANSMISSION COEFFICIENT PRINT OPTION
      IF(IPRTTC.LT.2) GO TO 48
      WRITE(6,1)
      WRITE(6,2) ID,BCD(ID),I,IP,IR,NK,NL
      KPRT=IPRTTC-1
      DEFTT=KPRT
      EK = DE*(1.-DEFTT)
      DO 46 K=1,NK,KPRT
      EK=EK+DE*DEFTT
      NL = NLE(IP,K)
      WRITE(6,7) EK,NL
46    WRITE(6,4) (T(L,K),L=1,NL)
48    NPTS=NK*NLDIM
      NTC2(IP)=NPTS
      INDEX=ITLC+NKDIM*NLDIM*(IP-1)
      CALL ECWR(T,INDEX,NPTS,IERR)
C
C    COMPUTE AND STORE LEVEL DENSITIES AND YRASTS
50    EKMAX=JP-SAC(1)-S(IR)
      XIEFF=7.47656E-3*XMR3(IR)**6
      EK=DE
      DO 60 K=1,NK
      EK=EK+DE
      EX = EKMAX-EK
      U = EX*PAIR(IR)
      US = AMAX1(U,UCUTOFF)
      SJMAX=SQRT(2.*US*XIEFF)
      JMAX2=SJMAX+0E
      JMAX2=MIN0(JMAX2,NJMAX)
      JRAST(K,IP)=JMAX2
      SIG22 = 0.1776*SQRT(A2(IR)*US)*XMR3(IR)**2
      IF(EX.LE.EMATGC(IR)) GO TO 70
      AURT= SQRT(A2(IR)*U)
      RHOE = EXP(2.*AURT)/(10.1142*XMR3(IR)*U*AURT)
      GO TO 72
70    RHOE = EXP((EX-EMATGC(IR))/TGC(IR))/(2.*TGC(IR))
72    XJJ=-1.0
      IF(IOE2(IR).EQ.1) XJJ=-0.5
      DO 76 J=1,JMAX2

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LCMLOA53
LCMLOA54
LCMLOA55
LCMLOA56
LCMLOA57
LCMLOA58
LCMLOA59
LCMLOA60
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LCMLO113
LCMLO114
LCMLO115

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	XJJ=XJJ+1.0	LCML0116
76	RHO(J,K) = RHOE*(2.*XJJ+1.0)+EXP(-(XJJ+0.5)**2/81622)/31622	LCML0117
80	CONTINUE	LCML0118
C		LCML0119
C	LEVEL DENSITY PRINT OPTION	LCML0120
	IF(IPRTGC.LT.2) GO TO 84	LCML0121
	WRITE(6,5)	LCML0122
	WRITE(6,6) ID,BCD(ID),I,IP,IR,NK,NJMAX	LCML0123
	KPRT=IPRTGC-1	LCML0124
	DEFTIR=KPRT	LCML0125
	EK=DE*DEFTIR	LCML0126
	DO 82 K=1,NK,KPRT	LCML0127
	EK=EK+DE*DEFTIR	LCML0128
	EX=EKMAX-EK	LCML0129
	JMAX2=JRAST(K,IP)	LCML0130
	WRITE(6,3) EX,JMAX2	LCML0131
82	WRITE(6,4) (RHO(J,K),J=1,JMAX2)	LCML0132
84	NPTS=NK*NJDIM	LCML0133
	NRHO(IP)=NPTS	LCML0134
	INDEX=IRHOLC+NKDIM*NJDIM*(IP-1)	LCML0135
	CALL ECHR(RHO,INDEX,NPTS,IERR)	LCML0136
100	CONTINUE	LCML0137
	RETURN	LCML0138
	END	LCML0139
	SUBROUTINE GAMSET(I)	GAMSET 2
C		GAMSET 3
C	SET UP GAMMA-RAY CASCADE CALCULATION. DETERMINE WEISSKOPF OR AXEL	GAMSET 4
C	PARAMETERS AND COMPUTE GAMMA RAY TRANSMISSION COEFFICIENTS	GAMSET 5
C		GAMSET 6
1	FORMAT(// * GAMMA-RAY TRANSMISSION COEFFICIENTS*,10X,*I=*12,	GAMSET 7
	1 3X,*IP=*12,3X,*IR=*13, / * ENERGY*,10(6X,A1,F1.0,4X))	GAMSET 8
2	FORMAT(F8.3,1P,10(1X,E11.4))	GAMSET 9
C		GAMSET 10
	COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	BASIC1 2
1	ZACN(10),CSGR(40),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 3
	COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
1	CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOF2(60),IBUF(6,10),	BASIC2 3
2	ECM,IIP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60),	BASIC2 4
3	NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOFCN(10),NKKCN(10),ECON,	BASIC2 5
4	JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILL(30)	BASIC2 6
5	ICAPT,PLBUF(50,10),INOPT,KEEP	BASIC2 7
	COMMON/LEVDEN/DEF(60),XNLGC(60),ECGC(60),UCUTOFF,DEFCN,TGC(60),	LEVDEN 2
1	EGGC(60),EMATGC(60),PAIR(60),XMR3(60),XNLLN(60),SZ(100),SN(150),	LEVDEN 3
2	PZ(100),PN(150)	LEVDEN 4
	COMMON /SPNPAR/ SPIN,PARITY,KGRD	LEVDEN 5
	COMMON/GAMMA/NMP,LGROPT,SW(10),GML(6),GMP(6),REI(6),LMGHOL(6),	GAMMA 2
1	TGR(200,6),WKCON,CAXEL,GAXEL,ERAXEL,EXSW(10),WKNORM	GAMMA 3
	COMMON/PRNTOUT/IPRTLEV,IPRTTC,IPRTMLD,IPRTWID,IPRTSP,IPRTGC	PRNTOUT 2
	DIMENSION RDM(2)	GAMSET16
	DATA GAXEL/5.0/,R0/1.25/	GAMSET17
C		GAMSET18
	NIP=XNIP(1)	GAMSET19
	DO 50 IP=1,NIP	GAMSET20
	IR= LR(IP,1)	GAMSET21
	ID= ID1(IR)	GAMSET22
	IF(ID.EQ.7) GO TO 52	GAMSET23
50	CONTINUE	GAMSET24
	RETURN	GAMSET25
52	CAXEL=0.013*XM2(IR)	GAMSET26
	ERAXEL=40.0/XMR3(IR)	GAMSET27
	WKNORM=1.0E-8	GAMSET28
	CALL WEISSKF(1,IP,IR)	GAMSET29
	WRITE(6,10) I,WKCON	GAMSET30

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10  FORMAT(/* GAMMA RAY STRENGTH NORMALIZATION CONSTANT / I=,
1  I2,*, CONSTANT **IP12,4)
70  RATIO = 4.48758/((R0*XM2(IR)*XMR3(IR))*2)
    DO 75 MP=1,NMP
    L = GML(MP)
    IF(GMP(MP).LT.0.) GO TO 73
    IF (L.LT.2) GO TO 74
    IF(RE1(MP).EQ.0.) RE1(MP)=1.0E-6
74  RDUM(L)=RE1(MP)
75  CONTINUE
    DO 78 MP=1,NMP
    L = GML(MP)
    IF((GMP(MP).GT.0.).OR.(RE1(MP).GT.0.)) GO TO 78
    RE1(MP) = RATIO*RDUM(L)
78  CONTINUE
    NK= NKK(IR)
    EG=0.
    DO 90 KD=1,NK
    EG=EG+DE
    DO 90 MP=1,NMP
    L = GML(MP)
    GO TO (81,82),LGROPT
81  TGR(KD,MP)=WKCON*WKNORM*RE1(MP)*EG**2*(L+1)
    GO TO 90
82  TGR(KD,MP)=1.634928E-3*(GAXEL*RE1(MP)*GAXEL*EG**4/
1  ((ERAXEL**2+EG**2)**2+(EG*GAXEL)**2)
    TGR(KD,MP)=TGR(KD,MP)*WKCON
90  CONTINUE
C
C  TRANSMISSION COEFFICIENT PRINT OPTION
    IF(IPRTTC.LT.2) GO TO 100
    WRITE(6,1) I,IP,IR,(LMGHOL(MP),GML(MP),MP=1,NMP)
    KPRT=IPRTTC-1
    DEFTR=KPRT
    EG=0.
    DO 94 KD=1,NK,KPRT
    EG=EG+DE*DEFTR
    WRITE(6,2) EG,(TGR(KD,MP),MP=1,NMP)
94  CONTINUE
100 RETURN
END
SUBROUTINE WEISSKF(I,IP,IR)
C
C  OBTAIN NORMALIZATION FACTOR FOR WEISSKOPF APPROXIMATION FROM
C  INPUTTED STRENGTH FUNCTION
C
COMMON/LCINDEX/IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,
1  ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,
2  NIDDIM,NIRDIM
COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)
1,SPNGN(200),PL(50,6),G(200,6),RHOFTR(40)
COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM
1,EG(240),SG(240),NGRAYS(60)
COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),
1  CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOE2(60),IBUF(6,10),
2  ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TC(30),QMDP(40),A(60),A2(60),
3  NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,BASIC2 5
4  JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILL(30)
5,ICAPT,PLBUF(50,10),INPORT,YKEEP
COMMON/TCOFF/ETC(25,6),TC(25,30),BCD(7),XSPIN(7),NLDIM,
1  INPART,NEF(6),NO(6),NTC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25),
2  NLE(6,200),JRAST(200,6)
COMMON/GAMMA/NMP,LGROPT,SWS(10),GML(6),GMP(6),RE1(6),LMGHOL(6),

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GAMSET31
GAMSET32
GAMSET33
GAMSET34
GAMSET35
GAMSET36
GAMSET37
GAMSET38
GAMSET39
GAMSET40
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GAMSET42
GAMSET43
GAMSET44
GAMSET45
GAMSET46
GAMSET47
GAMSET48
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GAMSET51
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GAMSET63
GAMSET64
GAMSET65
GAMSET66
GAMSET67
GAMSET68
GAMSET69
GAMSET70
GAMSET71
WEISSKF2
WEISSKF3
WEISSKF4
WEISSKF5
WEISSKF6
LCNDEX 2
LCNDEX 3
LCNDEX 4
RHO 2
RHO 3
LEVEL1 2
LEVEL1 3
BASIC2 2
BASIC2 3
BASIC2 4
BASIC2 5
BASIC2 6
BASIC2 7
TCOEF 2
TCOEF 3
TCOEF 4
GAMMA 2

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C      I TGR(200,6),WKCON,CAXEL,GAXEL,ERAXEL,FXSWG(10),WKNORM
      IF(SWS(I))20,25,30
20     WKCON=SWS(I)
      RETURN
25     WKCON=1.
      RETURN
30     GAMCON=1.634928E-3*CAXEL*GAXEL
C
C      SET WKCON=1. IF EXSWS(I) IS EQUAL TO 0.
      IF((EXSWS(I).GT.0.),AND.(NKK(IR).GE.1)) GO TO 48
      WKCON=1.0
      RETURN
C
C      READ IN LEVEL DENSITIES AND DISCRETE LEVELS
48     NPTS=NRHO(YP)
      INDEX=IRHOLC+(IP-1)*NKDIM+NJDIM
      CALL ECRD(RHO,INDEX,NPTS,IERR)
      NLEV2=XNL(IR)
      INDEX=IFLLC+(IR-1)*NLEVDIM
      CALL ECRD(EL,INDEX,NLEV2,IERR)
      INDEX=IAJLC+(IR-1)*NLEVDIM
      CALL ECRD(AJ,INDEX,NLEV2,IERR)
C
C      FIND INITIAL K FOR INTEGRATION
      NK=NKK(IR)
      EKMAX=UP-SAC(I)-S(IR)
      EX=EKMAX+DE
      DO 50 K=1,NK
      EX=EX-DE
      IF(EX.LT.EXSWS(I)) GO TO 52
50     CONTINUE
52     KLOW=K
      EXLOW=EX
C
C      INTEGRATE OVER COMPOUND NUCLEUS SPINS,PARITIES
      SUM=0.
      IPICOMP=PIT
      XJCN=ABS(XJT-XJP)-1.0
      XJCNH=XJT+XJP+0.01
      DO 100 JCN=1,1000
      XJCN=XJCN+1.0
      JCN=XJCN+1.01
      IF((XJCN.GT.XJCNH).OR.(JCN.GT.NJMAX)) GO TO 110
C
C      INTEGRATE OVER FINAL STATE SPINS,PARITIES
      XJ2=ABS(XJCN-1.)-1.0
      XJ2H=XJCN+1.01
      DO 90 JJ2=1,1000
      XJ2=XJ2+1.0
      JJ2=XJ2+1.01
      IF((XJ2.GT.XJ2H).OR.(JJ2.GT.NJMAX)) GO TO 100
      JJ2J=2.*XJ2+0.01
C
C      INTEGRATE OVER CONTINUUM ENERGIES
      EX=EXLOW+DE
      DO 70 KP=KLOW,NK
      IF(JRAST(KP,IP).LT.J2) GO TO 75
      EX=EX+DE
      ED=EXSWS(I)-EX
      GO TO (60,62),LGROPT
60     SFTR=WKNORM*ED**3
      GO TO 70

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GAMMA 1
WEISSK13
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WEISSK73
WEISSK74

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62	SFTP=GAMCON*ED**4/((ERAXEL**2=ED**2)**2+(ED*GAXEL)**2)	WEISSK75
70	SUM=SUM+DE*RHO(J2,KP)*SFTR	WEISSK76
75	CONTINUE	WEISSK77
C		WEISSK78
C	INTEGRATE OVER DISCRETE STATES	WEISSK79
	IF(NLEV2.LT.1) GO TO 90	WEISSK80
	DO 80 N=1,NLEV2	WEISSK81
	IAJ2J=2,*ABS(AJ(N)) +0.01	WEISSK82
	IF(J22J.NE.IAJ2J) GO TO 80	WEISSK83
	PIAJ = SIGN(1.0,AJ(N))	WEISSK84
	IPIAJ = PIAJ+SIGN(0.1,PIAJ)	WEISSK85
	IF(IPIAJ.NE.IPICOMP) GO TO 80	WEISSK86
	ED = EXSWS(I) -EL(N)	WEISSK87
	IF(ED.LE.0.) GO TO 90	WEISSK88
	GO TO (76,78),LGROPT	WEISSK89
76	SFTR=WKNNORM*ED**3	WEISSK90
	GO TO 79	WEISSK91
78	SFTR=GAMCON*ED**4/((ERAXEL**2=ED**2)**2+(ED*GAXEL)**2)	WEISSK92
79	SUM=SUM+SFTR	WEISSK93
80	CONTINUE	WEISSK94
90	CONTINUE	WEISSK95
100	CONTINUE	WEISSK96
110	WKCON = SWS(I)/SUM	WEISSK97
	RETURN	WEISSK98
	END	WEISSK99
	SUBROUTINE INCHSUM(MM)	INCHSUM2
C		INCHSUM3
C	PERFORM SUMS OVER S AND L OF INCIDENT CHANNEL FOR GIVEN COMPOUND	INCHSUM4
C	NUCLEUS SPIN AND PARITY	INCHSUM5
		INCHSUM6
	COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)	RHO 2
	1,SPNGN(200),PL(50,6),G(200,6),RHOFT(40)	RHO 3
	COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
	1 CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOE2(60),IBUF(6,10),	BASIC2 3
	2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM, TCP(30),QMDP(40),A(60),A2(60),	BASIC2 5
	3 NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,BASIC2	BASIC2 6
	4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILLL(30)	BASIC2 7
	5,ICAPT,PLBUF(50,10),INPOPT,TKFEP	GAMMA 2
	COMMON/GAMMA/NMP,LGROPT,SWS(10),GML(6),GMP(6),RE1(6),LMGHOL(6),	GAMMA 3
	1 TGR(200,6),WKCON,CAXEL,GAXEL,ERAXEL,EXSWS(10),WKNNORM	SUMBLK12
	COMMON/SUMBLK1/KP,KD,IP,ID,KNGN,JPI2,N,DP,IK	SUMBLK22
	COMMON/SUMBLK2/XJCN,PICN,JPICN,ECONJ,MP,J2,L2,TGRL,TLEV,XJ2,	SUMBLK23
	1 TTOT(20)	INCHSU12
	COMMON/PREQ/LPEQ,SIGR,PREQI(6),CSIGI(6),NITT(6),ALPHA(6)	INCHSU13
	MX= (MM+1)/2 + 1	INCHSU14
	CS = CSL	INCHSU15
	DP=0.	INCHSU16
	PICOMP=PIT+PICN	INCHSU17
	LPTCOMP=PICOMP+SIGN(0.1,PICOMP)	INCHSU18
	DO 60 ISP=1,1000	INCHSU19
	CS=CS+1.0	INCHSU20
	IF(CS=CSH)200,200,70	INCHSU21
200	LPL=ABS(XJCN-CS)+1.01	INCHSU22
	LPH=XJCN+CS+1.01	INCHSU23
	LPH=MIN0(LPH,NLP)	INCHSU24
	IF(LPL=LPH)201,201,60	INCHSU25
201	CONTINUE	INCHSU26
	DO 55 LP=LPL,LPH	INCHSU27
	LPPI=PILLL(LP)	INCHSU28
	IF(LPPI=LPICOMP) 55,202,55	INCHSU29
202	CONTINUE	INCHSU30
50	DP=ECONJ*TCP(LP) + DP	INCHSU31
55	CONTINUE	

60	CONTINUE	INCHSU32
70	RETURN	INCHSU33
	END	INCHSU34
	SUBROUTINE SUMER(NN,DE)	SUMER 2
C		SUMER 3
C	ADD POPULATION INCREMENT INTO POPULATION ARRAY AND INTO SPECTRA	SUMER 4
C		SUMER 5
	COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)	RHO 2
	1,SPNGN(200),PL(50,6),G(200,6),RHOFTR(40)	RHO 3
	COMMON/SUMBLK1/XP,KD,IP,ID,KNGN,JPI2,N,DP,IK	SUMBLK12
	COMMON/TOTALS/SIGTOT(10)	SUMER 8
C		SUMER 9
	GO TO (51,52),NN	SUMER 10
51	P(JPI2) = P(JPI2)+DP	SUMER 11
	GO TO 58	SUMER 12
52	PL(N,IP) = PL(N,IP)+DP	SUMER 13
58	DS= DP/DE	SUMER 14
	SP(KD,IP) = SP(KD,IP)+DS	SUMER 15
	SPP(KD,ID) = SPP(KD,ID)+DS	SUMER 16
	IF(1K-2)70,70,72	SUMER 17
70	SIGTOT(IP)=SIGTOT(IP)+DP	SUMER 18
72	GO TO (61,62),KNGN	SUMER 19
61	SPNGN(KD)=SPNGN(KD)+DS	SUMER 20
62	RETURN	SUMER 21
	END	SUMER 22
	SUBROUTINE GRLINES	GRLINES2
C		GRLINES3
C	CALCULATE DISCRETE GAMMA-RAY CROSS SECTIONS AND SUM SPECTRA	GRLINES4
C	TO GET INTEGRAL CROSS SECTIONS	GRLINES5
C		GRLINES6
1	FORMAT(/,* LEVEL DATA OUT OF ORDER, ZA=*I5,2X,*ZA2=*I5,4X,*EL=*I3,	GRLINES7
	1 4X,*LDATE=*I7,* ABORT JOB,*)	GRLINES8
C		GRLINES9
	COMMON/LCINDEX/IPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,	LCINDEX 2
	1 ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,	LCINDEX 3
	2 NIDDIM,NIRDIM	LCINDEX 4
	COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)	RHO 2
	1,SPNGN(200),PL(50,6),G(200,6),RHOFTR(40)	RHO 3
	COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM	LEVEL1 2
	1,EG(240),SG(240),NGRAYS(60)	LEVEL1 3
	COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	BASIC1 2
	1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 3
	COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
	1 CNPI(10),S(60),SAC(10),ID1(60),IDP,IOE2(60),IBUF(6,10),	BASIC2 3
	2 ECH,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60),	BASIC2 4
	3 NRHO(6),XJT, NPOPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,	BASIC2 5
	4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,FILL(30)	BASIC2 6
	5,ICAPT,PLBUF(50,10),INOPT,KEEP	BASIC2 7
	DIMENSION NTT(50),IG(50,40),NFF(50,40),PR(50,40),CPR(50,40)	GRLINE15
	EQUIVALENCE (IG,RHO),(NFF,RHO(1,101)),(PR,T),(CPR,T(1,101))	GRLINE16
C		GRLINE17
C	MAIN CALCULATION LOOPS	GRLINE18
	CALL ECRD(PLBUF,IZEROLC,500,IERR)	GRLINE19
	CALL ECRD(CSGR,IZEROLC,NIR,IERR)	GRLINE20
	CALL ECRD(CSTOT,IZEROLC,NIR,IERR)	GRLINE21
	CALL ECRD(EAV,IZEROLC,NIR,IERR)	GRLINE22
	CALL ECRD(CSLEV,IZEROLC,NIR,IERR)	GRLINE23
	REWIND KL	GRLINE24
	DO 100 I=1,NI	GRLINE25
	NIP=XNIP(I)	GRLINE26
	NPTS=NIP*NLEVDIM	GRLINE27
	INDEX=IPLLC+(I-1)*NLEVDIM+NIPDIM	GRLINE28
	CALL ECRD(PL,INDEX,NPTS,IERR)	GRLINE29


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      NPTS = NXDIM * NIP
      INDEX = ISPLC + (I-1) * NKDIM * NIPDIM
      CALL ECRC(SP, INDEX, NPTS, IERR)
      DO 100 IP=1, NIP
      IR = LR(IP, I)
      NLEV2 = XNL(IR)
C
C      ADD PARTICLE-INDUCED POPULATIONS TO STATES THAT GAMMA DECAY
      IB = IRUF(IP, I)
      IF (IB, LF, 0) GO TO 90
      DO 40 N=1, NLEV2
      PLBUF(N, IB) = PLBUF(N, IB) + PL(N, IP)
      ID = ID1(IR)
      IF (ID, NE, 7) GO TO 90
40
C
C      COMPUTE DISCRETE GAMMA CROSS SECTIONS
      IZA2 = ZA2(IR)
      READ(KL) IZA, NL, LDATE
      IF (IZA, EQ, IZA2) GO TO 50
      WRITE(6, 1) IZA, IZA2, NL, LDATE
      STOP
50
      NG = 0
      DO 60 N=1, NL
      PL(N, IP) = PLBUF(N, IB)
      READ (KL) EL(N), AJ(N), AT(N), TAU, NTT(N)
      NT = NTT(N)
      IF (NT, LT, 1) GO TO 60
      DO 58 KN=1, NT
      NG = NG + 1
      IG(N, KN) = NG
58
      READ(KL) NFF(N, KN), PR(N, KN), CPR(N, KN), AMR, LL1, LL2
60
      CONTINUE
      NGRAYS(IR) = NG
      NGR = NG
      DO 70 NN=2, NL
      N = NL - NN + 2
      NT = NTT(N)
      IF (NT, LT, 1) GO TO 70
      DO 66 KN=1, NT
      NG = IG(N, KN)
      NF = NFF(N, KN)
      EG(NG) = EL(N) * EL(NF)
      DP = PL(N, IP) * PR(N, KN)
      PL(NF, IP) = PL(NF, IP) + DP
      DP = DP * CPR(N, KN)
      SG(NG) = DP
      CSGR(IR) = CSGR(IR) + DP
      KD = EG(NG) / DE + 0.5
      IF (KD, LT, 1) KD = 1
      DS = DP / DE
      SP(KD, IP) = SP(KD, IP) + DS
      SPP(KD, ID) = SPP(KD, ID) + DS
66
70
      CONTINUE
      INDEX = IEGLC + (IR-1) * NGRDIM
      CALL ECWR(EG, INDEX, NGR, IERR)
      INDEX = ISGLC + (IR-1) * NGRDIM
      CALL ECWR(SG, INDEX, NGR, IERR)
      NPTS = NIP * NLEV2DIM
      INDEX = IPLLC + (I-1) * NLEV2DIM * NIPDIM
      CALL ECWR(PL, INDEX, NPTS, IERR)
      NPTS = NKDIM * NIP
      INDEX = ISPLC + (I-1) * NKDIM * NIPDIM
      CALL ECWR(SP, INDEX, NPTS, IERR)

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      GRLINE31
      GRLINE32
      GRLINE33
      GRLINE34
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      GRLINE88
      GRLINE89
      GRLINE90
      GRLINE91
      GRLINE92

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C		GRLINE91
C	SUM INDIVIDUAL SPECTRA	GRLINE94
90	ED=0.	GRLINE95
	NK=NKK(IR)	GRLINE96
	DO 92 K=1,NKMAX	GRLINE97
	ED=ED+DE	GRLINE98
	EAV(IR)=EAV(IR)+ED*SP(K,IP)	GRLINE99
92	CSTOT(IR)=CSTOT(IR)+SP(K,IP)	GRLINE100
	IF(CSTOT(IR).GT.0.) EAV(IR)=EAV(IR)/CSTOT(IR)	GRLINE101
	CSTOT(IR)=CSTOT(IR)*DE	GRLINE102
0		GRLINE103
C	SUM LEVEL POPULATIONS FROM CONTINUUM AND LEVEL TRANSITIONS	GRLINE104
	DO 94 N=1,NLEV2	GRLINE105
94	CSLEV(IR)=CSLEV(IR)+PL(N,IP)	GRLINE106
100	CONTINUE	GRLINE107
C		GRLINE108
C	SUM COMPOSITE SPECTRA	GRLINE109
	DO 110 ID=1,7	GRLINE110
	CSID(ID)=0.	GRLINE111
	EAVID(ID)=0.	GRLINE112
	ED=0.	GRLINE113
	IF(IDSTAT(ID).LT.1) GO TO 110	GRLINE114
	DO 108 K=1,NKMAX	GRLINE115
	ED=ED+DE	GRLINE116
	EVID(ID)=EVID(ID)+ED*SPP(K,ID)	GRLINE117
108	CSID(ID)=CSID(ID)+SPP(K,ID)	GRLINE118
	IF(CSID(ID).GT.0.) EVID(ID)=EVID(ID)/CSID(ID)	GRLINE119
	CSID(ID)=CSID(ID)*DE	GRLINE120
110	CONTINUE	GRLINE121
	CSID(8)=0.	GRLINE122
	EAVID(8)=0.	GRLINE123
	ED=0.	GRLINE124
	DO 120 K=1,NKMAX	GRLINE125
	ED=ED+DE	GRLINE126
	EAVID(8)=EAVID(8)+ED*SPNGN(K)	GRLINE127
120	CSID(8)=CSID(8)+SPNGN(K)	GRLINE128
	IF(CSID(8).GT.0.) EAVID(8)=EAVID(8)/CSID(8)	GRLINE129
	CSID(8)=CSID(8)*DE	GRLINE130
	RETURN	GRLINE131
	END	GRLINE132
	SUBROUTINE DATAOUT	DATAOUT2
C		DATAOUT3
C	MAIN OUTPUT ROUTINE	DATAOUT4
C		DATAOUT5
1	FORMAT(1H1,10X,*R A D I A T I O N W I D T H S* /)	DATAOUT6
2	FORMAT(1H1,10X,*S P E C T R A F R O M I N D I V I D U A L	DATAOUT7
	1 R E A C T I O N S* /)	DATAOUT8
3	FORMAT(16X,10(A6,FS,0))	DATAOUT9
4	FORMAT(A6,A10,10(1X,A10))	DATAOUT10
5	FORMAT(A10,A7,1P,10(E10.3,1X))	DATAOUT11
6	FORMAT(I5,F10.3,2X,1P,10(E10.3,1X))	DATAOUT12
7	FORMAT(1H1,30X,*C O M P O S I T E S P E C T R A* /)	DATAOUT13
8	FORMAT(1H1,10X,*D I S C R E T E L E V E L I N F O R M A T I	DATAOUT14
	10 N* /)	DATAOUT15
9	FORMAT(// 3H I=I2,3X,3HIP=I2,3X,3HIR=I2,3X,4HZA1=F4.0,3X,4HZA2=F5	DATAOUT16
	1.0,3X,10HSEPARATION ENERGY =F7.3,4H MEV,3X,31HACCUMULATED SEPARATI	DATAOUT17
	20N ENERGY =F7.3,4H MEV)	DATAOUT18
10	FORMAT(39H NUMBER OF LEVEL IN RESIDUAL NUCLEUS =I3,3X,22HNUMBER O	DATAOUT19
	1F GAMMA RAYS =I3,3X, *RESIDUAL NUCLEUS ID =*I5)	DATAOUT20
11	FORMAT(// * LEVEL LEVEL SPIN, PRODUCTION NUMBER OF FINDATAOU	DATAOUT21
	1AL FINAL TRANSITION CONDITIONAL GAMMA GAMMA PRODUCTION	DATAOUT22
	2 * / * NO ENERGY PARITY CROSS SECTION TRANSITIONS LEV	DATAOUT23
	3EL ENERGY PROBABILITY PROBABILITY NUMBER ENERGY CROSS SECTI	DATAOUT24

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4N* / * (MEV) (BARN) (MEV) (BARN)*) NODATA0025
5 (MEV) DATA0026
12 FORMAT(/ I4,F10.4,F7.1,3X,1PE11.4,I10) DATA0027
13 FORMAT(45X,I10,F10.4,F11.4,F13.4,I8,F10.4,3X,1PE11.4) DATA0028
14 FORMAT(1H1. 10X,*L E V E L D E N S I T Y P A R A M E T E R JUL19776
15*) DATA0030
15 FORMAT(/ * 1 IP IR IZA1 IZA2 A TEMP E0 EMATCH DATA0031
1ECUT LEVELS PN PZ SN SZ S SAC * / DATA0032
2 * (/MEV) (MEV) (MEV) (MEV) (DATA0033
3MEV) AT ECUT (MEV) (MEV) (MEV) (MEV) (MEV) (MEV)* ) DATA0034
16 FORMAT(3I3,F5.0,F7.0,1X,2F7.3,3F8.3,F6.2,1X,4F8.2,2F9.3) DATA0035
17 FORMAT(* NUMBER OF LEVELS IN RESIDUAL NUCLEUS **,I3//) DATA0036
1* LEVEL LEVEL SPIN, ISO= PRODUCTION*/ DATA0037
2* NO ENERGY PARITY SPIN CROSS SECTION*/ DATA0038
3* (MEV) (BARN)*//) DATA0039
18 FORMAT(I4,F10.4,2F7.1,3X,1PE11.4) DATA0040
219 FORMAT(1H1.8A10,/1H.8A10) DATA0041
220 FORMAT(/* LAB NEUTRON ENERGY **1PE11.4,* MEV*/) DATA0042
221 FORMAT(/* BINARY REACTION SUMMARIES (COMPOUND NUCLEUS ONLY)*,//) DATA0043
1* REACTION SIGMA **,* PRODUCT (BARN)*,// DATA0044
2* -----) DATA0045
222 FORMAT(1X,A10,2X,1PE11.4) DATA0046
DATA0047
C
COMMON/LCINDEX/IPBL,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC, LCNDEX 2
1 ISTCLC,IRHOLC,ITLCL,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM, LCNDEX 3
2 NIDIM,NIRDIM LCNDEX 4
COMMON/RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7) RHO 2
1,SPNGN(200),PL(50,6),G(200,6),RHOFTR(40) RHO 3
COMMON/LEVEL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEVDIM LEVEL 2
1,EG(240),SG(240),NGRAVS(60) LEVEL 3
COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60), BASIC 2
1 ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),FAVID(8),EAV(60) BASIC 1 3
COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10), BASIC 2 2
1 CNPIP(10),S(60),SAC(10),ID1(60),IDP,IOF2(60),IBUF(6,10), BASIC 2 3
2 ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM,TCP(30),QMDP(40),A(60),A2(60), BASIC 2 4
3 NRHO(6),XJT, NPDPMAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,BASIC 2 5
4 JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,I0STAT(7),SIC,CSH,PILL(30)BASIC 2 6
5,ICAPT,PLRUF(50,10),INOPT,TKEEP BASIC 2 7
COMMON/PRNTOUT/IPRTLEV,IPRTYC,IPRTMLD,IPRTWID,IPRTSP,IPRTGC PRNTOUT 2
COMMON/LEVDEFN/DEF(40),XNLGC(60),ECGC(60),UCUTOFF,DEFCON,TGC(60), LEVDEN 2
1 E0GC(60),FMATGC(60),PAIR(60),XMR3(60),XNLLN(60),SZ(100),SN(150), LEVDEN 3
2 PZ(100),PN(150) LEVDEN 4
COMMON /SPNPAR/ SPIN,PARITY,KGRD LEVDEN 5
DIMENSION SCBUF3(200,10),HK(2),HGAM(2),HLEV(2),HTOT(2),ZADUM(60), DATA0055
1 SCBUF4(200,6,10),BLANK(2),BCD2(8),HEAV(2) DATA0056
COMMON/PREFQ/LPEQ,SIGR,PREQI(6),CSIGI(6),NITT(6),ALPHA(6) DATA0057
COMMON/TOTALS/SIGTOT(10) DATA0058
EQUIVALENCE (RHO,SCBUF3),(RHO(1.51),SCBUF4) DATA0059
DIMENSION MTA(50),SPX(200),XE(200) DATA0060
DIMENSION INT(1),NBT(1) DATA0061
DATA MTA/18,18,17,17,16,16,4.91,102,0,0,0,0,0,0,32,28,0,0,0,0, DATA0062
X105,33,104,22,34,0,0,103,0,0,0,107,0,106,14*0/ DATA0063
DATA C1,L1,L2,NR,MC/0,0,0,1,1/ DATA0064
DATA0065
C
DATA BCD2/10H NEUTRON,10H PROTON,10H DEUTERON,10H TRITON, DATA0066
1 10H HELIUM-3,10H HELIUM-4,10H GAMMA-RAY,10H G,NEUTRON/ DATA0067
DATA HWID,HMEV,HSIG,HBARN,HBMV,HDASH,HK,HGAM,HLEV,HTOT,HZACN, DATA0068
1 HZA1,HZA2/10H WIDTH,10H (MEV),10H SIGMA,10H (BARN) DATA0069
2,10H (B/MEV),10H -----, 6H K,10H ENERGY,10H LEVEL DEC DATA0070
3, 7HAY C/S=,10H LEVEL EXC,7HIT C/S=,10H TOTAL PRO,7HD. C/S=, DATA0071
4 6H ZACN=,6H ZA1=,6H ZA2=,BLANK/10H, 10H / DATA0072
DATA HSPEC/10H SPECTRUM/,HEAV/10H AVG.ENERG,7HY (MEV)/ DATA0073
DATA HNON/10HNONELASTIC/ DATA0074

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C	ENERGY AND BINARY CROSS SECTION PRINT	DATA0075
C	NIP=XNIP(1)	DATA0076
	DO 250 IP=1,NIP	DATA0077
250	SIGTOT(10)=SIGTOT(10)+SIGTOT(IP)	DATA0078
	WRITE(6,219) TITLE	DATA0079
	WRITE(6,220) ELAB	DATA0080
	WRITE(6,221)	DATA0081
	WRITE(6,222) HNON,SIGTOT(10)	DATA0082
	DO 260 IP=1,NIP	DATA0083
	IR=LR(IP,1)	DATA0084
	ID=ID1(IR)	DATA0085
260	WRITE(6,222) RCD2(ID),SIGTOT(IP)	DATA0086
	IF(LPEQ.NE.1)GO TO 248	DATA0087
	WRITE(6,246)	DATA0088
	DO 249 IP=1,NIP	DATA0089
	IR=LR(IP,1)	DATA0090
	ID=ID1(IR)	DATA0091
	NK=NKK(IR)	DATA0092
	IF(NK,LT,1)GO TO 249	DATA0093
	IF(ID.EQ.7)GO TO 249	DATA0094
	WRITE(6,247)IP, ID,RCD2(ID),NITT(ID),ALPHA(ID),CSIGI(ID),PREGI(ID)	DATA0095
246	FORMAT(//15X*----- PRE-EQUILIBRIUM SUMMARY -----//)	DATA0096
247	FORMAT(/5X*IP = *I3,2X*ID = *I3,2X*OUTGOING PARTICLE = *A10,5X*DATA0097	DATA0097
	X*INITIAL EXCITON NUMBER = *I3,5X*PREQ NORMALIZATION = *E14,5/5X*DATA0098	DATA0098
	X COMPOUND X-SEC(BARNS) = *E14,5,5X* PREEQ X-SEC(BARNS) = *E14,5/5X*DATA0099	DATA0099
	X)	DATA0100
249	CONTINUE	DATA0101
248	CONTINUE	DATA0102
C		DATA0103
C	WIDTH PRINT OPTION	DATA0104
	IF(IPRTWID.LT.1) GO TO 60	DATA0105
	NPTS=NKDIM*6*NJ	DATA0106
	CALL ECRD(SCBUF4,IQLC,NPTS,IERR)	DATA0107
	ICT=0	DATA0108
	DO 50 I=1,NJ	DATA0109
	NIP= XNIP(I)	DATA0110
	DO 50 IP=1,NIP	DATA0111
	IR=LR(IP,I)	DATA0112
	ZADUM(IR)= ZACN(I)	DATA0113
	ICT=ICT+1	DATA0114
	DO 52 K=1,NKMAX	DATA0115
52	SCBUF3(K,ICT) = SCBUF4(K,IP,I)	DATA0116
	IF((ICT.LT.10).AND.(IR.LT.NIR)) GO TO 50	DATA0117
	IRH=IR	DATA0118
	NICT=ICT	DATA0119
	IRL=IRH-NICT+1	DATA0120
C		DATA0121
C	PRINT WIDTHS	DATA0122
	WRITE (6,1)	DATA0123
	WRITE(6,3) (HZACN,ZADUM(II),II=IRL,IRH)	DATA0124
	WRITE(6,3) (HZA1, ZA1(II),II=IRL,IRH)	DATA0125
	WRITE(6,3) (HZA2, ZA2(II),II=IRL,IRH)	DATA0126
	WRITE(6,4) BLANK, (HDASH,II=IRL,IRH)	DATA0127
	WRITE(6,4) HK,(HWID,II=IRL,IRH)	DATA0128
	WRITE(6,4) BLANK(1),HMEV,(HMEV,II=IRL,IRH)	DATA0129
	EK=UP+OE	DATA0130
	DO 54 K=1,NKMAX	DATA0131
	EK=EK+OE	DATA0132
54	WRITE(6,6) K,EK,(SCBUF3(K,II),II=1,NICT)	DATA0133
	ICT=0	DATA0134
58	CONTINUE	DATA0135
		DATA0136
		DATA0137

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C      INDIVIDUAL SPECTRA PRINT OPTION
60     IF(IPRTSP.LT.2) GO TO 70
        ICT=0
        DO 68 I=1,N1
            NIP= XNIP(I)
            NPTS= NKDIM*NIP
            INDEX=ISPLC*(I-1)+NKDIM*NIPDIM
            CALL ECRD(SP,INDEX,NPTS,IERR)
            DO 68 IP=1,NIP
                IR = LR(IP,I)
                ZADUM(IR)= ZACN(I)
                ICT = ICT+1
            DO 62 K=1,NKMAX
                SCBUF3(K,ICT)= SP(K,IP)
                IF((ICT.LT.10).AND.(IR.LT.NIR)) GO TO 68
                IRH=IR
                NICT=ICT
                IRL=IRH-NICT+1
C
C      PRINT CROSS SECTIONS AND SPECTRA
        WRITE(6,2)
        WRITE(6,3) (HZACN,ZADUM(II),II=IRL,IRH)
        WRITE(6,3) (HZA1, ZA1(II),II=IRL,IRH)
        WRITE(6,3) (HZA2, ZA2(II),II=IRL,IRH)
        WRITE(6,4) BLANK, (HDASH,II=IRL,IRH)
        WRITE(6,4) BLANK, (HSIG,II=IRL,IRH)
        WRITE(6,4) BLANK, (HBARN,II=IRL,IRH)
        WRITE(6,5) HGAM, (CSGR(II),II=IRL,IRH)
        WRITE(6,5) HLEV, (CSLEV(II),II=IRL,IRH)
        WRITE(6,5) HTOT, (CSTOT(II),II=IRL,IRH)
        WRITE(6,4) BLANK, (HDASH,II=IRL,IRH)
        WRITE(6,5) HEAV, (EAV(II),II=IRL,IRH)
        WRITE(6,4) BLANK, (HDASH,II=IRL,IRH)
        WRITE(6,4) HK, (HSTG,II=IRL,IRH)
        WRITE(6,4) BLANK(1),HMEV,(HBMEV,II=IRL,IRH)
        EK=0.
        DO 64 K=1,NKMAX
            EK=EK+DE
64     WRITE(6,6) K,EK,(SCBUF3(K,II),II=1,NICT)
            ICT=0
68     CONTINUE
70     IF((IPRTSP.NE.1).AND.(IPRTSP.NE.3)) GO TO 80
C
C      PRINT COMPOSITE SPECTRA
        WRITE(6,7)
        WRITE(6,4) BLANK,(BCD2(ID),ID=1,8)
        WRITE(6,4) BLANK,(HSPEC,ID=1,8)
        WRITE(6,4) BLANK,(HDASH,ID=1,8)
        WRITE(6,4) BLANK,(HSIG ,ID=1,8)
        WRITE(6,4) BLANK,(HBARN,ID=1,8)
        WRITE(6,5) HTOT,(CSID(ID),ID=1,8)
        WRITE(6,4) BLANK,(HDASH,ID=1,8)
        WRITE(6,5) HEAV,(EAVID(ID),ID=1,8)
        WRITE(6,4) BLANK,(HDASH,ID=1,8)
        WRITE(6,4) HK, (HSIG ,ID=1,8)
        WRITE(6,4) BLANK(1),HMEV,(HBMEV,ID=1,8)
        EK=0.
        DO 74 K=1,NKMAX
            EK=EK+DE
74     WRITE(6,6) K,EK,(SPP(K,ID),ID=1,7),SPNGN(K)
80     IF(IPRTLEV.LT.1) GO TO 90
C
C      PRINT DISCRETE LEVEL AND GAMMA-RAY DATA

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DATA0200

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	WRITE(6,8)	DATA0201
	REWIND KL	DATA0202
	DO 88 I=1,NI	DATA0203
	NIP= XNIP(I)	DATA0204
	NPTS= NIP*NLEVDIM	DATA0205
	INDEX=IPLLC+(I-1)*NLEVDIM*NIPDIM	DATA0206
	CALL ECRD(PL,INDEX,NPTS,IERR)	DATA0207
	DO 88 IP=1,NIP	DATA0208
	IF((PL(I,IP).EQ.0.).AND.(NKKCN(I),LT.1)) GO TO 86	DATA0209
	IR= LR(IP,I)	DATA0210
	NLEV2= XNL(IR)	DATA0211
	WRITE(6,9) I,IP,IR,ZA1(IR),ZA2(IR),S(IR),SAC(I)	DATA0212
	IF(ID1(IR).EQ.7) GO TO R2	DATA0213
	WRITE(6,17) NLEV2	DATA0214
	INDEX=IELLC+(IR-1)*NLEVDIM	DATA0215
	CALL ECRD(EL,INDEX,NLEV2,IERR)	DATA0216
	INDEX=IAJLC+(IR-1)*NLEVDIM	DATA0217
	CALL ECRD(AJ,INDEX,NLEV2,IERR)	DATA0218
	INDEX=IATLC+(IR-1)*NLEVDIM	DATA0219
	CALL ECRD(AT,INDEX,NLEV2,IERR)	DATA0220
	DO 81 N=1,NLEV2	DATA0221
81	WRITE(6,18) N,EL(N),AJ(N),AT(N),PL(N,IP)	DATA0222
	GO TO 88	DATA0223
82	READ(KL) IZA,NL,LDATE	DATA0224
	NGR = NGRAYS(IR)	DATA0225
	INDEX=IRGLC+(IR-1)*NGRDIM	DATA0226
	CALL ECRD(EG,INDEX,NGR,IERR)	DATA0227
	INDEX=ISGLC+(IR-1)*NGRDIM	DATA0228
	CALL ECRD(SG,INDEX,NGR,IERR)	DATA0229
	WRITE(6,19) NLEV2,NGR,IZA	DATA0230
	WRITE(6,11)	DATA0231
	NG=0	DATA0232
	DO 86 N=1,NL	DATA0233
	READ(KL)EL(N),AJJ,ATT,TAU,NT	DATA0234
	WRITE(6,12) N,EL(N),AJJ,PL(N,IP),NT	DATA0235
	IF(NT,LT.1) GO TO 85	DATA0236
	DO 84 K=1,NT	DATA0237
	NG=NG+1	DATA0238
	READ(KL) NF,PROB,CPROB,AMIX,LL1,LL2	DATA0239
84	WRITE(6,13) NF,EL(NF),PROB,CPROB,NG,EG(NG),SG(NG)	DATA0240
86	CONTINUE	DATA0241
88	CONTINUE	DATA0242
90	IF(IPRTGC,LT.1) GO TO 100	DATA0243
C		DATA0244
C	PRINT GILBERT-CAMERON PARAMETERS	DATA0245
	WRITE(6,14)	DATA0246
	WRITE(6,15)	DATA0247
	DO 98 I=1,NI	DATA0248
	NIP= XNIP(I)	DATA0249
	DO 98 IP=1,NIP	DATA0250
	IR= LR(IP,I)	DATA0251
	IZA= ZA2(IR)	DATA0252
	IA= MOD(IZA,1000)	DATA0253
	IZ= IZA/1000	DATA0254
	IN= IA-IZ	DATA0255
98	WRITE(6,16) I,IP,IR,ZA1(IR),ZA2(IR),A2(IR),TGC(IR),E0GC(IR),EMATGC	DATA0256
100	I(IR),ECGC(IR),XNLGC(IR),PN(IN),PZ(IZ),SN(IN),SZ(IZ),S(IR),SAC(I)	DATA0257
	CONTINUE	DATA0258
	RETURN	DATA0259
	END	DATA0260
	FUNCTION ISERCH (X,EE,NE,A,A1,A2)	ISERCH 2
C		ISERCH 3
C	FIND PARAMETERS NECESSARY FOR SPLINE INTERPOLATION	ISERCH 4

C		ISERCH 5
C	X = ENERGY AT WHICH FUNCTION IS TO BE EVALUATED	ISERCH 6
C	EE = ARRAY OF FUNCTION ENERGIES	ISERCH 7
C	NE = NUMBER OF ENERGIES STORED IN EE	ISERCH 8
C	A, A1, A2 = SPLINE INTERPOLATION PARAMETERS	ISERCH 9
C		ISERCH10
1	FORMAT(/ /* SPLINE FUNCTION ISERCH OUT OF RANGE. K = *10,5H NE*14)	ISERCH11
	DIMENSION EE(NE)	ISERCH12
C		ISERCH13
	K = 0	ISERCH14
	IF((X.LT.EE(1)).OR.(X.GT.EE(NE))) GO TO 50	ISERCH15
	K = 1	ISERCH16
10	IF(X.LT.EE(K)) GO TO 20	ISERCH17
	IF (X.LT.EE(K+1)) GO TO 40	ISERCH18
	K = K + 1	ISERCH19
	IF(K.LT.NE) GO TO 10	ISERCH20
	K = K + 1	ISERCH21
	GO TO 40	ISERCH22
20	IF(K.EQ.1) GO TO 40	ISERCH23
	K = 1	ISERCH24
	GO TO 10	ISERCH25
40	H = EE(K+1) - EE(K)	ISERCH26
	H1 = X - EE(K)	ISERCH27
	H2 = EE(K+1) - X	ISERCH28
	A = H2*H1/6.	ISERCH29
	A1 = H1/H	ISERCH30
	A2 = H2/H	ISERCH31
	ISERCH = K	ISERCH32
C		ISERCH33
	RETURN	ISERCH34
50	IF(X.GT.EE(NE)) K=999	ISERCH35
	WRITE(6,1) K,NE	ISERCH36
	RETURN	ISERCH37
	END	ISERCH38
	SUBROUTINE PRECHP	PRECMP 2
C		PRECMP 3
C		PRECMP 4
C		PRECMP 5
	COMMON/LCINDEX/JPBLC,IGLC,IZEROLC,ISPLC,IPLLC,IEGLC,ISGLC,ITCLC,	LCINDEX 2
1	ISTCLC,IRHOLC,ITLC,IELLC,IAJLC,IATLC,NIDIM,NIPDIM,NIBDIM,NGRDIM,	LCINDEX 3
2	NIDDIM,NIRDIM	LCINDEX 4
	COMMON RHO(40,200),T(30,200),P(80),SP(200,6),PP(80),SPP(200,7)	RHO 2
1	SPNGN(200),PL(50,6),G(200,6),RHOFTR(40)	RHO 3
	COMMON/TCOEF/ETC(25,6),TC(25,30),RCD(7),XSPIN(7),NLDIM,	TCOEF 2
1	INPART,NEE(6),NO(6),NTC(6),IZAID(7),XMASS(7),NEEDIM,NLEIN(6,25),	TCOEF 3
2	NLE(6,200),JRAST(200,6)	TCOEF 4
	COMMON/LEVFL1/EL(50),AJ(50),AT(50),XNL(60),ELMAX(60),NLEV DIM	LEVEL1 2
1	,EG(240),SG(240),NGRAYS(60)	LEVEL1 3
	COMMON/BASIC1/NI,XNIP(10),NIR,LR(6,10),ZA1(60),ZA2(60),XM2(60),	BASIC1 2
1	ZACN(10),CSGR(60),CSTOT(60),CSLEV(60),CSID(8),EAVID(8),EAV(60)	BASIC1 3
	COMMON/BASIC2/TITLE(16),ELAB,DE,ZAP,ZAT,XMT, NKKM(10),CNPI(10),	BASIC2 2
1	CNPI(10),S(60),SAC(10),ID1(60),IDP,IOF2(60),IBUF(6,10),	BASIC2 3
2	ECM,UP,NKMAX,NJMAX,NKK(60),NKDIM, TCP(30),QMDP(40),A(60),A2(60),	BASIC2 4
3	NRHO(6),XJT, NPOP MAX,NTC2(6),NJDIM, IOECN(10),NKKCN(10),ECON,	BASIC2 5
4	JPI(40,2),XMP,XJP,PIT,NLP,XNLP,KL,IDSTAT(7),SIC,CSL,CSH,PILL(30)	BASIC2 6
5	ICAPT,PLRUF(50,10),INOPT,TKEEP	BASIC2 7
	COMMON/PREEQ/LPEQ,SIGN,PREQI(6),CSIGI(6),NI7T(6),ALPHA(6)	PREEQ 2
	COMMON/PREQI/EP SIG(200,6),NLEV,NPIT,NIT	PREQI 2
	COMMON/FITTING/ACN,FSIGCN,SIGPEQ	FITTING2
	DIMENSION SPZ(200)	PRECMP15
	DIMENSION PREQ(200),PREQID(6,200) ,SPZID(6,200)	PRECMP16
	DIMENSION PPREP(80),PREP(80)	PRECMP17
	NIP=XNIP(1)	PRECMP18

```

X=0,SY=0.
DO 2000 IP=1,NIP
KMAX=NKMAX
IR=LR(IP,1)
ID=ID1(IR)
IF(ID.EQ.7)GO TO 2000
NK=NK(IR)
IF(NK.LT.1)GO TO 2000
E=(KMAX+.5)*DE
PII=3.14159
GGG=6.*ACN/PII**2
AAA=XMT+1.
NFIN=SQRT(1.5+GGG*E)
XMO=XMASS(ID)*XMT/(XMT+XMASS(ID))
ALPH1=(14.+SIC)*ALPHA(ID)
ALPH=ALPH1/E
PCON=SIGR*(2.*XSPIN(ID)+1.)/(ALPH*12.*PII**2)
PCON=PCON/(AAA*E**3)
NIT=NIT1(ID)
KMAX=NKMAX
EGR=SAC(1)+S(IR)
KGR=EGR/DE
KLM=(UP-SAC(1)-S(IR))/DE+0.5
DO 2 II=1,KLM
U=(KLM-II+.5)*DE
PREQ(1)=0.
DO 4 N=NIT,NFIN,2
PREQ(1)=PREQ(1)+EPSIG(I,ID)*((N-1)*(N+1)**2)*(U/E)**(N-2)
CONTINUE
PREQ(1)=PREQ(1)*PCON
IF(SPP(I,ID).LE.0.)PREQ(1)=0.
PREQID(ID,I)=PREQ(1)
X=X+PREQ(1)SY=Y+SPP(I,ID)
CONTINUE
2000 CONTINUE
IF(Y.LE.0.)PRINT 3006
FRACT1=1.
IF((X.GE.Y).AND.(X'.GT.1.E-99)) FRACT1=Y/X
3006 FORMAT(///25X* ---- SPECTRUM SUM =0. NO PRECMP ----//)
IF(Y.LE.0.)GO TO 3007
FRACT=(1.-X/Y)
IF(FRACT.LE.0.)FRACT=0.
X=X+DESY=Y*DE
DO 3000 IP=1,NIP
IR=LR(IP,1)ID=ID1(IR)
NK=NKK(IR)
IF(ID.EQ.7.OR.NK.LT.1)GO TO 3000
U=0,SPREQ1(ID)=0,CSIG1(ID)=0.
KLM=(UP-SAC(1)-S(IR))/DE+0.5
DO 30 II=1,KLM
PREQ(II)=FRACT1+PREQID(ID,II)
PREQID(ID,II)=PREQ(II)
YY=FRACT*SPP(II,ID)
Z=YY+PREQ(II)
IF(SPP(II,ID).EQ.0.)Z=0.
U=U+DE
I30=KMAX-II
SPZ(II)=Z
SPZID(ID,II)=Z
PREQ1(ID)=PREQ(II)*DE+PREQ1(ID)
CSIG1(ID)=YY*DE+CSIG1(ID)
CONTINUE
3000 CONTINUE

```

```

PRECMP19
PRECMP20
PRECMP21
PRECMP22
PRECMP23
PRECMP24
PRECMP25
PRECMP26
PRECMP27
PRECMP28
JUL29775
PRECMP30
JUL29776
PRECMP32
PRECMP33
PRECMP34
PRECMP35
PRECMP36
PRECMP37
PRECMP38
PRECMP39
PRECMP40
PRECMP41
PRECMP42
PRECMP43
PRECMP44
PRECMP45
PRECMP46
PRECMP47
PRECMP48
PRECMP49
PRECMP50
PRECMP51
PRECMP52
PRECMP53
PRECMP54
PRECMP55
PRECMP56
PRECMP57
PRECMP58
PRECMP59
PRECMP60
PRECMP61
PRECMP68
PRECMP69
PRECMP70
PRECMP71
PRECMP72
PRECMP73
PRECMP74
PRECMP75
PRECMP76
PRECMP77
PRECMP78
PRECMP79
PRECMP80
PRECMP81
PRECMP82
PRECMP83
PRECMP84
PRECMP85
PRECMP86
PRECMP87

```


C		PRECMP88
C	NORMALIZATION OF PREEQ	PRECMP89
C		PRECMP90
	DO 1000 IP=1,NIP	PRECMP91
	IR=LR(IP,1)SID=ID1(IR)	PRECMP92
	NK=NKK(IR)	PRECMP93
	IF(ID.EQ.7.OR.NK.LT.1)GO TO 1000	PRECMP94
	KLM=(UP-SAC(1)-S(IR))/DE+0.5	PRECMP95
	DO 31 I=1,KLM	PRECMP96
31	PREQ(I)=PREQID(ID,I)	PRECMP97
C		PRECMP98
	NK2=NKK(IR)	PRECMP99
		PRECM101
C	MOD OF CONTINUUM	PRECM102
C		PRECM103
C		PRECM104
	NKCN=1	PRECM105
C		PRECM106
C		PRECM108
C		PRECM109
	IB=IBUF(IP,1)	PRECM110
	IF(IB.EQ.0)GO TO 999	PRECM111
	DO 400 K=1,NKCN	PRECM112
	KD=0	PRECM113
	KLOW=K+1	PRECM114
	IF(KLOW-NK2)250,250,400	JUL29777
250	DO 399 KP=KLOW,NK2	JUL29778
	KD=KD+1	PRECM116
	JMAX22=2.*JRAST(KP,IP)	PRECM117
	INDEX=IPBLC+(KP-1)*2*NJDIM+(IB-1)*2*NJDIM*NKDJM	PRECM118
	CALL ECRD(PREP(1),INDEX,JMAX22,IERR)	PRECM119
	DO 300 J=1,JMAX22	PRECM120
	PREP(J)=PREP(J)	PRECM121
	IF(SPP(KD,ID).LE.0.)299,299	PRECM122
298	CONTINUE	PRECM123
	PREQF=(FRACT+PREQ(KD)/SPP(KD,ID))	PRECM124
	PREP(J)=PREP(J)*PREQF	PRECM125
299	CONTINUE	PRECM126
300	CONTINUE	PRECM127
	CALL FCWR(PREP(1),INDEX,JMAX22,IERR)	PRECM128
399	CONTINUE	PRECM129
	I=1	PRECM130
400	CONTINUE	PRECM131
999	CONTINUE	PRECM132
	NLEV=XNL(IR)	PRECM133
	INDEX=IELLC+(IR-1)*NLEVDM	PRECM134
	CALL ECRD(EL,INDEX,NLEV,IERR)	PRECM135
	UUCN=UP-SAC(1)	PRECM136
	UU2MAX=UUCN+S(IR)	PRECM137
	DO 80 II=1,NLEV	PRECM138
	ECC2=UU2MAX-EL(II)	PRECM139
	KKD=ECC2/DE+0.5	PRECM140
	IF(SPP(KKD,ID).LE.0.)GO TO 110	PRECM141
	PL(II,IP)=PL(II,IP)*(FRACT+PREQ(KKD)/SPP(KKD,ID))	PRECM142
110	CONTINUE	PRECM143
80	CONTINUE	PRECM144
	IF(IBUF(IP,1).EQ.0)GO TO 81	PRECM145
	I=1	PRECM146
81	CONTINUE	PRECM147
	DO 401 I=1,KLM	PRECM148
	SP(I,IR)=SPZID(ID,I)SSPP(I,ID)=SPZID(ID,I)	PRECM149
401	CONTINUE	PRECM150
402	CONTINUE	PRECM151

```

1000 CONTINUE
3007 CONTINUE
      RETURN
      END
      SUBROUTINE INTERP(X,Y,NPTS,NTERMS,XIN,YOUT)
      DIMENSION X(1),Y(1),DELTA(10),A(10)

C
C      SEARCH FOR X(1)
C
11      DO 19 I=1,NPTS
      IF(XIN=X(I))13,17,19
13      I1=I-NTERMS/2
      IF(I1.GT.0)GO TO 21
15      I1=1
      GO TO 21
17      YOUT=Y(I)
18      GO TO 61
19      CONTINUE
      I1=NPTS-NTERMS+1
21      I2=I1+NTERMS-1
      IF(NPTS.GE.I2)GO TO 31
23      I2=NPTS
      I1=I2-NTERMS+1
25      IF(I1.GT.0)GO TO 31
26      I1=1
27      NTERMS=I2-I1+1
0
C      EVALUATE DEVIATIONS DATA
31      CONTINUE
      DENOM=X(I1+1)-X(I1)
      IF(DENOM.EQ.0.)100,101
100      YOUT=Y(I1)
      GO TO 61
101      CONTINUE
      DELTAX=(XIN-X(I1))/DENOM
      DO 35 I=1,NTERMS
      IX=I1+I-1
      DELTA(I)=(X(IX)-X(I1))/DENOM
35      CONTINUE
C
C      ACCUM COEF A
C
40      A(1)=Y(I1)
41      DO 50 K=2,NTERMS
      PROD=1.
      SUM=0.
      IMAX=K-1
      IXMAX=I1+IMAX
      DO 49 I=1,IMAX
      J=K-I
      PROD=PROD*(DELTA(K)-DELTA(J))
      SUM=SUM+A(J)/PROD
49      CONTINUE
      A(K)=SUM+Y(IXMAX)/PROD
50      CONTINUE
C
C      ACCUM SUM OF EXPANSION
C
      SUM=A(1)
      DO 57 J=2,NTERMS
      PROD=1.
      IMAX=J-1
      DO 56 I=1,IMAX

```

```

PRECMI52
PRECMI53
PRECMI54
PRECMI55
INTERP 2
INTERP 3
INTERP 4
INTERP 5
INTERP 6
INTERP 7
INTERP 8
INTERP 9
INTERP10
INTERP11
INTERP12
INTERP13
INTERP14
INTERP15
INTERP16
INTERP17
INTERP18
INTERP19
INTERP20
INTERP21
INTERP22
INTERP23
INTERP24
INTERP25
INTERP26
INTERP27
INTERP28
INTERP29
INTERP30
INTERP31
INTERP32
INTERP33
INTERP34
INTERP35
INTERP36
INTERP37
INTERP38
INTERP39
INTERP40
INTERP41
INTERP42
INTERP43
INTERP44
INTERP45
INTERP46
INTERP47
INTERP48
INTERP49
INTERP50
INTERP51
INTERP52
INTERP53
INTERP54
INTERP55
INTERP56
INTERP57
INTERP58
INTERP59
INTERP60

```

DO 56 I=1,IMAX

INTERP01

56 PROD=PROD*(DELTA(X)-DELTA(I))
 CONTINUE
 SUM=SUM+A(J)*PROD
57 CONTINUE
60 YOUT=SUM
61 CONTINUE
 RETURN
 END

INTERP61
INTERP62
INTERP63
INTERP64
INTERP65
INTERP66
INTERP67
INTERP68

APPENDIX B

GROUND2: GROUND-STATE MASS, SPIN AND PARITY DATA FILE

11	14	18	19	30	20	26	29
26	26	16	-4	-3	-34	4	3
13	13	-61	25	-59	43	6	10
-17	22	32	32	38	-33	50	-34
58	18	10	9	11	7	8	8
10	4	7	12	0	18	28	37
48	55	63	71	81	85	92	104
0	198	338	500	709	919	1079	1287
1577	1681	1863	2055				
.100000E+07	.100000E+07	.100000E+07	.100000E+07	.100000E+07	.100000E+07	.807169E+01	
.161434E+02	.242151E+02	.322868E+02	.403585E+02	.484302E+02	.100000E+07		
.100000E+07	.100000E+07	.728922E+01	.131363E+02	.149504E+02	.259000E+02		
.340000E+02	.460000E+02	.585000E+02	.763307E+02	.100000E+07	.100000E+07		
.100000E+07	.149317E+02	.242494E+01	.113900E+02	.175973E+02	.261110E+02		
.316500E+02	.540126E+02	.621981E+02	.100000E+07	.100000E+07	.251300E+02		
.116800E+02	.140875E+02	.149086E+02	.209475E+02	.249660E+02	.353000E+02		
.434000E+02	.672440E+02	.100000E+07	.348700E+02	.183750E+02	.157703E+02		
.494180E+01	.113484E+02	.126001E+02	.201770E+02	.249500E+02	.357200E+02		
.507410E+02	.475554E+02	.279400E+02	.229223E+02	.124157E+02	.120523E+02		
.866795E+01	.133704E+02	.165670E+02	.242300E+02	.294100E+02	.475524E+02		
.355996E+02	.289120E+02	.157027E+02	.186502E+02	.400010E+05	.312527E+01		
.301995E+01	.087350E+01	.136930E+02	.175600E+02	.283000E+02	.414992E+02		
.254500E+02	.173440E+02	.534570E+01	.286302E+01	.101804E+00	.568350E+01		
.787100E+01	.132740E+02	.163500E+02	.250052E+02	.328972E+02	.231060E+02		
.800859E+01	.286110E+01	.473668E+01	.807396E+00	.782496E+00	.333230E+01		
.350000E+01	.106700E+02	.137301E+02	.342073E+02	.176600E+02	.106930E+02		
.195180E+01	.872874E+00	.148610E+01	.156960E+01	.459960E+01	.282800E+01		
.579432E+01	.100070E+02	.237120E+02	.164800E+02	.531900E+01	.175210E+01		
.708170E+01	.573120E+01	.802510E+01	.515000E+01	.594800E+01	.193576E+01		
.926066E+00	.253598E+02	.129800E+02	.684000E+01	.218300E+01	.518290E+01		
.952900E+01	.841670E+01	.935600E+01	.751000E+01	.658000E+01	.382215E+01		
.175100E+02	.109110E+02	.383996E+00	.547240E+01	.139313E+02	.131915E+02		
.162134E+02	.145547E+02	.150170E+02	.125529E+02	.126582E+02	.180500E+02		
.677000E+01	.489960E+01	.891230E+01	.122088E+02	.171950E+02	.168488E+02		
.182130E+02	.158900E+02	.167240E+02	.129243E+02	.107600E+02	.382000E+02		
.714700E+01	.123854E+02	.214911E+02	.218933E+02	.244313E+02	.229479E+02		
.249910E+02	.210651E+02	.208304E+02	.838467E+01	.210004E+00	.715400E+01		
.169500E+02	.202039E+02	.240396E+02	.243042E+02	.263370E+02	.248300E+02		
.249132E+02	.208025E+02	.159162E+01	.315000E+01	.147650E+02	.189980E+02		
.260143E+02	.265860E+02	.299292E+02	.288456E+02	.306659E+02	.269070E+02		
.268630E+02	.375294E+00	.720000E+01	.132630E+02	.210024E+02	.244384E+02		
.290130E+02	.295218E+02	.317615E+02	.298000E+02	.298020E+02	.275400E+02		
.940000E+01	.183950E+02	.230494E+02	.302305E+02	.309474E+02	.347144E+02		
.332400E+02	.350392E+02	.330661E+02	.344200E+02	.318900E+02	.327463E+02		
.298806E+02	.304730E+02	.112500E+02	.173170E+02	.247904E+02	.287920E+02		
.338235E+02	.335341E+02	.355583E+02	.350214E+02	.365020E+02	.358050E+02		
.366110E+02	.354260E+02	.357040E+02	.333807E+02	.132300E+02	.220230E+02		
.272830E+02	.340457E+02	.351371E+02	.385381E+02	.383990E+02	.414636E+02		
.408063E+02	.431387E+02	.423430E+02	.442220E+02	.412920E+02	.395780E+02		
.201185E+02	.205210E+02	.286410E+02	.321070E+02	.361790E+02	.378140E+02		
.410631E+02	.417584E+02	.443289E+02	.444950E+02	.465520E+02	.445450E+02		
.432270E+02	.399582E+02	.202779E+02	.251210E+02	.293200E+02	.375480E+02		
.390007E+02	.441258E+02	.449292E+02	.484856E+02	.485573E+02	.514336E+02		
.497390E+02	.494700E+02	.465660E+02	.456353E+02	.200612E+02	.273295E+02		
.319000E+02	.377714E+02	.420048E+02	.444702E+02	.479561E+02	.492167E+02		
.521974E+02	.514369E+02	.510610E+02	.499300E+02	.493301E+02	.460904E+02		
.242108E+02	.335182E+02	.345000E+02	.420160E+02	.453880E+02	.502557E+02		
.514460E+02	.554150E+02	.552038E+02	.560323E+02	.551210E+02	.552660E+02		
.524991E+02	.520815E+02	.288327E+02	.334957E+02	.377200E+02	.426246E+02		
.482402E+02	.507050E+02	.546865E+02	.555570E+02	.577100E+02	.569087E+02		
.576200E+02	.569600E+02	.557332E+02	.529505E+02	.296617E+02	.374329E+02		
.413293E+02	.483330E+02	.509420E+02	.562517E+02	.574784E+02	.606094E+02		

+.601030E+02	+.621551E+02	+.606700E+02	+.614350E+02	+.590300E+02	+.593966E+02
+.319169E+02	+.373940E+02	+.444751E+02	+.480020E+02	+.540124E+02	+.560412E+02
+.593470E+02	+.590472E+02	+.622357E+02	+.616556E+02	+.629200E+02	+.615300E+02
+.618630E+02	+.601120E+02	+.125189E+02	+.190916E+02	+.287213E+02	+.340710E+02
+.424793E+02	+.479704E+02	+.539080E+02	+.561040E+02	+.602350E+02	+.611626E+02
+.644792E+02	+.642270E+02	+.667519E+02	+.655215E+02	+.671093E+02	+.651330E+02
+.662620E+02	+.632000E+02	+.220830E+02	+.280396E+02	+.387301E+02	+.438107E+02
+.497644E+02	+.916690E+02	+.563630E+02	+.583520E+02	+.619818E+02	+.628050E+02
+.655874E+02	+.654318E+02	+.672640E+02	+.662598E+02	+.673020E+02	+.654200E+02
+.659400E+02	+.632075E+02	+.361565E+02	+.410192E+02	+.461136E+02	+.498766E+02
+.541930E+02	+.565800E+02	+.611150E+02	+.622220E+02	+.660064E+02	+.659141E+02
+.688945E+02	+.678767E+02	+.700043E+02	+.684162E+02	+.695597E+02	+.673320E+02
+.681310E+02	+.651689E+02	+.397151E+02	+.428894E+02	+.499122E+02	+.512830E+02
+.567200E+02	+.589340E+02	+.626550E+02	+.637190E+02	+.668760E+02	+.651330E+02
+.693230E+02	+.689060E+02	+.701381E+02	+.695876E+02	+.697400E+02	+.679200E+02
+.685400E+02	+.645800E+02	+.437306E+02	+.467574E+02	+.540190E+02	+.563600E+02
+.616170E+02	+.624500E+02	+.666980E+02	+.670975E+02	+.705395E+02	+.699233E+02
+.725807E+02	+.712932E+02	+.734224E+02	+.718410E+02	+.732136E+02	+.711600E+02
+.717800E+02	+.693900E+02	+.459347E+02	+.504423E+02	+.560974E+02	+.580437E+02
+.631300E+02	+.643330E+02	+.678940E+02	+.682300E+02	+.709540E+02	+.708587E+02
+.730297E+02	+.722862E+02	+.739170E+02	+.727600E+02	+.736900E+02	+.717600E+02
+.725900E+02	+.705530E+02	+.535412E+02	+.562485E+02	+.615868E+02	+.628900E+02
+.676300E+02	+.682140E+02	+.722130E+02	+.721649E+02	+.752546E+02	+.746014E+02
+.770268E+02	+.759330E+02	+.777570E+02	+.763870E+02	+.775870E+02	+.754400E+02
+.759200E+02	+.726914E+02	+.564326E+02	+.589439E+02	+.635100E+02	+.652100E+02
+.691550E+02	+.701500E+02	+.732369E+02	+.734530E+02	+.760741E+02	+.750853E+02
+.779740E+02	+.775030E+02	+.790180E+02	+.777300E+02	+.786700E+02	+.759600E+02
+.742000E+02	+.709228E+02	+.621100E+02	+.640500E+02	+.691500E+02	+.702370E+02
+.741470E+02	+.704430E+02	+.778960E+02	+.776800E+02	+.805910E+02	+.799870E+02
+.824332E+02	+.814726E+02	+.832613E+02	+.807000E+02	+.797020E+02	+.765600E+02
+.748900E+02	+.715000E+02	+.670567E+02	+.709200E+02	+.721020E+02	+.752020E+02
+.761940E+02	+.789490E+02	+.797530E+02	+.821596E+02	+.827383E+02	+.845926E+02
+.826040E+02	+.817100E+02	+.793000E+02	+.780000E+02	+.750200E+02	+.730500E+02
+.696176E+02	+.677659E+02	+.634302E+02	+.703588E+02	+.716200E+02	+.755900E+02
+.766990E+02	+.806390E+02	+.810960E+02	+.845094E+02	+.848661E+02	+.879076E+02
+.861960E+02	+.859279E+02	+.836840E+02	+.829200E+02	+.799500E+02	+.787400E+02
+.755400E+02	+.741857E+02	+.700380E+02	+.683543E+02	+.681409E+02	+.722000E+02
+.736900E+02	+.778360E+02	+.792360E+02	+.829840E+02	+.842800E+02	+.848566E+02
+.864739E+02	+.863490E+02	+.848340E+02	+.842540E+02	+.822600E+02	+.812360E+02
+.786300E+02	+.768300E+02	+.737288E+02	+.718211E+02	+.678574E+02	+.711049E+02
+.729400E+02	+.779400E+02	+.794840E+02	+.836100E+02	+.848510E+02	+.687626E+02
+.878935E+02	+.884569E+02	+.871437E+02	+.872631E+02	+.856660E+02	+.854260E+02
+.829330E+02	+.812730E+02	+.783600E+02	+.770900E+02	+.729000E+02	+.726145E+02
+.687930E+02	+.742800E+02	+.764100E+02	+.809800E+02	+.826520E+02	+.866320E+02
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+.835100E+02	+.828600E+02	+.801900E+02	+.794000E+02	+.762000E+02	+.753382E+02
+.718365E+02	+.718100E+02	+.750100E+02	+.801650E+02	+.821880E+02	+.868084E+02
+.868090E+02	+.884099E+02	+.877133E+02	+.887959E+02	+.875402E+02	+.881109E+02
+.859560E+02	+.861851E+02	+.835040E+02	+.836000E+02	+.805000E+02	+.801900E+02
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+.834500E+02	+.860730E+02	+.860400E+02	+.882230E+02	+.876202E+02	+.892219E+02
+.879557E+02	+.891002E+02	+.872530E+02	+.880940E+02	+.859300E+02	+.863230E+02
+.837100E+02	+.837100E+02	+.807255E+02	+.800638E+02	+.729964E+02	+.784500E+02
+.796300E+02	+.825500E+02	+.831660E+02	+.855680E+02	+.855920E+02	+.874020E+02
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+.858300E+02	+.851100E+02	+.829400E+02	+.819186E+02	+.792349E+02	+.766824E+02
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+.876060E+02	+.883400E+02	+.860200E+02	+.862800E+02	+.834117E+02	+.832950E+02
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-.853114E+02	-.170740E+02	-.169280E+02	-.304448E+02	-.176450E+02	-.117219E+02
-.874555E+02	-.882240E+02	-.865800E+02	-.870350E+02	-.850100E+02	-.849100E+02
-.824200E+02	-.701753E+02	-.741956E+02	-.754800E+02	-.794700E+02	-.803800E+02
-.840130E+02	-.842800E+02	-.871320E+02	-.869910E+02	-.892480E+02	-.885390E+02
-.903464E+02	-.892516E+02	-.902576E+02	-.890440E+02	-.900142E+02	-.880900E+02
-.887150E+02	-.864080E+02	-.867040E+02	-.842100E+02	-.838867E+02	-.808251E+02
-.807374E+02	-.777437E+02	-.771780E+02	-.740533E+02	-.732636E+02	-.699719E+02
-.687532E+02	-.683704E+02	-.696700E+02	-.737800E+02	-.755100E+02	-.791800E+02
-.803900E+02	-.835000E+02	-.841000E+02	-.865200E+02	-.864200E+02	-.884260E+02
-.879800E+02	-.893420E+02	-.895840E+02	-.895410E+02	-.887480E+02	-.889290E+02
-.874500E+02	-.877140E+02	-.854900E+02	-.858200E+02	-.832400E+02	-.834200E+02
-.808300E+02	-.874427E+02	-.778720E+02	-.771294E+02	-.742997E+02	-.731560E+02
-.781173E+02	-.658800E+02	-.709100E+02	-.725800E+02	-.770900E+02	-.787000E+02
-.820000E+02	-.827200E+02	-.858240E+02	-.859180E+02	-.866480E+02	-.863170E+02
-.905650E+02	-.900270E+02	-.915218E+02	-.903926E+02	-.916483E+02	-.900616E+02
-.910943E+02	-.892027E+02	-.899356E+02	-.878090E+02	-.882290E+02	-.858900E+02
-.860130E+02	-.835100E+02	-.834000E+02	-.804444E+02	-.790127E+02	-.767000E+02
-.756564E+02	-.631800E+02	-.656900E+02	-.701000E+02	-.722000E+02	-.762200E+02
-.776200E+02	-.810200E+02	-.818500E+02	-.844190E+02	-.848700E+02	-.869970E+02
-.870200E+02	-.886400E+02	-.879530E+02	-.894830E+02	-.884140E+02	-.895899E+02
-.883256E+02	-.862191E+02	-.876142E+02	-.882620E+02	-.863300E+02	-.867900E+02
-.647000E+02	-.845910E+02	-.823500E+02	-.820900E+02	-.795900E+02	-.790000E+02
-.733794E+02	-.600500E+02	-.652900E+02	-.674200E+02	-.721200E+02	-.736700E+02
-.776500E+02	-.785200E+02	-.821700E+02	-.824600E+02	-.854600E+02	-.851500E+02
-.876500E+02	-.871800E+02	-.894020E+02	-.885900E+02	-.903630E+02	-.901620E+02
-.905141E+02	-.890273E+02	-.900649E+02	-.882890E+02	-.889889E+02	-.870040E+02
-.873454E+02	-.851910E+02	-.851930E+02	-.829000E+02	-.825700E+02	-.777800E+02
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-.734700E+02	-.769600E+02	-.781600E+02	-.808400E+02	-.815500E+02	-.839000E+02
-.841000E+02	-.862200E+02	-.861600E+02	-.879600E+02	-.873540E+02	-.888793E+02
-.879140E+02	-.889814E+02	-.877351E+02	-.885030E+02	-.868800E+02	-.874432E+02
-.856980E+02	-.858600E+02	-.839700E+02	-.837760E+02	-.794200E+02	-.768100E+02
-.727766E+02	-.555988E+02	-.605741E+02	-.625914E+02	-.671987E+02	-.694900E+02
-.736600E+02	-.747700E+02	-.782500E+02	-.790000E+02	-.819000E+02	-.824300E+02
-.850600E+02	-.852900E+02	-.874500E+02	-.871400E+02	-.891650E+02	-.883170E+02
-.898601E+02	-.886940E+02	-.898801E+02	-.884140E+02	-.892784E+02	-.876600E+02
-.881230E+02	-.865220E+02	-.864230E+02	-.822130E+02	-.800700E+02	-.759800E+02
-.732420E+02	-.810900E+02	-.815500E+02	-.840700E+02	-.841600E+02	-.862270E+02
-.859530E+02	-.875900E+02	-.868570E+02	-.880590E+02	-.871790E+02	-.880870E+02
-.869060E+02	-.876590E+02	-.863600E+02	-.865610E+02	-.828700E+02	-.807800E+02
-.775400E+02	-.748700E+02	-.710700E+02	-.795700E+02	-.823600E+02	-.827300E+02
-.852500E+02	-.851500E+02	-.872970E+02	-.867190E+02	-.884510E+02	-.875720E+02
-.889650E+02	-.878680E+02	-.889040E+02	-.877340E+02	-.882740E+02	-.849260E+02
-.832410E+02	-.799700E+02	-.777700E+02	-.740100E+02	-.718000E+02	-.777300E+02
-.784500E+02	-.811500E+02	-.816000E+02	-.837600E+02	-.837400E+02	-.856700E+02
-.852550E+02	-.868300E+02	-.860300E+02	-.872300E+02	-.864800E+02	-.871860E+02
-.842767E+02	-.829690E+02	-.799700E+02	-.792100E+02	-.749000E+02	-.729100E+02
-.694400E+02	-.761962E+02	-.793065E+02	-.794600E+02	-.823400E+02	-.823700E+02
-.847500E+02	-.845300E+02	-.864620E+02	-.860300E+02	-.875360E+02	-.869110E+02
-.880420E+02	-.853990E+02	-.844870E+02	-.815930E+02	-.884030E+02	-.771100E+02
-.757400E+02	-.722300E+02	-.706800E+02	-.742923E+02	-.750600E+02	-.781059E+02
-.785500E+02	-.809500E+02	-.812600E+02	-.832800E+02	-.830990E+02	-.847990E+02
-.846540E+02	-.859800E+02	-.837520E+02	-.830380E+02	-.807190E+02	-.795990E+02
-.768200E+02	-.754300E+02	-.724800E+02	-.713800E+02	-.686600E+02	-.722634E+02
-.755467E+02	-.763000E+02	-.788000E+02	-.792800E+02	-.818000E+02	-.820000E+02
-.841800E+02	-.841750E+02	-.859160E+02	-.839700E+02	-.837160E+02	-.814040E+02
-.808900E+02	-.781290E+02	-.773810E+02	-.743770E+02	-.736620E+02	-.708990E+02
-.701267E+02	-.703345E+02	-.712640E+02	-.744951E+02	-.752684E+02	-.775000E+02
-.782830E+02	-.804500E+02	-.811000E+02	-.829010E+02	-.813400E+02	-.812340E+02
-.794210E+02	-.790230E+02	-.768520E+02	-.760460E+02	-.735300E+02	-.733650E+02
-.713530E+02	-.707400E+02	-.684500E+02	-.680765E+02	-.715358E+02	-.723531E+02
-.752745E+02	-.760500E+02	-.790500E+02	-.794220E+02	-.819040E+02	-.805960E+02
-.809470E+02	-.792480E+02	-.793170E+02	-.771180E+02	-.770330E+02	-.745530E+02

747400E+02	723400E+02	724310E+02	701290E+02	693700E+02	636620E+02
668720E+02	701692E+02	713875E+02	744200E+02	755770E+02	770760E+02
770750E+02	774860E+02	762170E+02	763600E+02	747190E+02	746290E+02
728630E+02	733470E+02	717130E+02	718190E+02	700720E+02	694610E+02
672500E+02	659200E+02	635300E+02	621724E+02	592427E+02	574750E+02
539323E+02	629867E+02	667580E+02	681373E+02	718800E+02	728800E+02
758800E+02	751580E+02	762070E+02	780720E+02	757280E+02	741650E+02
746910E+02	731060E+02	736910E+02	720650E+02	725240E+02	708210E+02
706800E+02	685530E+02	679340E+02	654940E+02	642900E+02	620074E+02
609320E+02	571640E+02	553164E+02	625478E+02	624901E+02	668294E+02
677800E+02	705600E+02	705900E+02	713750E+02	710600E+02	715570E+02
708710E+02	713100E+02	702900E+02	712200E+02	702200E+02	707570E+02
694400E+02	695030E+02	678130E+02	674450E+02	656900E+02	646700E+02
625900E+02	607045E+02	579330E+02	562081E+02	529554E+02	582119E+02
623942E+02	642165E+02	677900E+02	674800E+02	691000E+02	685520E+02
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703840E+02	691380E+02	696480E+02	680270E+02	681510E+02	663510E+02
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649550E+02	648730E+02	668440E+02	622800E+02	620800E+02	587500E+02
563900E+02	544163E+02	515466E+02	531970E+02	579000E+02	582000E+02
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649100E+02	643400E+02	659300E+02	651610E+02	662990E+02	691340E+02
659100E+02	645010E+02	649040E+02	632600E+02	629800E+02	608990E+02
600910E+02	577000E+02	564800E+02	534200E+02	521077E+02	509000E+02
519300E+02	539000E+02	544900E+02	563100E+02	566900E+02	581900E+02
583100E+02	601400E+02	601300E+02	616400E+02	616000E+02	627170E+02
619560E+02	629360E+02	618690E+02	625210E+02	612000E+02	612510E+02
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426900E+02	439300E+02	463100E+02	471100E+02	489400E+02	495300E+02
516400E+02	522000E+02	542200E+02	544600E+02	561800E+02	561100E+02
575000E+02	571900E+02	580740E+02	573010E+02	579000E+02	567400E+02
568450E+02	555620E+02	551490E+02	533700E+02	523710E+02	501700E+02
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528680E+02	524220E+02	504500E+02	497660E+02	473890E+02	459000E+02
432190E+02	277361E+02	307684E+02	320957E+02	348350E+02	357814E+02
415200E+02	424600E+02	448800E+02	456100E+02	478000E+02	481900E+02
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484120E+02	464030E+02	452590E+02	426370E+02	413000E+02	385800E+02
249025E+02	281628E+02	293871E+02	327844E+02	377800E+02	406100E+02
414000E+02	439900E+02	443000E+02	466000E+02	465900E+02	485400E+02
483500E+02	498600E+02	493400E+02	504600E+02	497100E+02	504200E+02
492300E+02	496500E+02	482250E+02	482000E+02	463270E+02	456670E+02
433450E+02	424750E+02	398700E+02	386340E+02	354400E+02	286629E+02
243342E+02	260315E+02	337000E+02	349900E+02	375000E+02	384000E+02
406900E+02	412400E+02	431500E+02	434600E+02	450400E+02	449600E+02
461100E+02	457600E+02	465400E+02	498600E+02	464300E+02	453480E+02
457710E+02	440600E+02	437740E+02	418810E+02	411810E+02	389830E+02
379420E+02	354900E+02	344600E+02	318085E+02	108713E+02	228026E+02
296000E+02	326000E+02	334900E+02	361400E+02	367500E+02	390600E+02
393400E+02	413600E+02	414100E+02	429600E+02	427400E+02	439600E+02
434000E+02	442500E+02	433700E+02	441580E+02	427590E+02	429580E+02

-.411840E+02	-.411010E+02	-.389700E+02	-.389740E+02	-.361620E+02	-.348500E+02
-.333670E+02	-.323970E+02	-.298500E+02	-.152437E+02	-.252300E+02	-.266200E+02
-.293000E+02	-.303700E+02	-.327400E+02	-.335800E+02	-.355900E+02	-.359600E+02
-.376400E+02	-.378600E+02	-.391000E+02	-.389500E+02	-.399700E+02	-.394400E+02
-.402600E+02	-.391270E+02	-.396800E+02	-.382680E+02	-.384500E+02	-.366200E+02
-.366720E+02	-.347990E+02	-.344990E+02	-.324940E+02	-.318510E+02	-.294600E+02
-.284100E+02	-.255100E+02	-.208400E+02	-.240000E+02	-.249700E+02	-.268100E+02
-.286800E+02	-.310700E+02	-.316500E+02	-.336800E+02	-.338500E+02	-.355900E+02
-.354800E+02	-.369400E+02	-.364600E+02	-.375000E+02	-.367800E+02	-.377280E+02
-.365500E+02	-.372930E+02	-.356720E+02	-.362560E+02	-.344380E+02	-.347330E+02
-.327860E+02	-.326350E+02	-.304140E+02	-.299060E+02	-.274000E+02	-.266100E+02
-.235000E+02	-.108105E+02	-.206200E+02	-.218900E+02	-.243400E+02	-.253800E+02
-.274200E+02	-.280900E+02	-.297500E+02	-.301400E+02	-.314900E+02	-.315000E+02
-.327500E+02	-.324300E+02	-.335500E+02	-.328900E+02	-.337700E+02	-.327420E+02
-.334400E+02	-.322240E+02	-.325570E+02	-.311530E+02	-.311610E+02	-.296020E+02
-.290900E+02	-.273100E+02	-.261600E+02	-.238500E+02	-.227700E+02	-.201900E+02
-.161300E+02	-.193000E+02	-.201200E+02	-.226600E+02	-.234200E+02	-.255900E+02
-.259300E+02	-.279600E+02	-.279100E+02	-.295200E+02	-.293500E+02	-.308900E+02
-.304700E+02	-.318400E+02	-.311000E+02	-.321740E+02	-.311600E+02	-.318370E+02
-.307460E+02	-.309750E+02	-.295520E+02	-.295090E+02	-.276620E+02	-.273460E+02
-.252670E+02	-.246860E+02	-.222820E+02	-.209370E+02	-.170674E+02	-.215100E+02
-.219200E+02	-.236500E+02	-.238900E+02	-.254700E+02	-.255400E+02	-.269000E+02
-.266700E+02	-.279600E+02	-.274400E+02	-.283500E+02	-.275100E+02	-.261500E+02
-.270550E+02	-.272500E+02	-.261000E+02	-.257580E+02	-.243420E+02	-.238110E+02
-.222440E+02	-.210140E+02	-.167490E+02	-.136320E+02	-.922400E+01	-.652614E+01
-.187044E+01	-.169500E+02	-.191900E+02	-.194700E+02	-.215400E+02	-.210000E+02
-.234700E+02	-.233600E+02	-.250400E+02	-.246500E+02	-.260100E+02	-.235000E+02
-.263500E+02	-.254500E+02	-.260590E+02	-.247760E+02	-.251050E+02	-.237680E+02
-.237770E+02	-.224460E+02	-.217430E+02	-.176090E+02	-.147200E+02	-.104630E+02
-.754400E+01	-.313000E+01	-.146996E+00	-.123700E+02	-.129400E+02	-.150000E+02
-.153700E+02	-.172600E+02	-.174400E+02	-.191500E+02	-.191100E+02	-.205520E+02
-.203500E+02	-.214500E+02	-.208600E+02	-.215900E+02	-.207100E+02	-.210640E+02
-.201250E+02	-.200410E+02	-.188750E+02	-.182570E+02	-.147830E+02	-.118390E+02
-.811700E+01	-.522600E+01	-.118300E+01	-.173000E+01	-.599000E+01	-.740000E+01
-.978000E+01	-.103000E+02	-.124600E+02	-.127600E+02	-.147400E+02	-.148600E+02
-.166300E+02	-.164200E+02	-.178900E+02	-.174300E+02	-.184500E+02	-.177800E+02
-.183080E+02	-.171320E+02	-.174640E+02	-.163640E+02	-.159440E+02	-.124290E+02
-.103640E+02	-.664700E+01	-.446000E+01	-.513996E+00	-.178600E+01	-.597000E+01
-.839000E+01	-.332000E+01	-.547000E+01	-.606000E+01	-.806000E+01	-.842000E+01
-.102500E+02	-.104300E+02	-.119200E+02	-.118600E+02	-.130100E+02	-.126200E+02
-.132900E+02	-.125400E+02	-.128820E+02	-.120690E+02	-.116370E+02	-.862400E+01
-.657800E+01	-.340900E+01	-.125400E+01	-.226000E+01	-.439800E+01	-.811700E+01
-.105400E+02	-.142200E+02	-.168519E+02	-.292019E+01	-.302000E+01	-.347000E+01
-.555000E+01	-.580000E+01	-.766000E+01	-.761000E+01	-.908000E+01	-.875000E+01
-.975000E+01	-.912000E+01	-.972300E+01	-.874100E+01	-.864800E+01	-.569600E+01
-.431000E+01	-.116500E+01	-.262004E+00	-.366620E+01	-.523200E+01	-.885600E+01
-.106160E+02	-.143900E+02	-.164020E+02	-.203998E+02	-.227885E+02	-.679480E+01
-.164000E+01	-.112000E+01	-.769996E+00	-.108000E+01	-.259000E+01	-.266000E+01
-.380000E+01	-.352000E+01	-.420000E+01	-.358000E+01	-.355400E+01	-.105600E+01
-.331004E+00	-.297600E+01	-.431800E+01	-.701300E+01	-.861400E+01	-.114830E+02
-.132800E+02	-.163640E+02	-.184060E+02	-.217300E+02	-.241510E+02	-.276424E+02
-.301661E+02	-.863641E+01	-.429000E+01	-.389000E+01	-.203000E+01	-.196000E+01
-.502004E+00	-.710004E+00	-.299996E+00	-.170004E+00	-.259960E+01	-.254700E+01
-.325700E+01	-.589000E+01	-.666200E+01	-.939200E+01	-.102790E+02	-.129740E+02
-.143360E+02	-.172570E+02	-.188200E+02	-.220110E+02	-.236940E+02	-.272010E+02
-.289620E+02	-.327000E+02	-.345900E+02	-.127550E+02	-.939000E+01	-.895000E+01
-.746000E+01	-.729000E+01	-.612000E+01	-.625000E+01	-.597000E+01	-.803000E+01
-.867000E+01	-.107460E+02	-.115820E+02	-.137480E+02	-.145290E+02	-.165690E+02
-.178210E+02	-.202310E+02	-.216390E+02	-.243270E+02	-.258710E+02	-.289070E+02
-.307000E+02	-.337000E+02	-.359300E+02	-.391700E+02	-.416164E+02	-.162860E+02
-.143553E+02	-.122200E+02	-.107500E+02	-.108000E+02	-.102000E+02	-.120200E+02
-.123000E+02	-.143700E+02	-.146800E+02	-.169430E+02	-.172150E+02	-.192710E+02
-.200000E+02	-.223190E+02	-.232120E+02	-.258270E+02	-.267700E+02	-.296040E+02

.300000E+02	.330200E+02	.354670E+02	.307520E+02	.406450E+02	.444233E+02
.469190E+02	.218812E+02	.199649E+02	.192296E+02	.178733E+02	.191150E+02
.194177E+02	.206954E+02	.207211E+02	.218700E+02	.223520E+02	.237990E+02
.243310E+02	.259800E+02	.268270E+02	.288830E+02	.298990E+02	.321900E+02
.334430E+02	.359530E+02	.375080E+02	.403820E+02	.423300E+02	.455600E+02
.417710E+02	.513000E+02	.536906E+02	.289000E+02	.292360E+02	.312160E+02
.316280E+02	.338000E+02	.346080E+02	.369370E+02	.381680E+02	.409340E+02
.424630E+02	.454070E+02	.473350E+02	.506040E+02	.527420E+02	.563615E+02
.589672E+02	.337680E+02	.352030E+02	.356500E+02	.373100E+02	.380200E+02
.399760E+02	.410570E+02	.434370E+02	.448890E+02	.474810E+02	.493260E+02
.522300E+02	.543300E+02	.575400E+02	.599204E+02	.634461E+02	.385826E+02
.383600E+02	.400570E+02	.403630E+02	.421900E+02	.429000E+02	.451130E+02
.461860E+02	.486720E+02	.501400E+02	.529720E+02	.547420E+02	.577770E+02
.598310E+02	.631800E+02	.653200E+02	.431365E+02	.444360E+02	.446200E+02
.462300E+02	.466500E+02	.484900E+02	.494760E+02	.515400E+02	.529510E+02
.554940E+02	.571690E+02	.598980E+02	.619220E+02	.649400E+02	.671600E+02
.705200E+02	.480455E+02	.479900E+02	.491800E+02	.494190E+02	.511100E+02
.577100E+02	.513730E+02	.548270E+02	.571960E+02	.584690E+02	.610200E+02
.626410E+02	.655560E+02	.674170E+02	.707760E+02	.730700E+02	.529114E+02
.542500E+02	.543000E+02	.557200E+02	.561200E+02	.578300E+02	.587020E+02
.607400E+02	.618400E+02	.642400E+02	.655000E+02	.680100E+02	.698680E+02
.729700E+02	.752000E+02	.785600E+02	.579543E+02	.581300E+02	.592100E+02
.593530E+02	.609300E+02	.614740E+02	.634030E+02	.641210E+02	.662200E+02
.672640E+02	.697420E+02	.711950E+02	.741530E+02	.760590E+02	.793370E+02
.814320E+02	.634320E+02	.644600E+02	.645576E+02	.659800E+02	.664500E+02
.679700E+02	.685780E+02	.703200E+02	.711460E+02	.732000E+02	.745170E+02
.771800E+02	.790380E+02	.820210E+02	.841100E+02	.872800E+02	.691821E+02
.689260E+02	.699975E+02	.701510E+02	.715600E+02	.719000E+02	.735300E+02
.742940E+02	.760100E+02	.768420E+02	.793730E+02	.809340E+02	.838210E+02
.855180E+02	.886280E+02	.100000E+03	.757969E+02	.761659E+02	.763916E+02
.773100E+02	.773300E+02	.786500E+02	.790500E+02	.805900E+02	.812700E+02
.834200E+02	.848900E+02	.875100E+02	.890600E+02	.100000E+03	.100000E+03
.100000E+03	.818920E+02	.813690E+02	.815832E+02	.818785E+02	.827800E+02
.828710E+02	.843520E+02	.847540E+02	.868700E+02	.878200E+02	.902490E+02
.100000E+03	.100000E+03	.100000E+03	.100000E+03	.100000E+03	.876330E+02
.889951E+02	.883430E+02	.890848E+02	.887721E+02	.896606E+02	.902077E+02
.918200E+02	.927800E+02	.100000E+03	.100000E+03	.100000E+03	.100000E+03
.100000E+03	.100000E+03	.100000E+03	.100000E+03	.100000E+03	.100000E+03
.0.000	.0.000	.0.000	.0.000	.0.000	.0.000
.0.000	.0.000	.0.000	.0.000	.0.000	.0.000
100.500	9999.000	9999.000	9999.000	9999.000	9999.000
.0.000	100.500	100.000	=98.500	100.000	9999.000
100.000	.0.000	.0.000	9999.000	=98.500	101.000
=98.500	9999.000	9999.000	9999.000	.0.000	9999.000
100.000	=98.500	100.000	100.500	100.000	9999.000
9999.000	102.000	=98.500	103.000	=98.500	101.000
9999.000	9999.000	100.000	=98.500	100.000	=99.500
100.000	100.500	100.000	9999.000	100.000	9999.000
=99.500	101.000	=99.500	=98.000	=99.500	9999.000
100.000	9999.000	100.000	=99.500	100.000	102.500
100.000	9999.000	100.000	9999.000	=100.000	102.500
100.500	102.000	102.500	9999.000	9999.000	100.000
100.000	100.500	100.000	101.500	100.000	102.500
100.000	9999.000	9999.000	102.000	101.500	103.000
102.500	100.000	9999.000	100.000	102.500	100.000
100.000	102.500	100.000	100.500	100.000	101.500
100.000	102.500	100.000	100.500	100.000	9999.000
102.500	104.000	102.500	105.000	102.500	103.000
9999.000	9999.000	100.000	102.500	100.000	102.500
100.000	101.500	100.000	9999.000	100.000	9999.000
100.500	101.000	100.500	101.000	100.500	101.000
100.000	9999.000	100.000	100.500	100.000	101.500
100.000	=96.500	100.000	9999.000	9999.000	102.000
101.500	102.000	101.500	=98.000	101.500	100.000

B-8

B-9

100.000	9999.000	100.000	9999.000	100.000	9999.000	100.000	999.500
100.000	9999.000	100.000	9999.000	100.000	104.500	100.000	101.500
100.000	9999.000	100.000	9999.000	100.000	9999.000	9999.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000
9999.000	-99.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000
9999.000	9999.000	101.500	9999.000	9999.000	9999.000	9999.000	9999.000
100.000	9999.000	100.000	9999.000	100.000	9999.000	100.000	9999.000
100.000	9999.000	100.000	9999.000	100.000	9999.000	100.000	9999.000
100.000	100.500	100.000	-97.500	100.000	9999.000	100.000	9999.000
100.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000
-97.500	9999.000	-98.500	9999.000	-98.500	103.000	9999.000	9999.000
9999.000	9999.000	9999.000	9999.000	100.000	9999.000	100.000	9999.000
100.000	9999.000	100.000	9999.000	100.000	9999.000	100.000	9999.000
100.000	101.500	100.000	101.500	100.000	102.500	100.000	102.500
100.000	100.500	100.000	9999.000	100.000	9999.000	9999.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000
9999.000	9999.000	-97.500	103.000	-97.500	-98.000	-98.500	9999.000
-98.500	104.000	-98.500	-99.000	-98.500	9999.000	9999.000	9999.000
100.000	101.500	100.000	-97.500	100.000	102.500	100.000	-96.500
100.000	100.500	100.000	102.500	100.000	9999.000	100.000	9999.000
9999.000	9999.000	9999.000	9999.000	100.000	102.500	-94.000	102.500
102.000	102.500	105.000	102.500	9999.000	9999.000	9999.000	9999.000
100.000	9999.000	100.000	102.500	100.000	-96.500	100.000	100.000
100.000	102.500	100.000	103.500	100.000	-95.500	100.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	-97.500	-97.000	-97.500
-99.000	-97.500	-94.000	102.500	102.000	9902.500	9999.000	9999.000
100.000	9999.000	100.000	9999.000	100.000	100.500	100.000	102.500
100.000	103.500	100.000	-95.500	100.000	100.500	100.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	-98.500	-96.000	-98.500
-98.000	-98.500	-92.000	103.500	-98.000	103.500	9999.000	9999.000
100.000	9999.000	100.000	9999.000	100.000	100.500	100.000	103.500
100.000	-95.500	100.000	100.500	100.000	103.500	100.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	103.500
9999.000	-98.500	107.000	103.500	107.000	9999.000	9999.000	9999.000
100.000	9999.000	100.000	9999.000	100.000	103.500	100.000	9999.000
100.000	100.500	100.000	103.500	100.000	104.500	0.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000
9999.000	-96.500	-100.000	9999.000	0.000	0.000	0.000	9999.000
100.000	9999.000	100.000	9999.000	100.000	-95.500	100.000	100.000
100.000	9999.000	0.000	0.000	0.000	0.000	0.000	9999.000
9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000	9999.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

APPENDIX C

SAMPLE PROBLEM INPUT FOR MAIN PROGRAM

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N + CO-59 -- H=1 AND HE-4 PRODUCTION -- 10 TO 40 MEV RUNS
APRIL 7, 1977 -- STANDARD PARAMETERS
  1  0  0  3  1
-1 12 12  4  0
  5  3  2  1
1.      27059.      1.
  1
14.
27060.  4.      -0.683  1.      1001.  2004.
26059.  4.      -1.008  1.      1001.  2004.
25056.  4.      -1.003  1.      1001.  2004.
27059.  4.      -0.173  1.      1001.  2004.
27058.  4.      -0.476  1.      1001.  2004.
      E1  1.
      M1  0.
      E2  0.
0.      0.      .001  .001  .001  .003

```

APPENDIX D

SAMPLE PROBLEM SUPPLEMENTARY INPUT: DISCRETE-LEVEL DATA AND TRANSMISSION COEFFICIENTS

23052	7		99.	52.		99.	040676		23052
1	0.		3.	99.	99.		0		23052
2	.0172		2.	99.	99.		1.		23052
	1	1	1.		1.	99.	99 99		23052
3	.0228		4.	99.	99.		1.		23052
	1	1	1.		1.	99.	99 99		23052
4	.1416		1.	99.	99.		1.		23052
	1	2	1.		1.	99.	99 99		23052
5	.1478		3.	99.	99.		2.		23052
	1	1	.17		1.	99.	99 99		23052
	2	3	.83		1.	99.	99 99		23052
6	.4366		2.	99.	99.		3.		23052
	1	1	.48		1.	99.	99 99		23052
	2	2	.31		1.	99.	99 99		23052
	3	4	.21		1.	99.	99 99		23052
7	.7935		2.	99.	99.		2.		23052
	1	3	.80		1.	99.	99 99		23052
	2	1	.2		1.	99.	99 99		23052
24055	5		99.	99.			092976		24055
1	0.		=1.5	99.	99.		0		24055
2	.240		=0.5	99.	99.		1.		24055
	1	1	1.		1.	99.	99 99		24055
3	.521		=2.5	99.	99.		2.		24055
	1	1	.6		1.	99.	99 99		24055
	2	2	.4		1.	99.	99 99		24055
4	.572		=1.5	99.	99.		1.		24055
	1	3	1.		1.	99.	99 99		24055
5	.885		=2.5	99.	99.		1		24055
	1	4	1.		1.	99.	99 99		24055
25052	3	99.000000	99.000000	=0.000000	929760				25052
1	0.000000	6.0	99.0	.99000E+02	0				25052
2	.377800	2.0	99.0	.99000E+02	1				25052
	1	1	1.000000	1.000000	.99000E+02	99 99			25052
3	.546000	1.0	99.0	.99000E+02	1				25052
	1	2	1.000000	1.000000	.99000E+02	99 99			25052
25053	3	99.000000	99.000000	=0.000000	929760				25053
1	0.000000	=3.5	99.0	.99000E+02	0				25053
2	.377500	=2.5	99.0	.99000E+02	1				25053
	1	1	1.000000	1.000000	.99000E+02	99 99			25053
3	1.288400	1.5	99.0	.99000E+02	2				25053
	1	1	.600000	1.000000	.99000E+02	99 99			25053
	2	2	.400000	1.000000	.99000E+02	99 99			25053
25054	1	0.000000	53.940357	=55.557000	100975				25054
1	0.000000	3.0	99.0	.27000E+00	0				25054
25055	7	99.000000	55.000000	=0.000000	=0				25054

1	0.000000	-2.5	99.0	.990000E+02	0	25055
2	.126000	-3.5	99.0	.990000E+02	1	25055
	1 1	1.000000	1.000000	.990000E+02	99 99	25055
3	.984000	-4.5	99.0	.990000E+02	2	25055
	1 1	.000000	1.000000	.990000E+02	99 99	25055
	2 2	.910000	1.000000	.990000E+02	99 99	25055
4	1.292000	-5.5	99.0	.990000E+02	2	25055
	1 3	.300000	1.000000	.990000E+02	99 99	25055
	2 2	.700000	1.000000	.990000E+02	99 99	25055
5	1.528000	-1.5	99.0	.990000E+02	1	25055
	1 1	1.000000	1.000000	.990000E+02	99 99	25055
6	1.883000	-2.5	99.0	.990000E+02	2	25055
	1 1	.620000	1.000000	.990000E+02	99 99	25055
	2 2	.300000	1.000000	.990000E+02	99 99	25055
7	2.199000	-3.5	99.0	.990000E+02	1	25055
	1 3	1.000000	1.000000	.990000E+02	99 99	25055
25056	3 99.000000	56.000000	-0.000000	510760		
1	0.000000	3.0	99.0	.990000E+02	0	25056
2	.026700	2.0	99.0	.990000E+02	1	25056
	1 1	1.000000	1.000000	.990000E+02	99 99	25056
3	.110000	1.0	99.0	.990000E+02	1	25056
	1 2	1.000000	1.000000	.990000E+02	99 99	25056
25058	1 0.	-0.	99.0	0	051377	
1	0.	-0.	99.0	0		25058
26055	0 0.000000	54.938294	-57.478400	100775		
1	0.000000	-1.5	99.0	.840000E+00	0	26055
2	.411400	-0.5	99.0	.990000E+02	1	26055
	1 1	1.000000	1.000000	.990000E+02	99 99	26055
3	.931200	-2.5	99.0	.990000E+02	2	26055
	1 2	.012000	1.000000	.990000E+02	99 99	26055
	2 1	.988000	1.000000	.990000E+02	99 99	26055
4	1.316400	-2.5	99.0	.990000E+02	2	26055
	1 3	.084000	1.000000	.990000E+02	99 99	26055
	2 1	.916000	1.000000	.990000E+02	99 99	26055
5	1.408400	-3.5	99.0	.990000E+02	3	26055
	1 4	.044000	1.000000	.990000E+02	99 99	26055
	2 3	.450000	1.000000	.990000E+02	99 99	26055
	3 1	.506000	1.000000	.990000E+02	99 99	26055
6	1.910000	-0.5	99.0	.990000E+02	2	26055
	1 2	.324000	1.000000	.990000E+02	99 99	26055
	2 1	.676000	1.000000	.990000E+02	99 99	26055
7	2.050000	-1.5	99.0	.990000E+02	2	26055
	1 2	.421000	1.000000	.990000E+02	99 99	26055
	2 1	.579000	1.000000	.990000E+02	99 99	26055
8	2.153000	-2.5	99.0	.990000E+02	1	26055
	1 1	1.000000	1.000000	.990000E+02	99 99	26055
26056	34 99.000000	99.000000	-0.000000	929760		
1	0.000000	0.0	99.0	.990000E+02	0	26056
2	.846000	2.0	99.0	.990000E+02	1	26056
	1 1	1.000000	1.000000	.990000E+02	99 99	26056
3	2.085100	4.0	99.0	.990000E+02	1	26056
	1 2	1.000000	1.000000	.990000E+02	99 99	26056
4	2.657600	2.0	99.0	.990000E+02	2	26056
	1 2	.980000	1.000000	.990000E+02	99 99	26056
	2 1	.020000	1.000000	.990000E+02	99 99	26056
5	2.941700	0.0	99.0	.990000E+02	1	26056
	1 2	1.000000	1.000000	.990000E+02	99 99	26056
6	2.960000	2.0	99.0	.990000E+02	2	26056
	1 2	.980000	1.000000	.990000E+02	99 99	26056
	2 1	.020000	1.000000	.990000E+02	99 99	26056
7	3.120000	1.0	99.0	.990000E+02	2	26056
	1 2	.970000	1.000000	.990000E+02	99 99	26056
	2 1	.030000	1.000000	.990000E+02	99 99	26056

8	3.1231100	4.0 99.0	.99000E+02	1	26056
	1 3	1.000000	1.000000	.99000E+02 99 99	26056
9	3.370200	2.0 99.0	.99000E+02	2	26056
	1 2	.840000	1.000000	.99000E+02 99 99	26056
	2 1	.160000	1.000000	.99000E+02 99 99	26056
10	3.388000	6.0 99.0	.99000E+02	1	26056
	1 3	1.000000	1.000000	.99000E+02 99 99	26056
11	3.445000	3.0 99.0	.99000E+02	3	26056
	1 4	.030000	1.000000	.99000E+02 99 99	26056
	2 3	.100000	1.000000	.99000E+02 99 99	26056
	3 2	.780000	1.000000	.99000E+02 99 99	26056
12	3.450000	1.0 99.0	.99000E+02	2	26056
	1 2	.540000	1.000000	.99000E+02 99 99	26056
	2 1	.460000	1.000000	.99000E+02 99 99	26056
13	3.601900	2.0 99.0	.99000E+02	1	26056
	1 2	1.000000	1.000000	.99000E+02 99 99	26056
14	3.607000	0.0 99.0	.99000E+02	2	26056
	1 2	.510000	1.000000	.99000E+02 99 99	26056
	2 1	.490000	1.000000	.99000E+02 99 99	26056
15	3.755000	6.0 99.0	.99000E+02	1	26056
	1 3	1.000000	1.000000	.99000E+02 99 99	26056
16	3.832000	2.0 99.0	.99000E+02	3	26056
	1 4	.280000	1.000000	.99000E+02 99 99	26056
	2 2	.640000	1.000000	.99000E+02 99 99	26056
	3 1	.080000	1.000000	.99000E+02 99 99	26056
17	3.856000	3.0 99.0	.99000E+02	3	26056
	1 0	.010000	1.000000	.99000E+02 99 99	26056
	2 3	.920000	1.000000	.99000E+02 99 99	26056
	3 2	.070000	1.000000	.99000E+02 99 99	26056
18	4.046000	3.0 99.0	.99000E+02	2	26056
	1 3	.140000	1.000000	.99000E+02 99 99	26056
	2 2	.860000	1.000000	.99000E+02 99 99	26056
19	4.099000	3.0 99.0	.99000E+02	2	26056
	1 3	.330000	1.000000	.99000E+02 99 99	26056
	2 2	.670000	1.000000	.99000E+02 99 99	26056
20	4.120000	4.0 99.0	.99000E+02	1	26056
	1 1	1.000000	1.000000	.99000E+02 99 99	26056
21	4.298000	4.0 99.0	.99000E+02	3	26056
	1 2	.250000	1.000000	.99000E+02 99 99	26056
	2 3	.090000	1.000000	.99000E+02 99 99	26056
	3 8	.660000	1.000000	.99000E+02 99 99	26056
22	4.302000	0.0 99.0	.99000E+02	1	26056
	1 2	1.000000	1.000000	.99000E+02 99 99	26056
23	4.395000	3.0 99.0	.99000E+02	1	26056
	1 2	1.000000	1.000000	.99000E+02 99 99	26056
24	4.401000	2.0 99.0	.99000E+02	3	26056
	1 2	.770000	1.000000	.99000E+02 99 99	26056
	2 5	.080000	1.000000	.99000E+02 99 99	26056
	3 11	.150000	1.000000	.99000E+02 99 99	26056
25	4.458000	3.0 99.0	.99000E+02	2	26056
	1 3	.500000	1.000000	.99000E+02 99 99	26056
	2 8	.500000	1.000000	.99000E+02 99 99	26056
26	4.510000	3.0 99.0	.99000E+02	4	26056
	1 2	.350000	1.000000	.99000E+02 99 99	26056
	2 3	.150000	1.000000	.99000E+02 99 99	26056
	3 4	.480000	1.000000	.99000E+02 99 99	26056
	4 11	.020000	1.000000	.99000E+02 99 99	26056
27	4.539500	1.0 99.0	.99000E+02	3	26056
	1 1	.080000	1.000000	.99000E+02 99 99	26056
	2 4	.130000	1.000000	.99000E+02 99 99	26056
	3 6	.790000	1.000000	.99000E+02 99 99	26056
28	4.554000	3.0 99.0	.99000E+02	3	26056
	1 3	.780000	1.000000	.99000E+02 99 99	26056

	2	8	.160000	1.000000	.99000E+02 99 99	26056	
	3	11	.060000	1.000000	.99000E+02 99 99	26056	
29	4.612000	2.0	99.0	.99000E+02	2	26056	
	1	2	.330000	1.000000	.99000E+02 99 99	26056	
	2	6	.670000	1.000000	.99000E+02 99 99	26056	
30	4.660000	3.0	99.0	.99000E+02	2	26056	
	1	2	.500000	1.000000	.99000E+02 99 99	26056	
	2	8	.500000	1.000000	.99000E+02 99 99	26056	
31	4.684700	3.0	99.0	.99000E+02	1	26056	
	1	6	1.000000	1.000000	.99000E+02 99 99	26056	
32	4.729900	0.0	99.0	.99000E+02	1	26056	
	1	2	1.000000	1.000000	.99000E+02 99 99	26056	
33	4.739600	2.0	99.0	.99000E+02	2	26056	
	1	4	.800000	1.000000	.99000E+02 99 99	26056	
	2	8	.300000	1.000000	.99000E+02 99 99	26056	
34	4.878000	2.0	99.0	.99000E+02	3	26056	
	1	2	.430000	1.000000	.99000E+02 99 99	26056	
	2	3	.250000	1.000000	.99000E+02 99 99	26056	
	3	6	.320000	1.000000	.99000E+02 99 99	26056	
26057	5	.021400	56.935391	-60.183800	100975		
	1	0.000000	-1.5	99.0	.10000E+99	0	26057
	2	.014400	-1.5	99.0	.97810E-07	1	26057
	1	1	1.000000	1.000000	.99000E+02 99 99	26057	
3	.136460	-2.5	99.0	.87000E-08	2	26057	
	1	2	.880000	1.000000	.99000E+02 99 99	26057	
	2	1	.120000	1.000000	.99000E+02 99 99	26057	
4	.366800	-1.5	99.0	.99000E+02	3	26057	
	1	3	.120000	1.000000	.99000E+02 99 99	26057	
	2	2	.740000	1.000000	.99000E+02 99 99	26057	
	3	1	.140000	1.000000	.99000E+02 99 99	26057	
5	.706600	-2.5	99.0	.33000E-11	4	26057	
	1	4	.022000	1.000000	.99000E+02 99 99	26057	
	2	3	.081000	1.000000	.99000E+02 99 99	26057	
	3	2	.864000	1.000000	.99000E+02 99 99	26057	
	4	1	.033000	1.000000	.99000E+02 99 99	26057	
26058	9	99.000000	58.000000	99.000000	406760		
	1	0.000000	0.0	99.0	.99000E+02	0	26058
	2	.810600	2.0	99.0	.99000E+02	1	26058
	1	1	1.000000	1.000000	.99000E+02 99 99	26058	
3	1.675000	2.0	99.0	.99000E+02	2	26058	
	1	1	.390000	1.000000	.99000E+02 99 99	26058	
	2	2	.610000	1.000000	.99000E+02 99 99	26058	
4	2.133400	3.0	99.0	.99000E+02	2	26058	
	1	2	.740000	1.000000	.99000E+02 99 99	26058	
	2	3	.260000	1.000000	.99000E+02 99 99	26058	
5	2.257000	0.0	99.0	.99000E+02	1	26058	
	1	2	1.000000	1.000000	.99000E+02 99 99	26058	
6	2.596000	4.0	99.0	.99000E+02	1	26058	
	1	4	1.000000	1.000000	.99000E+02 99 99	26058	
7	2.782000	1.0	99.0	.99000E+02	4	26058	
	1	1	.220000	1.000000	.99000E+02 99 99	26058	
	2	2	.480000	1.000000	.99000E+02 99 99	26058	
	3	3	.220000	1.000000	.99000E+02 99 99	26058	
	4	5	.080000	1.000000	.99000E+02 99 99	26058	
8	2.876000	1.0	99.0	.99000E+02	1	26058	
	1	2	1.000000	1.000000	.99000E+02 99 99	26058	
9	3.084000	2.0	99.0	.99000E+02	1	26058	
	1	1	1.000000	1.000000	.99000E+02 99 99	26058	
26059	3	99.000000	59.000000	99.000000	406760		
	1	0.000000	-1.5	99.0	.99000E+02	0	26059
	2	.280000	-1.5	99.0	.99000E+02	1	26059
	1	1	1.000000	1.000000	.99000E+02 99 99	26059	
3	.475000	-2.5	99.0	.99000E+02	2	26059	

	1	1	.940000	1.000000	.990000E+02	99	99	27059
	2	2	.060000	1.000000	.990000E+02	99	99	27059
5	1,434000	7,5	99.0	.990000E+02	2			27059
	1	2	.500000	1.000000	.990000E+02	99	99	27059
	2	4	.500000	1.000000	.990000E+02	99	99	27059
6	1,460000	5,5	99.0	.990000E+02	1			27059
	1	1	1.000000	1.000000	.990000E+02	99	99	27059
7	1,481000	2,5	99.0	.990000E+02	2			27059
	1	2	.600000	1.000000	.990000E+02	99	99	27059
	2	1	.400000	1.000000	.990000E+02	99	99	27059
8	1,744000	3,5	99.0	.990000E+02	2			27059
	1	1	.550000	1.000000	.990000E+02	99	99	27059
	2	3	.450000	1.000000	.990000E+02	99	99	27059
27060	11	1,000000	60,000000	99.000000	406760			
	1	0,000000	5,0	99.0	.990000E+02	0		27060
	2	.059000	2,0	99.0	.990000E+02	1		27060
	1	1	1.000000	1.000000	.990000E+02	99	99	27060
3	.278000	4,0	99.0	.990000E+02	1			27060
	1	1	1.000000	1.000000	.990000E+02	99	99	27060
4	.288000	3,0	99.0	.990000E+02	1			27060
	1	2	1.000000	1.000000	.990000E+02	99	99	27060
5	.436000	5,0	99.0	.990000E+02	2			27060
	1	1	.170000	1.000000	.990000E+02	99	99	27060
	2	3	.830000	1.000000	.990000E+02	99	99	27060
6	.505000	3,0	99.0	.990000E+02	1			27060
	1	2	1.000000	1.000000	.990000E+02	99	99	27060
7	.541000	2,0	99.0	.990000E+02	2			27060
	1	2	.420000	1.000000	.990000E+02	99	99	27060
	2	4	.580000	1.000000	.990000E+02	99	99	27060
8	.614000	3,0	99.0	.990000E+02	2			27060
	1	2	.970000	1.000000	.990000E+02	99	99	27060
	2	3	.030000	1.000000	.990000E+02	99	99	27060
9	.736000	2,0	99.0	.990000E+02	1			27060
	1	8	1.000000	1.000000	.990000E+02	99	99	27060
10	.782000	4,0	99.0	.990000E+02	2			27060
	1	1	.460000	1.000000	.990000E+02	99	99	27060
	2	4	.540000	1.000000	.990000E+02	99	99	27060
11	1,006000	3,0	99.0	.990000E+02	5			27060
	1	8	.520000	1.000000	.990000E+02	99	99	27060
	2	7	.070000	1.000000	.990000E+02	99	99	27060
	3	4	.150000	1.000000	.990000E+02	99	99	27060
	4	3	.120000	1.000000	.990000E+02	99	99	27060
	5	2	.140000	1.000000	.990000E+02	99	99	27060
3 N + CO=59 TRAN. COEFS. FOR N, P, HE-4 ---- W-H FOR N 9=28-76								
ENERGIES AND PENETRABILITIES FOR THE NEUTRON CONTINUUM 25 40								1
.100000E+00	.300000E+00	.500000E+00	.100000E+01	.200000E+01	.300000E+01			2
.400000E+01	.500000E+01	.600000E+01	.700000E+01	.800000E+01	.900000E+01			3
.100000E+02	.120000E+02	.140000E+02	.160000E+02	.180000E+02	.210000E+02			4
.240000E+02	.280000E+02	.320000E+02	.360000E+02	.400000E+02	.440000E+02			5
.54861E+00	.25062E-01	.22374E-02	.25062E-01	.22374E-02	.21556E+05			6
.17144E-07	.21556E-05	.17144E-07	.14375E-10	0.	.14375E-10			7
0.	0.	0.	0.	0.	0.			8
0.	0.	0.	0.	0.	0.			9
0.	0.	0.	0.	0.	0.			10
0.	0.	0.	0.	0.	0.			11
0.	0.	0.	0.	0.	0.			12
0.	0.	0.	0.	0.	0.			13
.73332E+00	.10248E+00	.30858E-01	.10248E+00	.30858E-01	.96899E+04			14
.23001E-05	.96899E-04	.23001E-05	.59370E-08	.14642E+10	.59370E-08			15
.14642E-10	0.	0.	0.	0.	0.			16
0.	0.	0.	0.	0.	0.			17
0.	0.	0.	0.	0.	0.			18
0.	0.	0.	0.	0.	0.			19
0.	0.	0.	0.	0.	0.			20
.80316E+00	.17799E+00	.94165E-01	.17799E+00	.94165E-01	.56903E+03			21

.21870E-04	.96701E-01	.21870E-04	.96701E-01	.39329E-09	.96701E-01	21
.39329E-09	.19243E-11	0.	.19243E-11	0.	0.	23
0.	0.	0.	0.	0.	0.	24
0.	0.	0.	0.	0.	0.	25
0.	0.	0.	0.	0.	0.	26
0.	0.	0.	0.	0.	0.	27
.86390E+00	.32390E+00	.31692E+00	.32390E+00	.31692E+00	.59095E-02	28
.43919E-03	.59095E-02	.43919E-03	.41889E-05	.33084E-07	.41889E-05	29
.33084E-07	.31939E-09	.31795E-11	.31939E-09	.31795E-11	0.	30
0.	0.	0.	0.	0.	0.	31
0.	0.	0.	0.	0.	0.	32
0.	0.	0.	0.	0.	0.	33
0.	0.	0.	0.	0.	0.	34
.87744E+00	.48790E+00	.61151E+00	.48790E+00	.61151E+00	.56278E-01	35
.74769E-02	.56278E-01	.74769E-02	.17611E-03	.25989E-05	.17611E-03	36
.25989E-05	.48765E-07	.95632E-09	.48765E-07	.95632E-09	.18302E-10	37
.33000E-12	.18302E-10	.33000E-12	0.	0.	0.	38
0.	0.	0.	0.	0.	0.	39
0.	0.	0.	0.	0.	0.	40
0.	0.	0.	0.	0.	0.	41
.86504E+00	.57164E+00	.71428E+00	.57164E+00	.71428E+00	.18725E+00	42
.33208E-01	.18725E+00	.33208E-01	.15338E-02	.31675E-04	.15338E-02	43
.31675E-04	.86451E-06	.25016E-07	.86451E-06	.25016E-07	.71218E-09	44
.19212E-10	.71218E-09	.19212E-10	.47981E-12	0.	.47981E-12	45
0.	0.	0.	0.	0.	0.	46
0.	0.	0.	0.	0.	0.	47
0.	0.	0.	0.	0.	0.	48
.84895E+00	.61988E+00	.74931E+00	.61988E+00	.74931E+00	.38067E+00	49
.83104E-01	.38067E+00	.83104E-01	.70687E-02	.18160E-03	.70687E-02	50
.18160E-03	.63641E-05	.24124E-06	.63641E-05	.24124E-06	.90717E-08	51
.32517E-09	.90717E-08	.32517E-09	.10836E-10	.33042E-12	.10836E-10	52
.33042E-12	0.	0.	0.	0.	0.	53
0.	0.	0.	0.	0.	0.	54
0.	0.	0.	0.	0.	0.	55
.83506E+00	.64972E+00	.76016E+00	.64972E+00	.76016E+00	.57250E+00	56
.15100E+00	.57250E+00	.15100E+00	.22993E-01	.68753E-03	.22993E-01	57
.68753E-03	.29006E-04	.13486E-05	.29006E-04	.13486E-05	.62734E-07	58
.27986E-08	.62734E-07	.27986E-08	.11659E-09	.44575E-11	.11659E-09	59
.44575E-11	.15481E-12	0.	.15481E-12	0.	0.	60
0.	0.	0.	0.	0.	0.	61
0.	0.	0.	0.	0.	0.	62
.81813E+00	.66896E+00	.76112E+00	.66896E+00	.76112E+00	.71567E+00	63
.22549E+00	.71567E+00	.22549E+00	.59524E-01	.20123E-02	.59524E-01	64
.20123E-02	.97794E-04	.53471E-05	.97794E-04	.53471E-05	.29508E-06	65
.15714E-07	.29508E-06	.15714E-07	.78506E-09	.36112E-10	.78506E-09	66
.36112E-10	.15119E-11	.57272E-13	.15119E-11	.57272E-13	0.	67
0.	0.	0.	0.	0.	0.	68
0.	0.	0.	0.	0.	0.	69
.80421E+00	.68161E+00	.75756E+00	.68161E+00	.75756E+00	.80425E+00	70
.29724E+00	.80425E+00	.29724E+00	.12921E+00	.49434E-02	.12921E+00	71
.49434E-02	.26922E-03	.16744E-04	.26922E-03	.16744E-04	.10647E-05	72
.65745E-07	.10647E-05	.65745E-07	.38269E-08	.20580E-09	.38269E-08	73
.20580E-09	.10095E-10	.44860E-12	.10095E-10	.44860E-12	0.	74
0.	0.	0.	0.	0.	0.	75
0.	0.	0.	0.	0.	0.	76
.79119E+00	.68992E+00	.75176E+00	.68992E+00	.75176E+00	.85221E+00	77
.36136E+00	.85221E+00	.36136E+00	.23967E+00	.10700E-01	.23967E+00	78
.10700E-01	.63636E-03	.44163E-04	.63636E-03	.44163E-04	.31667E-05	79
.22191E-06	.31667E-05	.22191E-06	.14732E-07	.30681E-09	.14732E-07	80
.90681E-09	.51036E-10	.26055E-11	.51036E-10	.26055E-11	.12023E-12	81
0.	.12023E-12	0.	0.	0.	0.	82
0.	0.	0.	0.	0.	0.	83
.77892E+00	.69527E+00	.74480E+00	.69527E+00	.74480E+00	.87458E+00	84

.41434E+00	.87458E+00	.41434E+00	.30232E+00	.21040E+01	.38232E+00	95
.21740E+01	.13434E+02	.10749E+03	.13434E+02	.10249E+03	.81313E+05	96
.63600E+06	.11313E+05	.63600E+06	.47367E+07	.32833E+08	.47367E+07	97
.32833E+08	.20862E+09	.12042E+10	.20862E+09	.12042E+10	.62878E+12	98
0.	.62878E+12	0.	0.	0.	0.	99
0.	0.	0.	0.	0.	0.	100
.76727E+03	.69850E+00	.73722E+00	.69850E+00	.73722E+00	.88197E+00	91
.46248E+00	.88197E+00	.46248E+00	.53017E+00	.36339E+01	.53017E+00	92
.36339E+01	.25967E+02	.21443E+03	.25967E+02	.21443E+03	.18607E+04	93
.16030E+05	.18607E+04	.16030E+05	.13218E+06	.10184E+07	.13218E+06	94
.10184E+07	.72126E+09	.46481E+10	.72126E+09	.46481E+10	.27120E+11	95
.14303E+12	.27120E+11	.14303E+12	0.	0.	0.	96
0.	0.	0.	0.	0.	0.	97
.74541E+00	.70076E+00	.72122E+00	.70076E+00	.72122E+00	.87500E+00	98
.53253E+00	.87500E+00	.53253E+00	.74047E+00	.10612E+00	.74047E+00	99
.10612E+00	.79522E+02	.74571E+03	.79522E+02	.74571E+03	.75031E+04	100
.75031E+04	.76039E+05	.76039E+05	.74539E+06	.68851E+07	.74539E+06	101
.68851E+07	.58804E+08	.45874E+09	.58804E+08	.45874E+09	.32470E+10	102
.20793E+11	.32470E+10	.20793E+11	.12046E+12	0.	.12046E+12	103
0.	0.	0.	0.	0.	0.	104
.72497E+03	.69944E+00	.70494E+00	.69944E+00	.70494E+00	.85662E+00	105
.58035E+00	.85662E+00	.58035E+00	.81731E+00	.23860E+00	.81731E+00	106
.23860E+00	.20030E+01	.20715E+02	.20030E+01	.20715E+02	.23492E+03	107
.20715E+02	.23482E+03	.27070E+04	.30579E+05	.32837E+06	.30579E+05	108
.32837E+06	.32822E+07	.30099E+08	.32822E+07	.30099E+08	.25107E+09	109
.18974E+10	.25107E+09	.18974E+10	.12977E+11	.80402E+13	.12977E+11	110
.80402E+13	0.	0.	0.	0.	0.	111
.70558E+00	.69589E+00	.68883E+00	.69589E+00	.68883E+00	.83579E+00	112
.61289E+00	.83579E+00	.61289E+00	.82554E+00	.43930E+00	.82554E+00	113
.43930E+00	.43748E+01	.48968E+02	.43748E+01	.48968E+02	.61045E+03	114
.61045E+03	.61045E+03	.78332E+04	.99601E+05	.12150E+05	.99601E+05	115
.12150E+05	.13895E+06	.14652E+07	.13895E+06	.14652E+07	.14098E+08	116
.14098E+08	.14098E+08	.12310E+09	.97348E+11	.69744E+12	.97348E+11	117
.69744E+12	0.	0.	0.	0.	0.	118
.68708E+00	.69082E+00	.67315E+00	.69082E+00	.67315E+00	.81455E+00	119
.63483E+00	.81455E+00	.63483E+00	.80992E+00	.66383E+00	.80992E+00	120
.66383E+00	.85214E+01	.10252E+01	.85214E+01	.10252E+01	.13826E+02	121
.19436E+03	.13826E+02	.19436E+03	.27260E+04	.37086E+05	.27260E+04	122
.37086E+05	.47668E+06	.56813E+07	.47668E+06	.56813E+07	.62011E+08	123
.61548E+09	.62011E+08	.61548E+09	.55379E+10	.45155E+11	.55379E+10	124
.45155E+11	.33410E+12	0.	.33410E+12	0.	0.	125
.66081E+00	.68115E+00	.65082E+00	.68115E+00	.65082E+00	.78381E+00	126
.65440E+00	.78381E+00	.65440E+00	.77631E+00	.90752E+00	.77631E+00	127
.90752E+00	.19301E+00	.26126E+01	.19301E+00	.26126E+01	.38853E+02	128
.60960E+03	.38853E+02	.60960E+03	.96641E+04	.15069E+04	.96641E+04	129
.15069E+04	.22470E+05	.31366E+06	.22470E+05	.31366E+06	.40358E+07	130
.40358E+07	.40358E+07	.47002E+08	.50575E+09	.40937E+10	.50575E+09	131
.48937E+10	.42967E+11	0.	.42967E+11	0.	0.	132
.63632E+00	.66955E+00	.63023E+00	.66955E+00	.63023E+00	.75458E+00	133
.66349E+00	.75458E+00	.66349E+00	.74304E+00	.99397E+00	.74304E+00	134
.99397E+00	.35720E+00	.56662E+01	.35720E+00	.56662E+01	.91787E+02	135
.15738E+02	.91787E+02	.15738E+02	.27575E+03	.47950E+04	.27575E+03	136
.47950E+04	.80843E+05	.12894E+05	.80843E+05	.12894E+05	.19102E+06	137
.25962E+07	.19102E+06	.25962E+07	.32140E+08	.36132E+09	.32140E+08	138
.36132E+09	.36868E+10	.34190E+11	.36868E+10	0.	0.	139
.60650E+00	.65168E+00	.60573E+00	.65168E+00	.60573E+00	.71747E+00	140
.66544E+00	.71747E+00	.66544E+00	.70346E+00	.98016E+00	.70346E+00	141
.98016E+00	.13007E+00	.13007E+00	.60724E+00	.13007E+00	.23660E+01	142
.44772E+02	.23660E+01	.44772E+02	.87154E+03	.17058E+03	.87154E+03	143
.17058E+03	.32788E+04	.60575E+05	.32788E+04	.60575E+05	.10520E+05	144
.16900E+06	.10520E+05	.16900E+06	.24855E+07	.33281E+08	.24855E+07	145
.33281E+08	.40472E+09	0.	.40472E+09	0.	0.	146
.57994E+00	.63165E+00	.58446E+00	.63165E+00	.58446E+00	.68205E+00	147

.65992E+00	.68205E+00	.65992E+00	.66933E+00	.92307E+00	.66933E+00	140
.92382E+00	.79384E+00	.24471E+00	.79384E+00	.24471E+00	.51184E+01	149
.12585E+01	.51184E+01	.10585E+01	.22447E+02	.48195E+03	.22447E+02	150
.48195E+03	.10292E+03	.21384E+04	.10292E+03	.21384E+04	.42363E+05	151
.78427E+06	.42363E+05	.78427E+06	.13382E+06	.20870E+07	.13382E+06	152
.20870E+07	.29628E+08	.38248E+09	.29628E+08	0.	0.	153
.56548E+00	.62998E+00	.56588E+00	.60998E+00	.56588E+00	.64813E+00	154
.64936E+00	.64813E+00	.64936E+00	.63996E+00	.86289E+00	.63996E+00	155
.86289E+00	.88296E+00	.38562E+00	.88296E+00	.38562E+00	.96068E+01	156
.21744E+01	.96068E+01	.21744E+01	.49687E+02	.11509E+02	.49687E+02	157
.11509E+02	.26716E+03	.61077E+04	.26716E+03	.61077E+04	.13493E+04	158
.26716E+03	.13493E+04	.28179E+05	.54705E+06	.97583E+07	.54705E+06	159
.97583E+07	.15891E+07	.23561E+08	.15891E+07	0.	0.	160
.53574E+00	.58718E+00	.54929E+00	.58718E+00	.54929E+00	.61577E+00	161
.63518E+00	.61577E+00	.63518E+00	.61464E+00	.80574E+00	.61464E+00	162
.80574E+00	.90372E+00	.52268E+00	.90372E+00	.52268E+00	.15952E+00	163
.39901E+01	.15952E+00	.39901E+01	.97814E+02	.24183E+02	.97814E+02	164
.24183E+02	.60127E+03	.14865E+03	.60127E+03	.14865E+03	.35892E+04	165
.83015E+05	.35892E+04	.83015E+05	.18227E+05	.36219E+06	.18227E+05	166
.36219E+06	.66705E+07	.11200E+07	.66705E+07	0.	0.	167
.51722E+00	.56371E+00	.53397E+00	.56371E+00	.53397E+00	.58509E+00	168
.61827E+00	.58509E+00	.61827E+00	.59259E+00	.75357E+00	.59259E+00	169
.75357E+00	.88892E+00	.63070E+00	.88892E+00	.63070E+00	.23762E+00	170
.66577E+01	.23762E+00	.66577E+01	.17517E+01	.45948E+02	.17517E+01	171
.45948E+02	.12112E+02	.31917E+03	.12112E+02	.31917E+03	.82961E+04	172
.20906E+04	.20906E+04	.50016E+05	.50016E+05	.11165E+05	.50016E+05	173
.11165E+05	.22969E+06	0.	.22969E+06	0.	0.	174
ENERGIES AND PENETRABILITIES FOR THE PROTON CONTINUUM 25 40						2
.30000E+00	.60000E+00	.10000E+01	.20000E+01	.30000E+01	.40000E+01	3
.50000E+01	.60000E+01	.70000E+01	.80000E+01	.90000E+01	.10000E+02	4
.12000E+02	.14000E+02	.16000E+02	.18000E+02	.21000E+02	.24000E+02	5
.28000E+02	.32000E+02	.36000E+02	.40000E+02	.44000E+02	.50000E+02	6
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0.	0.	0.	0.	0.	0.	8
0.	0.	0.	0.	0.	0.	9
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0.	0.	0.	0.	0.	0.	11
0.	0.	0.	0.	0.	0.	12
0.	0.	0.	0.	0.	0.	13
.29016E+00	.86600E+00	.11094E+00	.74456E+00	.13107E+00	.58323E+11	14
.17346E+12	.48812E+11	.19828E+12	0.	0.	0.	15
0.	0.	0.	0.	0.	0.	16
0.	0.	0.	0.	0.	0.	17
0.	0.	0.	0.	0.	0.	18
0.	0.	0.	0.	0.	0.	19
0.	0.	0.	0.	0.	0.	20
.46752E+05	.13688E+05	.20519E+06	.11751E+05	.24348E+06	.12252E+07	21
.46507E+09	.10378E+07	.53472E+09	.11197E+10	.23070E+12	.11973E+10	22
.23720E+12	0.	0.	0.	0.	0.	23
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.64915E+02	.17568E+02	.39774E+03	.15261E+02	.47478E+03	.29618E+04	28
.18192E+05	.26263E+04	.21155E+05	.68288E+07	.23389E+08	.73941E+07	29
.24165E+08	.71833E+10	.19664E+11	.72868E+10	.19794E+11	0.	30
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0.	0.	0.	0.	0.	0.	32
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.11938E+00	.31382E+01	.11032E+01	.28181E+01	.13068E+01	.95543E+03	35
.86099E+04	.90776E+03	.10087E+03	.43218E+05	.20524E+06	.47487E+05	36
.21326E+06	.89460E+08	.35319E+09	.90960E+08	.35588E+09	.12520E+10	37

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0, 43843E+00	0, 13253E+00	0, 74825E-01	0, 12529E+00	0, 85547E-01	0, 73938E-02	42
0, 94298E-03	0, 76347E-02	0, 10875E-02	0, 57992E-04	0, 34929E-05	0, 64815E-04	43
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0, 94764E+00	0, 70059E+00	0, 91A17E+00	0, 74984E+00	0, 81200E+00	0, 47020E+00	84
0, 30655E+00	0, 66188E+00	0, 21482E+00	0, 44A66E-01	0, 55042E-02	0, 58879E-01	85
0, 61585E-02	0, 6A068E-03	0, 81338E-04	0, 71305E-03	0, 82975E-04	0, 91763E-05	86
0, 95669E-06	0, 92593E-05	0, 96077E-06	0, 90853E-07	0, 78500E-08	0, 91047E-07	87
0, 77939E-08	0, 59893E-09	0, 41308E-10	0, 59932E-09	0, 41325E-10	0, 25561E-11	88
0, 14223E-12	0, 25568E-11	0, 14225E-12	0, 0,	0, 0,	0, 0,	89
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0, 91843E+00	0, 75206E+00	0, 92711E+00	0, 80199E+00	0, 81755E+00	0, 65655E+00	91
0, 54406E+00	0, 86779E+00	0, 3582E+00	0, 12604E+00	0, 17820E-01	0, 17418E+00	92
0, 20685E-01	0, 25366E-02	0, 35441E-03	0, 26970E-02	0, 36392E-03	0, 47242E-04	93
0, 58916E-05	0, 47795E-04	0, 59236E-05	0, 67460E-06	0, 70056E-07	0, 67639E-06	94
0, 70154E-07	0, 65513E-08	0, 54998E-09	0, 65564E-08	0, 55024E-09	0, 41441E-10	95
0, 28072E-11	0, 41453E-10	0, 28078E-11	0, 17141E-12	0, 0,	0, 17144E-12	96
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0, 89433E+00	0, 79908E+00	0, 90990E+00	0, 84177E+00	0, 81266E+00	0, 79055E+00	98
0, 69015E+00	0, 95842E+00	0, 47188E+00	0, 27123E+00	0, 44926E-01	0, 37173E+00	99
0, 54493E-01	0, 71809E-02	0, 11361E-02	0, 77797E-02	0, 11760E-02	0, 17368E-03	100

100

25277F-04	17637F-03	25250F-04	33576F-05	41024E-06	33608F-05	101
41094E-06	45303E-07	44095E-08	45345F-07	45019E-08	40138E-06	102
32188E-10	40152E-09	32195E-10	23257E-11	15181E-12	23261E-11	103
15183F-12	0	0	0	0	0	104
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75204E+00	98559E+00	58218E+00	46644E+00	94003E-01	58729E+00	106
11968E+00	16675E-01	29233E-02	18488E-01	30567E-02	49999E-03	107
81632E-04	51000E-03	82351E-04	12483E-04	17544E-05	12535E-04	108
17587E-05	22385E-06	25752E-07	22410E-06	25768E-07	26636E-08	109
24772E-09	26647E-08	24779E-09	20750E-10	15689E-11	20754E-10	110
15691E-11	10659E-12	0	10660E-12	0	0	111
86157E+00	45461E+00	87296E+00	88033E+00	80637E+00	91300E+00	112
77465E+00	98445E+00	67127E+00	66620E+00	16982E+00	73629E+00	113
22660E+00	13390E-01	63925E-02	38052E-01	67673E-02	12009E-02	114
21768E-03	32318F-02	22020E-03	37262E-04	59151E-05	37457E-04	115
59303E-05	85712E-06	11233E-06	85828F-06	11242E-06	13257E-07	116
14073E-08	13263E-07	14078E-08	13455E-09	11612E-10	13458E-09	117
11614E-10	90683E-12	63770E-13	90693E-12	0	0	118
84819E+00	87407E+00	45511E+00	88962E+00	80887E+00	93795E+00	119
78032E+00	96370F+00	76645E+00	88370E+00	33028E+00	81787E+00	120
46205E+00	76769E-01	16514E-01	91832E-01	17894E-01	34837E-02	121
71706E-03	36117E-02	72894E-03	14150E-03	26207E-04	14258E-03	122
26299E-04	44776E-05	69619E-06	44856E-05	69687E-06	97791E-07	123
12373E-07	97847E-07	12377E-07	14100E-08	14495E-09	14103E-08	124
14497E-09	13465E-10	11214E-11	13466E-10	0	0	125
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80432E+00	93822E+00	82458E+00	97875E+00	51815E+00	82260E+00	127
72170E+00	14555E+00	34040E-01	18367E+00	38977E-01	81141E-02	128
18485E-02	85300E-02	18916E-02	40871E-03	85967E-04	41310E-03	129
86383E-04	16879E-04	30400E-05	16920E-04	30439E-05	49697E-06	130
73342E-07	49732E-06	73374E-07	97555E-08	11705E-08	97582E-08	131
11707E-08	12694E-09	12465E-10	12696E-09	0	0	132
84388E+00	88772E+00	84573E+00	88900E+00	82976E+00	92852E+00	133
82824E+00	90870E+00	86417E+00	99037E+00	73735E+00	81292E+00	134
94556E+00	27130E+00	75568E-01	36579E+00	88360E-01	19616E-01	135
49796E-02	21129E-01	51566E-02	12397E-02	29873E-03	12602E-02	136
30107E-03	68245E-04	14506E-04	68489E-04	14532E-04	28230E-05	137
49836E-06	28258E-05	49865E-06	79461E-07	11433E-07	79490E-07	138
11436E-07	14862E-08	17494E-09	14864E-08	0	0	139
85077E+00	88782E+00	85192E+00	88551E+00	84352E+00	91378E+00	140
85200E+00	88802E+00	87894E+00	95649E+00	87126E+00	81288E+00	141
99861E+00	41240E+00	13406E+00	58001E+00	16540E+00	38571E-01	142
10704E-01	42841E-01	11261E-01	20213E-02	78115E-03	29933E-02	143
79032E-03	20141E-03	49019E-04	20256E-03	49148E-04	11058E-04	144
22794E-05	11073E-04	22811E-05	42595E-06	71932E-07	42615E-06	145
71953E-07	10975E-07	15155E-08	10978E-07	0	0	146
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96933E+00	53832E+00	20375E+00	76250E+00	26571E+00	64722E-01	149
19422E-01	74593E-01	20850E-01	57101E-02	16554E-02	59127E-02	150
16838E-02	46908E-03	12754E-03	47299E-03	12807E-03	32566E-04	151
76777E-05	32630E-04	76859E-05	16506E-05	32160E-06	16517E-05	152
32172E-06	56662E-07	90323E-08	56676E-07	0	0	153
86924E+00	88718E+00	86950E+00	88271E+00	86508E+00	89305E+00	154
87484E+00	87099E+00	87881E+00	89641E+00	93123E+00	82862E+00	155
92444E+00	62974E+00	27365E+00	87141E+00	37586E+00	95462E-01	156
30748E-01	11479E+00	33836E-01	96284E-02	29772E-02	10104E-01	157
30496E-02	90808E-03	26963E-03	91895E-03	27124E-03	76335E-04	158
20283E-04	76547E-04	20233E-04	49162E-05	10891E-05	49202E-05	159
10896E-05	21861E-06	39718E-07	21868E-06	0	0	160
87783E+00	88869E+00	87731E+00	88440E+00	87267E+00	88907E+00	161
87954E+00	87071E+00	87505E+00	88309E+00	91386E+00	83566E+00	162
88831E+00	68293E+00	33273E+00	90909E+00	47782E+00	12615E+00	163

.43266E-01	.1590AF+00	.40040E-01	.14300E-01	.46637E-02	.15267E-01	164
.4A217E-02	.1507AF-02	.47980E-03	.15330E-02	.4A383E-03	.14781E-03	165
.43136E-04	.14845E-03	.43223E-04	.11703E-04	.29095E-05	.11716E-04	166
.29114E-05	.65768E-06	.13073E-06	.65793E-06	0.	0.	167
.8A877E+00	.89355E+00	.88680E+00	.88994E+00	.8A151E+00	.88931E+00	168
.88213E+00	.87530E+00	.87141E+00	.87621E+00	.8A085E+00	.84202E+00	169
.85478E+00	.70668E+00	.3A584E+00	.89121E+00	.58421E+00	.15990E+00	170
.58752E-01	.21902E+00	.70469E-01	.20681E-01	.71730E-02	.22801E-01	171
.75485E-02	.24750E-02	.84994E-03	.25411E-02	.86149E-03	.28785E-03	172
.94385E-04	.2A986E-03	.94702E-04	.29337E-04	.84749E-05	.29388E-04	173
.84830E-05	.27047E-05	.54103E-06	.22460E-05	0.	0.	174
ENERGIES AND PENETRABILITIES FOR THE ALPHA CONTINUUM 25 40						2
.30000E+00	.60000E+00	.10000E+01	.30000E+01	.50000E+01	.60000E+01	3
.70000E+01	.80000E+01	.90000E+01	.10000E+02	.11000E+02	.12000E+02	4
.14000E+02	.16000E+02	.18000E+02	.21000E+02	.24000E+02	.28000E+02	5
.32000E+02	.36000E+02	.40000E+02	.44000E+02	.48000E+02	.52000E+02	6
0.	0.	0.	0.	0.	0.	7
0.	0.	0.	0.	0.	0.	8
0.	0.	0.	0.	0.	0.	9
0.	0.	0.	0.	0.	0.	10
0.	0.	0.	0.	0.	0.	11
0.	0.	0.	0.	0.	0.	12
0.	0.	0.	0.	0.	0.	13
0.	0.	0.	0.	0.	0.	14
0.	0.	0.	0.	0.	0.	15
0.	0.	0.	0.	0.	0.	16
0.	0.	0.	0.	0.	0.	17
0.	0.	0.	0.	0.	0.	18
0.	0.	0.	0.	0.	0.	19
0.	0.	0.	0.	0.	0.	20
0.	0.	0.	0.	0.	0.	21
0.	0.	0.	0.	0.	0.	22
0.	0.	0.	0.	0.	0.	23
0.	0.	0.	0.	0.	0.	24
0.	0.	0.	0.	0.	0.	25
0.	0.	0.	0.	0.	0.	26
0.	0.	0.	0.	0.	0.	27
.28379E-08	0.	0.	.19483E-08	.98933E-09	0.	28
0.	.34848E-09	.94676E-10	0.	0.	.19180E-10	29
.31969E-11	0.	0.	.43587E-12	.51690E-13	0.	30
0.	0.	0.	0.	0.	0.	31
0.	0.	0.	0.	0.	0.	32
0.	0.	0.	0.	0.	0.	33
0.	0.	0.	0.	0.	0.	34
.29977E-03	0.	0.	.21721E-03	.11846E-03	0.	35
0.	.46885E-04	.14608E-04	0.	0.	.35181E-05	36
.69998E-06	0.	0.	.11756E-06	.17567E-07	0.	37
0.	.23963E-08	.30033E-09	0.	0.	.34652E-10	38
.36326E-11	0.	0.	.34523E-12	0.	0.	39
0.	0.	0.	0.	0.	0.	40
0.	0.	0.	0.	0.	0.	41
.71342E-02	0.	0.	.53904E-02	.30550E-02	0.	42
0.	.13250E-02	.44185E-03	0.	0.	.11699E-03	43
.24999E-04	0.	0.	.46131E-05	.75005E-06	0.	44
0.	.11360E-06	.15999E-07	0.	0.	.21210E-08	45
.25874E-09	0.	0.	.28917E-10	.29357E-11	0.	46
0.	.27064E-12	0.	0.	0.	0.	47
0.	0.	0.	0.	0.	0.	48
.67096E-01	0.	0.	.53736E-01	.32224E-01	0.	49
0.	.15503E-01	.56023E-02	0.	0.	.16507E-02	50
.38419E-03	0.	0.	.77118E-04	.13477E-04	0.	51
0.	.22282E-05	.34430E-06	0.	0.	.51287E-07	52
.71261E-08	0.	0.	.91781E-09	.108804E-09	0.	53

0.	.11589E+10	.11122E+11	0.	.10086E+12	54
0.	.28791E+02	0.	0.	0.	55
0.	.94876E-01	.38740E-01	0.	.16869E+00	56
0.	.32973E-02	0.	0.	0.	57
0.	.24149E-04	.40116E-05	0.	.12971E-01	58
0.	.10209E-06	0.	0.	.13638E-03	59
0.	.24582E-09	.27559E-10	0.	0.	60
0.	.26394E-12	0.	0.	.20006E-08	61
0.	.62731E+00	0.	0.	0.	62
0.	.31805E+00	.16150E+00	0.	.45494E+00	63
0.	.18610E-01	0.	0.	0.	64
0.	.17329E-03	.30273E-04	0.	.91278E-03	65
0.	.91188E-06	0.	0.	0.	66
0.	.31169E-08	.39599E-09	0.	.22435E-07	67
0.	.48796E-11	0.	0.	0.	68
0.	.82058E+00	0.	0.	.45960E-10	69
0.	.60907E+00	.40884E+00	0.	0.	70
0.	.91170E-03	.16733E-23	0.	.72414E+00	71
0.	.57215E-05	0.	0.	.45171E-02	72
0.	.26713E-07	.38050E-08	0.	0.	73
0.	.59101E-10	0.	0.	.17194E-06	74
0.	.91924E+02	0.	0.	0.	75
0.	.80857E+00	.66937E+00	0.	.49581E-09	76
0.	.2110E+00	0.	0.	0.	77
0.	.37984E-02	.72787E-03	0.	.45857E+00	78
0.	.16837E-06	0.	0.	0.	79
0.	.90733E+00	.83660E+00	0.	.14146E-03	80
0.	.44336E+00	0.	0.	.97873E-06	81
0.	.13131E-01	.26452E-02	0.	0.	82
0.	.10692E-03	0.	0.	.38652E-08	83
0.	.82914E-06	.14478E-06	0.	0.	84
0.	.33995E-08	0.	0.	.94068E+00	85
0.	.99032E+00	0.	0.	0.	86
0.	.97407E+00	.96105E+00	0.	.68989E+00	87
0.	.82388E+00	0.	0.	0.	88
0.	.97507E-01	.23307E-01	0.	.91337E+00	89
0.	.10312E-02	0.	0.	0.	90
0.	.11360E-04	.23603E-05	0.	.30989E+00	91
0.	.79579E-07	0.	0.	0.	92
0.	.9736E+00	0.	0.	.48356E-02	93
0.	.99063E+00	.98971E+00	0.	.51476E-04	94
0.	.95272E+00	0.	0.	0.	95
0.	.37254E+00	.12883E+00	0.	.45247E-06	96
0.	.66521E-02	0.	0.	0.	97
0.	.88432E-04	.21232E-04	0.	0.	98
0.	.98508E-06	0.	0.	.97263E+00	99
0.	.99932E+00	0.	0.	0.	100
0.	.99590E+00	.99703E+00	0.	.29854E-01	101
0.	.98599E+00	0.	0.	0.	102
0.	.71467E+00	.40905E+00	0.	.35933E-03	103
0.	.46431E-03	.12418E-03	0.	0.	104
0.	.75926E-05	0.	0.	.47639E-05	105
0.	.99993E+00	0.	0.	0.	106
0.	.99851E+00	.99937E+00	0.	.98980E+00	107
0.	.99677E+00	0.	0.	.90102E+00	108
0.	.94171E+00	.82170E+00	0.	0.	109
0.	.21389E+00	0.	0.	.17685E-02	110
		.55763E-01	0.	0.	111
			0.	.31791E-04	112
			0.	0.	113
			0.	.99984E+00	114
			0.	.99718E+00	115
			0.	.97896E+00	116
			0.	.54664E+00	
			0.	.13112E-01	

0.	34407E-02	0.	99051E-03	0.	22490F-A4	0.	29507E-03	117
0.	84190E-04	0.	22490F-A4	0.	99947E+00	0.	99986E+00	118
0.	99991E+00	0.	99964E+00	0.	99813E+00	0.	99344E+00	119
0.	99864E+00	0.	95420E+00	0.	27764E+00	0.	73362E-01	120
0.	98895E+00	0.	51328E-02	0.	16539E-03	0.	87897E+00	121
0.	61500E+00	0.	18721E-01	0.	99976E+00	0.	99975E+00	122
0.	52874E+03	0.	99978E+00	0.	99961E+00	0.	99984E+00	123
0.	99979E+00	0.	99979E+00	0.	99989E+00	0.	99779E+00	124
0.	99919E+00	0.	99879E+00	0.	76605E+00	0.	98164E+00	125
0.	92557E+00	0.	13377E+00	0.	34410E-01	0.	41406E+00	126
0.	33918E-02	0.	33918E-02	0.	12170E-02	0.	99783E-02	127
0.	99972E+00	0.	99985E+00	0.	99961E+00	0.	99969E+00	128
0.	99944E+00	0.	99957E+00	0.	99996E+00	0.	99991E+00	129
0.	98802E+00	0.	99957E+00	0.	99910E+00	0.	99908E+00	130
0.	50939E+00	0.	19066E+00	0.	94751E+00	0.	99509E+00	131
0.	15384E-01	0.	54972E-02	0.	99981E+00	0.	84214E+00	132
0.	99970E+00	0.	99964E+00	0.	99977E+00	0.	49948E-01	133
0.	99982E+00	0.	99964E+00	0.	99979E+00	0.	99968E+00	134
0.	99958E+00	0.	99946E+00	0.	99970E+00	0.	99983E+00	135
0.	99879E+00	0.	85735E+00	0.	58415E+00	0.	99957E+00	136
0.	63384E-01	0.	19861E-01	0.	99977E+00	0.	99771E+00	137
0.	99969E+00	0.	99966E+00	0.	99966E+00	0.	96959E+00	138
0.	99976E+00	0.	99966E+00	0.	99966E+00	0.	22031E+00	139
0.	99966F+00	0.	99942E+00	0.	99990E+00	0.	99974E+00	140
0.	99971E+00	0.	97193E+00	0.	86834E+00	0.	99971E+00	141
0.	23235E+00	0.	70509E-01	0.	99971E+00	0.	99968E+00	142
0.	99968E+00	0.	99971E+00	0.	99968E+00	0.	99968E+00	143
0.	99968E+00	0.	99967E+00	0.	99959E+00	0.	99967E+00	144
0.	99968E+00	0.	99977E+00	0.	99972E+00	0.	99972E+00	145
0.	99945E+00	0.	99944E+00	0.	99928E+00	0.	99925E+00	146
0.	99585E+00	0.	96214E+00	0.	23557E+00	0.	88735E+00	147
0.	57958E+00	0.	23557E+00	0.	99967E+00	0.	99966E+00	148
0.	99967E+00	0.	99966E+00	0.	99966E+00	0.	99962E+00	149
0.	99966E+00	0.	99966E+00	0.	99966E+00	0.	99966E+00	150
0.	99948E+00	0.	99961E+00	0.	99983E+00	0.	99949E+00	151
0.	99925E+00	0.	99921E+00	0.	98987E+00	0.	99773E+00	152
0.	86740E+00	0.	55014E+00	0.	99963E+00	0.	96700E+00	153
0.	99964E+00	0.	99963E+00	0.	99964E+00	0.	99964E+00	154
0.	99961E+00	0.	99963E+00	0.	99954E+00	0.	99958E+00	155
0.	99961E+00	0.	99949E+00	0.	99973E+00	0.	99955E+00	156
0.	99921E+00	0.	99979E+00	0.	81966E+00	0.	98681E+00	157
0.	97075E+00	0.	81966E+00	0.		0.		158
								159
								160
								161
								162
								163
								164
								165
								166
								167
								168
								169
								170
								171
								172
								173
								174

APPENDIX E

SAMPLE PROBLEM OUTPUT

N = CO-59 -- H=1 AND HE=4 PRODUCTION -- 10 TO 40 MEV RUNS
APRIL 7, 1977 -- STANDARD PARAMETERS

IPRTLEV= 1 IPRTTC= 0 IPRTWID= 0 IPRTSP= 3 IPRTGC= 1
INPOPT=-1 KLIN=12 KLIN=12 NIBD= 4 LMAXOPT= 0

++++ GROUND STATE OF 25058 IS INCOMPLETELY DESCRIBED, SPIN,PARITY = 99.00 99.00 ++++
++++ ASSIGNMENTS CHANGED TO, SPIN,PARITY = 0.00 1.00 ++++

LCM SPACE REQUIRED (EXCLUDING DISC BUFFERS) IS 225300
NUMBER OF LCM BUFFERS IS 4
MAXIMUM NUMBER OF ENERGY BINS IS 200

NI= 5 NMP= 3 LGROPT= 2 LPEQ= 1 NJMAX= 40 ICAPT=-0

ZAP= 1 ZAT= 27059 DE= 1.000 MEV XMT= 58.93319 AMU SP= 7.492 MEV ECUTOFF= .10 MEV
ACH= 0.000 /MEV FSIGN= 1.000 DEFCN= 0 SPINT = 3.5 PIT= .1

INCIDENT ENERGIES (MEV) = 1.000E+01

I	ZACN	NIP	PARENT	S-WAVE	IP	ZA1	ZA2	XMR	S	NLEV	DEF	A	NLGC	ECGC	BUFFER
--	----	---	I IP	STRENGTH, ENERGY	--	----	-----	(AMU)	(MEV)	--	---	(/MEV)	----	(MEV)	NUMBER
1	27060	4	1 1	-6.830E-01 7.492	1	0	27060	59.934	0.000	0	0	0.000	0	0.000	1
					2	1	27059	58.933	7.492	0	0	0.000	0	0.000	4
					3	1001	26059	58.935	8.275	0	0	0.000	0	0.000	2
					4	2004	25056	55.939	7.172	0	0	0.000	0	0.000	3
2	26059	4	1 3	-1.000E+00 6.587	1	0	26059	58.935	0.000	0	0	0.000	0	0.000	2
					2	1	26058	57.933	6.587	0	0	0.000	0	0.000	0
					3	1001	25058	57.940	11.899	0	0	0.000	0	0.000	0
					4	2004	24055	54.941	7.974	0	0	0.000	0	0.000	0
3	25056	4	1 4	-1.003E+00 7.270	1	0	25056	59.939	0.000	0	0	0.000	0	0.000	3
					2	1	25055	54.938	7.270	0	0	0.000	0	0.000	0
					3	1001	24055	54.941	9.077	0	0	0.000	0	0.000	0
					4	2004	23052	51.945	7.897	0	0	0.000	0	0.000	0
4	27059	4	1 2	-1.730E-01 10.460	1	0	27059	58.933	0.000	0	0	0.000	0	0.000	4
					2	1	27058	57.936	10.460	0	0	0.000	0	0.000	1
					3	1001	26058	57.933	7.370	0	0	0.000	0	0.000	0
					4	2004	25055	54.938	6.951	0	0	0.000	0	0.000	0
5	27058	4	4 2	-4.760E-01 8.572	1	0	27058	57.936	0.000	0	0	0.000	0	0.000	1
					2	1	27057	56.936	8.572	0	0	0.000	0	0.000	0
					3	1001	26057	56.935	6.953	0	0	0.000	0	0.000	0
					4	2004	25054	53.940	6.715	0	0	0.000	0	0.000	0

AXEL APPROXIMATION USED FOR GAMMA-RAY TRANSMISSION COEFFICIENTS

INDEX	L	PARITY	MULTIPOLARITY	RATIO TO E1
1	1	1	E1	1.000
2	1	-1	M1	0.
3	2	1	E2	0.

COLLI-MILAZZO CLOSED FORM USED FOR ABSOLUTE CAL OF PRE-EQUILIBRIUM CROSS SECTION

PRE-EQUILIBRIUM NORMALIZATION CONSTANTS ARE /	NEUTRON	PROTON	DEUTERON	TRITON	HE-3	ALPHA
(INPUT)	0.	0.	1.000E-03	1.000E-03	1.000E-03	1.000E-03
(USED)	5.000E-04	5.000E-04	1.000E-03	1.000E-03	1.000E-03	1.000E-03

TRANSMISSION COEFFICIENT DATA

3 N + CO-59 TRAN. COEFS. FOR N, P, HE-4 --- W-H FOR N 0-25-76

1

START OF SPECTRA SUBROUTINE. TIME FROM START OF THIS ENERGY = .002 SECONDS. TOTAL ELAPSED TIME = 22,122 SECONDS.
 +++ GILCAM SUBROUTINE UNABLE TO MATCH DISCRETE LEVELS WITH LEVEL DENSITY FUNCTION FOR RESIDUAL NUCLEUS IN REACTION IR = 20 +++
 START OF I= 1 LOOP. TIME FROM START OF THIS ENERGY = .002 SECONDS. TOTAL ELAPSED TIME = 22,202 SECONDS.
 GAMMA RAY STRENGTH NORMALIZATION CONSTANT / I= 1, CONSTANT = 6.8300E+01
 START OF I= 2 LOOP. TIME FROM START OF THIS ENERGY = 2.477 SECONDS. TOTAL ELAPSED TIME = 24,597 SECONDS.
 GAMMA RAY STRENGTH NORMALIZATION CONSTANT / I= 2, CONSTANT = 1.0000E+00
 START OF I= 3 LOOP. TIME FROM START OF THIS ENERGY = 3.274 SECONDS. TOTAL ELAPSED TIME = 25,395 SECONDS.
 GAMMA RAY STRENGTH NORMALIZATION CONSTANT / I= 3, CONSTANT = 1.2030E+00
 START OF I= 4 LOOP. TIME FROM START OF THIS ENERGY = 5.065 SECONDS. TOTAL ELAPSED TIME = 27,185 SECONDS.
 GAMMA RAY STRENGTH NORMALIZATION CONSTANT / I= 4, CONSTANT = 1.7300E+01
 START OF I= 5 LOOP. TIME FROM START OF THIS ENERGY = 6.366 SECONDS. TOTAL ELAPSED TIME = 28,486 SECONDS.
 GAMMA RAY STRENGTH NORMALIZATION CONSTANT / I= 5, CONSTANT = 4.7600E+01
 END OF I LOOP IN SUBROUTINE SPECTRA. TIME FROM START OF THIS ENERGY = 6.387 SECONDS. TOTAL ELAPSED TIME = 28,507 SECONDS.

N + CO-59 == H-1 AND HE-4 PRODUCTION == 10 TO 40 MEV RUNS
APRIL 7, 1977 == STANDARD PARAMETERS

LAB NEUTRON ENERGY = 1.4000E+01 MEV

BINARY REACTION SUMMARIES (COMPOUND NUCLEUS ONLY)---

REACTION PRODUCT	SIGMA (BARNs)
-----	-----
NONELASTIC	1.4142E+00
GAMMA-RAY	1.2395E-03
NEUTRON	1.3276E+00
PROTON	6.9175E-02
HELIUM-4	1.6112E-02

----- PRE-EQUILIBRIUM SUMMARY -----

IP = 2 ID = 1 OUTGOING PARTICLE = NEUTRON
INITIAL EXCITON NUMBER = 3 PREQ NORMALIZATION = .50000E-03
COMPOUND X-SEC(BARNs) = .93545E+00 PREQ X-SEC(BARNs) = .34940E+00

IP = 3 ID = 2 OUTGOING PARTICLE = PROTON
INITIAL EXCITON NUMBER = 3 PREQ NORMALIZATION = .50000E-03
COMPOUND X-SEC(BARNs) = .48740E-01 PREQ X-SEC(BARNs) = .62595E-01

IP = 4 ID = 6 OUTGOING PARTICLE = HELIUM-4

INITIAL EXCITON NUMBER = 3 PREQ NORMALIZATION = .30000E-02
COMPOUND X-SEC(BARNs) = .11352E-01 PREQ X-SEC(BARNs) = .53801E-02

REACTIONS

[illegible]

SPECTRA FROM INDIVIDUAL REACTIONS

[illegible]

COMPOSITE SPECTRA

TOTAL PROD. C/S		NEUTRON SPECTRUM	PROTON SPECTRUM	DEUTERON SPECTRUM	TRITON SPECTRUM	HELIUM-3 SPECTRUM	HELIUM-4 SPECTRUM	GAMMA-RAY SPECTRUM	G-NEUTRON SPECTRUM
		SIGMA (BARNs)	SIGMA (BARNs)	SIGMA (BARNs)	SIGMA (BARNs)	SIGMA (BARNs)	SIGMA (BARNs)	SIGMA (BARNs)	SIGMA (BARNs)
1	1.000	2.138E+00	2.069E+01	0.	0.	0.	1.793E+02	2.067E+00	0.
2	2.000	2.476E+00	4.714E+00	0.	0.	0.	9.402E+00	1.084E+00	0.
3	3.000								
4	4.000								
5	5.000								
6	6.000								
7	7.000								
8	8.000								
9	9.000								
10	10.000								
11	11.000								
12	12.000								
13	13.000								
14	14.000								
15	15.000								
16	16.000								
17	17.000								
18	18.000								
19	19.000								
20	20.000								
21	21.000								

DISCRETE LEVEL INFORMATION

I= 1 IP= 1 IR= 1 ZA1= 0 ZA2=27060 SEPARATION ENERGY = 0.000 MEV ACCUMULATED SEPARATION ENERGY = 0.000 MEV
 NUMBER OF LEVEL IN RESIDUAL NUCLEUS = 11 NUMBER OF GAMMA RAYS = 18 RESIDUAL NUCLEUS ID = 27060

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	PRODUCTION CROSS SECTION (BARNs)	NUMBER OF TRANSITIONS	FINAL LEVEL NO	FINAL ENERGY (MEV)	TRANSITION PROBABILITY	CONDITIONAL PROBABILITY	GAMMA NUMBER	GAMMA ENERGY (MEV)	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	5.0	3.3000E-06	0							
2	.0590	2.0	1.8459E-06	1	1	0.0000	1.0000	1.0000	1	.0590	1.8459E-06
3	.2700	4.0	8.2750E-07	1	1	0.0000	1.0000	1.0000	2	.2700	8.2750E-07
4	.2800	3.0	6.5204E-07	1	2	.0590	1.0000	1.0000	3	.2290	6.5204E-07
5	.4360	5.0	4.7466E-07	2	1	0.0000	.1700	1.0000	4	.4360	8.0693E-08
					3	.2700	.8300	1.0000	5	.1500	3.9397E-07
6	.5050	3.0	2.0702E-07	1	2	.0590	1.0000	1.0000	6	.4460	2.0702E-07
7	.5410	2.0	2.0741E-07	2	2	.0590	.4200	1.0000	7	.4820	8.7111E-08
					4	.2800	.5800	1.0000	8	.2530	1.2030E-07
8	.6140	3.0	6.1643E-07	2	2	.0590	.9700	1.0000	9	.5550	5.9794E-07
					3	.2700	.0300	1.0000	10	.3360	1.8493E-08
9	.7360	2.0	1.8657E-07	1	8	.6140	1.0000	1.0000	11	.1220	1.8657E-07
10	.7820	4.0	3.8003E-07	2	1	0.0000	.4600	1.0000	12	.7820	1.7481E-07
					4	.2800	.5400	1.0000	13	.4940	2.0521E-07
11	1.0060	3.0	2.7570E-07	5	8	.6140	.5200	1.0000	14	.3920	1.4340E-07
					7	.5410	.0700	1.0000	15	.4650	1.9394E-08
					4	.2800	.1500	1.0000	16	.7180	4.1367E-08
					3	.2700	.1200	1.0000	17	.7280	3.3093E-08
					2	.0590	.1400	1.0000	18	.9470	3.8609E-08

I= 1 IP= 2 IR= 2 ZA1= 1 ZA2=27059 SEPARATION ENERGY = 7.492 MEV ACCUMULATED SEPARATION ENERGY = 0.000 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 0

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO= SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-3.5	99.0	1.5750E-03
2	1.0393	-1.5	99.0	1.4973E-03
3	1.1920	-4.5	99.0	3.8514E-03
4	1.2915	-1.5	99.0	1.1044E-03
5	1.4340	-5.5	99.0	5.3715E-04
6	1.4600	-5.5	99.0	3.2654E-03
7	1.4810	-2.5	99.0	1.8832E-03
8	1.7440	-3.5	99.0	2.2726E-03

I= 1 IP= 3 IR= 3 ZA1=1001 ZA2=26059 SEPARATION ENERGY = 0.275 MEV ACCUMULATED SEPARATION ENERGY = 0.000 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 3

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO= SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-1.5	99.0	4.5694E-04
2	.2590	-5.5	99.0	2.1616E-04
3	.4750	-2.5	99.0	6.6594E-04

I= 1 IP= 4 IR= 4 ZA1=2000 ZA2=25056 SEPARATION ENERGY = 7.172 MEV ACCUMULATED SEPARATION ENERGY = 0.000 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 3

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO= SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	3.0	99.0	2.1185E-04
2	.0260	2.0	99.0	1.5207E-04
3	.1100	1.0	99.0	9.2096E-05

I= 2 IP= 1 IR= 9 ZA1= 0 ZA2=26059 SEPARATION ENERGY = 0.000 MEV ACCUMULATED SEPARATION ENERGY = 0.275 MEV
 NUMBER OF LEVEL IN RESIDUAL NUCLEUS = 3 NUMBER OF GAMMA RAYS = 3 RESIDUAL NUCLEUS ID =26059

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	PRODUCTION CROSS SECTION (BARNs)	NUMBER OF TRANSITIONS	FINAL LEVEL NO	FINAL ENERGY (MEV)	TRANSITION PROBABILITY	CONDITIONAL PROBABILITY	GAMMA NUMBER	GAMMA ENERGY (MEV)	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-1.5	6.8647E-02	0							
2	.2890	-1.5	1.6409E-02	1	1	0.0000	1.0000	1.0000	1	.2890	1.6409E-02
3	.4750	-2.5	4.1424E-02	2	1	0.0000	.7500	1.0000	2	.4750	3.1068E-02
					2	.2890	.2500	1.0000	3	.1860	1.0356E-02

I= 2 IP= 2 IR= 6 ZA1= 1 ZA2=26058 SEPARATION ENERGY = 6.587 MEV ACCUMULATED SEPARATION ENERGY = 8.275 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 9

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	0.0	99.0	8.5725E-03
2	.8106	2.0	99.0	2.2615E-02
3	1.5750	2.0	99.0	3.0559E-03
4	2.1334	3.0	99.0	5.1458E-03
5	2.2570	0.0	99.0	1.2544E-04
6	2.5960	4.0	99.0	2.7356E-03
7	2.7820	1.0	99.0	1.4346E-04
8	2.8760	1.0	99.0	1.2230E-04
9	3.0840	2.0	99.0	1.7128E-04

I= 2 IP= 3 IR= 7 ZA1=1001 ZA2=25058 SEPARATION ENERGY = 11.899 MEV ACCUMULATED SEPARATION ENERGY = 8.275 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 1

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-0.0	99.0	0.

I= 2 IP= 4 IR= 8 ZA1=2004 ZA2=24055 SEPARATION ENERGY = 7.974 MEV ACCUMULATED SEPARATION ENERGY = 8.275 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 5

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-1.5	99.0	4.0766E-11
2	.2440	-1.5	99.0	9.0508E-13
3	.5210	-2.5	99.0	7.7826E-12
4	.5720	-1.5	99.0	1.4270E-12
5	.8850	-2.5	99.0	2.0583E-12

I= 3 IP= 1 IR= 9 ZA1= 0 ZA2=25056 SEPARATION ENERGY = 0.000 MEV ACCUMULATED SEPARATION ENERGY = 7.172 MEV
 NUMBER OF LEVEL IN RESIDUAL NUCLEUS = 3 NUMBER OF GAMMA RAYS = 2 RESIDUAL NUCLEUS ID =25056

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	PRODUCTION CROSS SECTION (BARNs)	NUMBER OF TRANSITIONS	FINAL LEVEL NO	FINAL ENERGY (MEV)	TRANSITION PROBABILITY	CONDITIONAL PROBABILITY	GAMMA NUMBER	GAMMA ENERGY (MEV)	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	3.0	1.6455E-02	0							
2	.0260	2.0	7.5421E-03	1	1	0.0000	1.0000	1.0000	1	.0260	7.5421E-03
3	.1100	1.0	2.0286E-03	1	2	.0260	1.0000	1.0000	2	.0840	2.0286E-03

I= 3 IP= 2 IR=10 ZA1= 1 ZA2=25055 SEPARATION ENERGY = 7.270 MEV ACCUMULATED SEPARATION ENERGY = 7.172 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 7

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-2.5	99.0	9.7831E-05
2	.1260	-3.5	99.0	1.5538E-04
3	.9840	-4.5	99.0	9.0889E-06
4	1.2920	-5.5	99.0	1.0837E-05
5	1.5280	-1.5	99.0	1.8085E-06
6	1.8830	-2.5	99.0	1.2467E-06
7	2.1990	-3.5	99.0	1.1196E-06

I= 3 IP= 3 IR=11 ZA1=1001 ZA2=24055 SEPARATION ENERGY = 9.077 MEV ACCUMULATED SEPARATION ENERGY = 7.172 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 5

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-1.5	99.0	3.2107E-11
2	.2440	-1.5	99.0	7.7307E-13
3	.5210	-2.5	99.0	3.5026E-13
4	.5720	-1.5	99.0	1.8115E-13
5	.8850	-2.5	99.0	1.1267E-13

I= 3 IP= 4 IR=12 ZA1=2004 ZA2=23052 SEPARATION ENERGY = 7.897 MEV ACCUMULATED SEPARATION ENERGY = 7.172 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 7

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	3.0	99.0	6.9296E-15
2	.0172	2.0	99.0	4.3148E-15
3	.0220	4.0	99.0	1.5509E-14
4	.1416	1.0	99.0	1.8203E-15
5	.1478	3.0	99.0	4.7770E-15
6	.4366	2.0	99.0	2.0365E-15
7	.7935	2.0	99.0	1.0685E-15

I= 4 IP= 1 IR=13 ZA1= 0 ZA2=27059 SEPARATION ENERGY = 0.000 MEV ACCUMULATED SEPARATION ENERGY = 7.492 MEV
 NUMBER OF LEVEL IN RESIDUAL NUCLEUS = 8 NUMBER OF GAMMA RAYS = 11 RESIDUAL NUCLEUS ID = 27059

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	PRODUCTION CROSS SECTION (BARNs)	NUMBER OF TRANSITIONS	FINAL LEVEL NO	FINAL ENERGY (MEV)	TRANSITION PROBABILITY	CONDITIONAL PROBABILITY	GAMMA NUMBER	GAMMA ENERGY (MEV)	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-3.5	3.7819E-01	0							
2	1.0993	-1.5	4.2541E-02	1	1	0.0000	1.0000	1.0000	1	1.0993	4.2541E-02
3	1.1900	-4.5	7.9069E-02	1	1	0.0000	1.0000	1.0000	2	1.1900	7.9069E-02
4	1.2915	-1.5	2.2172E-02	2	1	0.0000	.9400	1.0000	3	1.2915	2.0795E-02
					2	1.0993	.0600	1.0000	4	.1922	1.3273E-03

5	1.4340	-5	8.6454E-03	2	2	1.0993	.5000	1.0000	5	.3347	4.3227E-03
					4	1.2915	.5000	1.0000	6	.1425	4.3227E-03
6	1.4600	-5.5	8.7962E-02	1	1	0.0000	1.0000	1.0000	7	1.4600	8.7962E-02
7	1.4810	-2.5	1.8790E-02	2	2	1.0993	.6000	1.0000	8	.3817	1.1274E-02
					1	0.0000	.4000	1.0000	9	1.4810	7.5150E-03
8	1.7440	-3.5	1.6091E-02	2	1	0.0000	.5500	1.0000	10	1.7440	8.8281E-03
					3	1.1900	.4500	1.0000	11	.5540	7.2230E-03

I= 4 IP= 2 IR=14 ZA1= 1 ZA2=27058 SEPARATION ENERGY = 10.460 MEV ACCUMULATED SEPARATION ENERGY = 7.492 MEV
NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 6

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNS)
1	0.0000	2.0	99.0	6.7070E-02
2	.0249	5.0	99.0	3.3623E-01
3	.0540	3.0	99.0	9.5163E-02
4	.1160	4.0	99.0	1.5206E-01
5	.3670	3.0	99.0	5.1398E-02
6	.4320	2.0	99.0	2.9767E-02

I= 4 IP= 3 IR=15 ZA1=1001 ZA2=26058 SEPARATION ENERGY = 7.370 MEV ACCUMULATED SEPARATION ENERGY = 7.492 MEV
NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 9

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNS)
1	0.0000	0.0	99.0	3.7731E-02
2	.0106	2.0	99.0	4.0844E-02
3	1.6750	2.0	99.0	3.5876E-03
4	2.1334	3.0	99.0	2.8986E-03
5	2.2570	0.0	99.0	2.1366E-04
6	2.5960	4.0	99.0	1.6681E-03
7	2.7820	1.0	99.0	2.1757E-04
8	2.8760	1.0	99.0	1.8641E-04
9	3.0840	2.0	99.0	2.1991E-04

I= 0 IP= 4 IR=16 ZA1=2000 ZA2=25055 SEPARATION ENERGY = 6.951 MEV ACCUMULATED SEPARATION ENERGY = 7.492 MEV
 NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 7

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-2.5	99.0	1.5360E-04
2	.1260	-3.5	99.0	6.8662E-04
3	.9840	-4.5	99.0	5.2054E-05
4	1.2920	-5.5	99.0	2.9761E-04
5	1.5280	-1.5	99.0	2.2376E-06
6	1.8830	-2.5	99.0	1.0058E-06
7	2.1990	-3.5	99.0	3.4425E-06

I= 5 IP= 1 IR=17 ZA1= 0 ZA2=27058 SEPARATION ENERGY = 0.000 MEV ACCUMULATED SEPARATION ENERGY = 17.952 MEV
 NUMBER OF LEVEL IN RESIDUAL NUCLEUS = 6 NUMBER OF GAMMA RAYS = 6 RESIDUAL NUCLEUS ID #27058

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	PRODUCTION CROSS SECTION (BARNs)	NUMBER OF TRANSITIONS	FINAL LEVEL NO	FINAL ENERGY (MEV)	TRANSITION PROBABILITY	CONDITIONAL PROBABILITY	GAMMA NUMBER	GAMMA ENERGY (MEV)	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	2.0	8.0915E-01	0							
2	.0249	5.0	3.4826E-01	1	1	0.0000	1.0000	1.0000	1	.0249	3.4826E-01
3	.0540	3.0	1.1611E-01	1	1	0.0000	1.0000	1.0000	2	.0540	1.1611E-01
4	.1160	4.0	1.6295E-01	2	2	.0249	.0300	1.0000	3	.0911	4.0000E-01
					1	0.0000	.9700	1.0000	4	.1160	1.5006E-01
5	.3670	3.0	5.7994E-02	1	1	0.0000	1.0000	1.0000	5	.3670	5.7994E-02
6	.4320	2.0	3.5064E-02	1	1	0.0000	1.0000	1.0000	6	.4320	3.5064E-02

IP= 5 IP= 2 IR=18 ZA1= 1 ZA2=27057 SEPARATION ENERGY = 8.572 MEV ACCUMULATED SEPARATION ENERGY = 17.952 MEV
NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 8

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-3.5	99.0	0.
2	1.2235	-4.5	99.0	0.
3	1.3779	-1.5	99.0	0.
4	1.5050	-0.5	99.0	0.
5	1.7577	-1.5	99.0	0.
6	1.8965	-3.5	99.0	0.
7	1.9201	-2.5	99.0	0.
8	2.1329	-2.5	99.0	0.

IP= 5 IP= 3 IR=19 ZA1=1001 ZA2=26097 SEPARATION ENERGY = 6.953 MEV ACCUMULATED SEPARATION ENERGY = 17.952 MEV
NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 5

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	-0.5	99.0	0.
2	.0144	-1.5	99.0	0.
3	.1365	-2.5	99.0	0.
4	.3668	-1.5	99.0	0.
5	.7066	-2.5	99.0	0.

IP= 5 IP= 4 IR=20 ZA1=2004 ZA2=25054 SEPARATION ENERGY = 6.715 MEV ACCUMULATED SEPARATION ENERGY = 17.952 MEV
NUMBER OF LEVELS IN RESIDUAL NUCLEUS = 1

LEVEL NO	LEVEL ENERGY (MEV)	SPIN, PARITY	ISO- SPIN	PRODUCTION CROSS SECTION (BARNs)
1	0.0000	3.0	99.0	0.

L E V E L				D E N S I T Y				P A R A M E T E R S								
I	IP	IR	IZA1	IZA2	A (/MEV)	TEMP (MEV)	E0 (MEV)	EMATCH (MEV)	ECUT (MEV)	LEVELS AT ECUT	PN (MEV)	PZ (MEV)	SN (MEV)	SZ (MEV)	S (MEV)	SAC (MEV)
1	1	1	0	27060	7.508	1.135	-1.714	5.837	1.006	11	.00	0.00	15.52	-17.36	0.000	0.000
1	1	2	1	27059	7.058	1.231	-1.816	7.769	1.744	8	1.29	0.00	14.92	-17.36	7.492	0.000
1	2	3	1001	26059	7.918	1.162	-1.802	0.375	.475	3	.00	1.54	15.52	-16.37	8.275	0.000
1	1	4	2004	25056	7.233	1.583	-1.629	.436	.110	3	.00	0.00	14.13	-15.53	7.172	0.000
2	1	5	0	26059	7.918	1.162	-1.802	0.375	.475	3	.00	1.54	15.52	-16.37	0.000	8.275
2	2	6	1	26058	7.465	1.214	-1.416	9.708	3.084	9	1.29	1.54	14.92	-16.37	6.587	8.275
2	3	7	1001	25058	8.231	.758	0.000	.046	0.000	1	.00	0.00	15.52	-15.53	11.899	8.275
2	4	8	2004	24059	7.517	1.204	-1.052	0.152	.605	5	0.00	1.35	14.13	-14.71	7.974	8.275
3	1	9	0	25056	7.233	1.583	-1.629	.436	.110	3	0.00	0.00	14.13	-15.53	0.000	7.172
3	2	10	1	25055	6.665	1.161	-1.009	6.410	2.199	7	1.27	0.00	13.26	-15.53	7.270	7.172
3	3	11	1001	24055	7.517	1.204	-1.052	0.152	.685	5	0.00	1.35	14.13	-14.71	9.077	7.172
3	4	12	2004	23052	6.750	1.186	-1.517	5.366	.794	7	0.00	0.00	12.60	-13.93	7.897	7.172
4	1	13	0	27059	7.058	1.231	-1.816	7.769	1.744	8	1.29	0.00	14.92	-17.36	0.000	7.492
4	2	14	1	27058	6.518	1.277	-1.855	6.201	.432	6	0.00	0.00	14.13	-17.36	10.460	7.492
4	3	15	1001	26058	7.465	1.214	-1.416	9.708	3.084	9	1.29	1.54	14.92	-16.37	7.370	7.492
4	4	16	2004	25055	6.665	1.181	-1.009	6.410	2.199	7	1.27	0.00	13.26	-15.53	6.951	7.492
5	1	17	0	27058	6.518	1.277	-1.855	6.201	.432	6	0.00	0.00	14.13	-17.36	0.000	17.952
5	2	18	1	27057	5.951	1.399	-1.776	8.073	2.133	0	1.27	0.00	13.26	-17.36	8.572	17.952
5	3	19	1001	26057	6.923	1.354	-1.473	9.664	.707	5	0.00	1.54	14.13	-16.37	6.953	17.952
5	4	20	2004	25054	6.217	2.373	0.000	.462	0.000	1	0.00	0.00	12.60	-15.53	6.713	17.952