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Evaluated Nuclear Structure Data File A Manual for Preparation of Data Sets

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**EVALUATED NUCLEAR STRUCTURE DATA FILE
A MANUAL FOR PREPARATION OF DATA SETS**

W. Bruce Ewbank and Marcel R. Schmorak

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W. Bruce Ewbank and Marcel R. Schmorak

I. INTRODUCTION

The Nuclear Data Project at ORNL is continuing to expand its computer-based file of nuclear structure data, which is intended for use by both basic and applied users. For every nucleus, the Evaluated Nuclear Structure Data File (ENSDF) contains evaluated nuclear structure information. For masses $A \geq 45$, this information is documented in the *Nuclear Data Sheets*; for $A \leq 45$, ENSDF is based on compilations published in the journal *Nuclear Physics*. In addition, the file will incorporate such important new data as may have become available since the most recent published evaluation. It is hoped that nuclear structure research workers will participate in building the data file by preparing their new data in such a form that it can easily be included. It is desired that the data file represent the best currently available nuclear structure data.

This manual describes a standard input format for nuclear structure data. The format is sufficiently structured that bulk data can be entered efficiently. At the same time, the structure is open-ended and can accommodate most measured or deduced quantities that yield nuclear structure information.

The data file is used by both basic and applied scientists and engineers. The Nuclear Data Project is using the data file to prepare *Nuclear Data Sheets*, collections of specific nuclear properties and of particular types of experimental information. Computer programs have been developed at the Data Project to perform consistency checking and routine calculations. Programs are also used for preparing level scheme drawings and for reformatting the nuclear structure data for special tabular presentation. Data extracted from the Evaluated Nuclear Structure Data File is also used by the Data Project to respond to specific requests from the nuclear community for current nuclear structure information.

II. GENERAL STRUCTURE OF THE DATA FILE

A. Introduction

The Evaluated Nuclear Structure Data File (ENSDF) is made up from a collection of "data sets", each of which describes the results of a single experiment or the combined evaluated results of a number of experiments of the same type. The appearance of these data sets within the computer file is of less concern here than is the appearance of the data sets either before they enter the computer or after they have been retrieved. The Nuclear Data Project has designed a card-based (or card-image-based) external representation of results of a nuclear structure experiment, which may be used for preparing input to the computer file. In the remainder of this manual, we shall refer to the group of cards or card images as a data set, even though it is understood to be only an external version of the internal data set which makes up part of the data file. A sample data set is given in Appendix 3.

B. Summary of Data Set Structure

A data set is composed of records; each record is made up of one or more card images.

A data set *must* begin with an IDENTIFICATION record (with label information) and must end with an END record (a blank card). Between these two records, there will be as many additional records as are needed to describe fully the experiment or the evaluated data set.

Immediately following the IDENTIFICATION record is a group of records which contain information about the entire data set. The NORMALIZATION (N), Q-VALUE (Q), FORMAT (F), PARENT (P), and general COMMENT (C) records are of this type.

The body of a data set is composed of numeric data records which describe the measured or deduced properties of levels, γ rays, α particles, etc. These records are associated with the level which decays (for GAMMA records) or the level which is populated (for B⁻, EC, or ALPHA records). Thus, each LEVEL record is followed by a group of records describing charged-particle decay into the level and γ -ray decay out of the level.

If a GAMMA record (or ALPHA or B⁺ or B⁻) properly belongs in a data set, but it cannot be associated with any particular level, then the record should be placed in the data set *before any* LEVEL records.

The placement of COMMENT records is described in Section III.C.

III. STANDARD ONE-CARD RECORD FORMATS

A. Introduction

In most cases, all information for a record can be placed on a single 80-column card. A "standard" format has been defined for each one-card record, such that the most commonly used quantities can be placed on a single card. The standard formats are described in this section for each record. If a needed quantity is not included in the standard format or if a value will not fit within the field defined for the value by the standard format, then a FORMAT record will be required (see Appendix 1). If a record cannot be contained on a single card, then additional cards can be prepared as described in Section IV (for examples, see Appendix 3).

B. The Standard One-Card Record Formats

Record formats are given below in the same order in which they would normally be encountered in a data set. Conditions under which each record may appear or be required are given in parentheses. The format descriptions give the *fields* (in inclusive card-column numbers), the *field names* (the formal "name" of the quantity that goes into the field), and a brief *field description*. Card columns not explicitly included in the fields are *expected to be blank*. Additional information about each field can be found in the reference section noted. (Any numerical field left blank usually implies that the numerical information is lacking. Numbers will usually be assumed to be positive unless stated otherwise.) Numbers can be entered anywhere in the appropriate field (i.e., there is no need to left-adjust or right-adjust.)

1. THE IDENTIFICATION RECORD

(Required for all data sets.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8		Must be blank	
10-39	DSID	Data set identification	V.B
40-64	DSREF	Data set references	V.C
75-80	DATE	The date (year/month/day) when the data set was placed in the data file (entered automatically by computer)	

2. THE FORMAT RECORD

(Required only if the standard format is not used. See Appendix 1.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
7	F	Letter "F" is required	
8	RTYPE	Record type being formatted	V.D
10-80	FORMATS	A complete description of the format for records of type RTYPE; e.g., E = 10, DE = 19, J = 24, ... SYM = COL, where SYM is any data type (DTYPE) allowed for RTYPE records and COL is the column on RTYPE cards where the value of SYM begins	

3. THE COMMENT RECORD

(See Section III.C and Appendix 3.)

General Comments

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
7	C	Letter "C" is required	
8		Must be blank	
10-70	CTEXT	Text of the comment. EBCDIC (extended binary coded decimal interchange code) should be used [see NDSLISIT Translation Dictionary (Appendix 4) of the Nuclear Data Project for details]	Appendix 4

Record Comments and Flagged Comments

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
7	C	Letter "C" is required	
8	RTYPE	Record type being commented upon	V.D
10-19	SYM(FLAG)	SYM = type of data being commented upon FLAG = character in col. 77 of all records to which the comment applies. If FLAG is omitted, the comment is understood to apply to all records of RTYPE	Appendix 1, Section C
20-70	CTEXT	Text of comment (same as for general comments). In cases where continuation cards are not used, the CTEXT may extend to col. 80. On continuation comment records, cols. 10-70 may be used for CTEXT, and SYM(FLAG) is <i>not</i> repeated	

4. THE NORMALIZATION RECORD

(Required if an absolute normalization is possible; used mainly with decay data sets.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8	N	Letter "N" is required	
10-19	NR	Multiplier for converting relative <i>photon</i> intensity (RI in the GAMMA record) to <i>photons</i> per 100 decays of the parent through the decay branch. <i>Required</i> if absolute photon intensity can be calculated	
20-21	DNR	Standard uncertainty in NR	VI
22-29	NT	Multiplier for converting relative <i>transition</i> intensity (including conversion electrons) [TI in the GAMMA record] to <i>transitions</i> per 100 decays of the parent through this decay branch	
30-31	DNT	Standard uncertainty in NT	VI
32-39	BR	Branching ratio multiplier for converting intensity per 100 decays through this decay branch to intensity per 100 decays of the parent nucleus. <i>Required if known</i>	
40-41	DBR	Standard uncertainty in BR	VI
42-49	NB	Multiplier for converting relative β^- and ϵ intensities (IB in the B- record; TI, IE, IB in the EC record) to intensities per 100 decays through this decay branch	
50-55	DNB	Standard uncertainty in NB	

5. THE PARENT RECORD

(Required for all decay data sets, except IT decay.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification for <i>parent</i> record	V.A
8	P	Letter "P" is required	
10-19	E	Energy of the decaying level in keV (0 for g.s.)	
20-21	DE	Standard uncertainty in E	VI
22-39	J	Spin and parity	
40-49	T	Half-life; units <i>must</i> be given	VII
50-55	DT	Standard uncertainty in T	VI
65-74	QP	Ground-state Q-value in keV (total energy available for <u>g.s. $\rightarrow$ g.s.</u> transition); will always be a positive number	
75-76	DQP	Standard uncertainty in QP	VI

6. THE Q-VALUE RECORD

*(Required for adopted levels data sets.**If signs are not given, they will be assumed to be +.)*

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8	Q	Letter "Q" is required	
10-19	Q ⁻	Total energy (keV) available for β^- decay of the ground state. ($Q^- > 0$ if β^- decay is energetically possible)	
20-21	DQ ⁻	Standard uncertainty in Q ⁻	VI
22-29	SN	Neutron separation energy in keV	
30-31	DSN	Standard uncertainty in SN	VI
32-39	SP	Proton separation energy in keV	
40-41	DSP	Standard uncertainty in SP	VI
42-49	QA	Total energy (keV) available for α decay of the ground state	
50-55	DQA	Standard uncertainty in QA	VI
56-80	REF	Reference citation(s) for the Q-values	

7. THE LEVEL RECORD

(Optional, although a data set usually has at least one.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8	L	Letter "L" is required	
10-19	E	Level energy in keV	
20-21	DE	Standard uncertainty in E	VI
22-39	J	Spin and parity	
40-49	T	Half-life of the level; units <i>must</i> be given. Mean-life expressed as width of level, in units of energy, may also be used	VII.A
50-55	DT	Standard uncertainty in T	VI
56-64	L	Angular momentum transfer in the reaction determining the data set. (Whether it is L_n , L_p , ΔL , etc., is determined from the DSID field of the IDENTIFICATION record.)	
65-74	S	Spectroscopic strength for this level as deter- mined from the reaction in the IDENTI- fication record. (Spectroscopic factor for particle-exchange reactions; β for inelastic scattering.)	
75-76	DS	Standard uncertainty in S	
77	C	Comment FLAG (see Section III.C.3) used to refer to a particular comment record	
78-79	MS	Metastable state is denoted by M or M1 for the first isomer; M2, for the second, etc.	
80	Q	The character "?" denotes an uncertain or questionable level Letter "S" denotes neutron or proton separation energy	

8. THE GAMMA RECORD

(Must follow the LEVEL record for the level from which the γ ray decays.

Records for γ rays which are unassigned in a level scheme should precede the first level of the data set.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8	G	Letter "G" is required	
10-19	E	Energy of the γ -ray photon in keV	
20-21	DE	Standard uncertainty in E	VI
22-29	RI	Relative <i>photon</i> intensity†	
30-31	DRI	Standard uncertainty in RI	VI
32-41	M	Multipolarity of transition	
42-49	MR	Mixing ratio, δ . (Sign must be shown explicitly if known. If no sign is given, it will be assumed to be unknown.)	
50-55	DMR	Standard uncertainty in MR	VI
56-62	CC	Total conversion coefficient	
63-64	DCC	Standard uncertainty in CC	VI
65-74	TI	Relative total transition intensity†	
75-76	DTI	Standard uncertainty in TI	VI
77	C	Comment FLAG (see Section III.C.3. "Flagged Comments") used to refer to a particular comment record. The character * denotes a multiply placed γ ray	
78	ORG	Letter "C" denoted coincidence with a preceding radiation	
79	END	Letter "C" denotes coincidence with a following radiation	
80	Q	The character "?" denotes an uncertain placement of the transition in the level scheme Letter "S" denotes an expected, but as yet unobserved, transition	

†The intensity units are defined by the NORMALIZATION record.

9. THE β^- RECORD(Must follow the LEVEL record for the level which is fed by the β^- .)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8	B	Letter "B" is required	
10-19	E	Endpoint energy of the β^- in keV <i>only if measured</i>	
20-21	DE	Standard uncertainty in E	VI
22-29	IB	Intensity of the β^- -decay branch	
30-31	DIB	Standard uncertainty in IB	VI
42-49	LOGFT	Log ft for the β^- transition	
50-55	DFT	Standard uncertainty in LOGFT	VI
77	C	Comment FLAG (see Section III.C.3, "Flagged Comments"). (Letter "C" denotes coincidence with a following radiation.)	
78-79	UN	Uniqueness classification for the β^- decay, e.g., 1U, 2U. (A blank signifies an allowed or a nonunique forbidden transition.)	
80	Q	The character "?" denotes an uncertain or questionable β^- decay Letter "S" denotes an expected or predicted transition	

10. THE EC (OR EC + β^+) RECORD

(Must follow the LEVEL record for the level being populated in the decay.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8	E	Letter "E" is required	
10-19	E	Energy for <i>electron capture</i> to the level <i>only if measured</i>	
20-21	DE	Standard uncertainty in E	VI
22-29	IB	Intensity of β^+ -decay branch	
30-31	DIB	Standard uncertainty in IB	VI

The EC (or EC + β^+) Record

Continued

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 32-39	IE	Intensity of electron capture branch†	
40-41	DIE	Standard uncertainty in IE	VI
42-49	LOGFT	Log ft for ($\epsilon + \beta^+$) transition	
50-55	DFT	Standard uncertainty in LOGFT	VI
65-74	TI	Total ($\epsilon + \beta^+$) decay intensity†	
75-76	DTI	Standard uncertainty in TI	VI
77	C	Comment FLAG (see Section III.C.3, "Flagged Comments"). (Letter "C" denotes coincidence between β^+ and a following radiation.)	
78-79	UN	Uniqueness classification for ϵ , β^+ decay, e.g., 1U. 2U. (A blank signifies an allowed or a nonunique forbidden transition.)	
80	Q	The character "?" denotes an uncertain or questionable ϵ , β^+ branch Letter "S" denotes an expected or predicted transition	

11. THE ALPHA RECORD

(Must follow the LEVEL record for the level being populated in the decay.)

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 1-5	NUCID	Nucleus identification	V.A
8	A	Letter "A" is required	
10-19	E	Alpha energy in keV	
20-21	DE	Standard uncertainty in E	VI
22-29	IA	Intensity of α -decay branch in percent of the total α decay	
30-31	DIA	Standard uncertainty in IA	VI

†IE, IB, and TI should be in the same units (see also NB in NORMALIZATION record).

The Alpha Record*Continued*

<u>Field</u>	<u>Name</u>	<u>Description</u>	<u>Reference</u>
Col. 32-39	HF	Hindrance factor for α decay	
40-41	DHF	Standard uncertainty in HF	VI
77	C	Comment FLAG (see Section III.C.3, "Flagged Comments"). (Letter "C" denotes coincidence with following radiation.)	
80	Q	The character "?" denotes uncertain or questional α branch Letter "S" denotes an expected or predicted α branch	

12. THE END RECORD

(Required for all data sets.)

<u>Field</u>	<u>Description</u>
Col. 1-80	All columns are blank

C. Comment Records

Several types of COMMENT records are available. The first cards of COMMENT records are described below.

1. *General comment* — RTYPE (col. 8) is left blank. The comment refers to the whole data set. (Or in the case that NUCID contains only the mass number, A, the comment refers to the whole mass-chain A.) General comments must be placed in a data set before any L, G, B, E, or A. records.

2. *Record comment* — RTYPE (col. 8) is one of the following: L, G, B, E, A. Columns 10-19 are either a) blank for comments referring to the whole record specified by RTYPE or b) cols. 10-19 specify the comment further (e.g., G in col. 8 and RI in cols. 10-11 define a comment referring to γ -ray photon intensity). Record comments placed at the head of the data set refer to all records of the specified RTYPE in the data set. Record comments placed immediately following a record refer only to that one record. (For example, a comment with L in col. 8 and T in col. 10,

placed at the head of a data set, refers to *all* level half-lives in that data set. The same comment placed immediately following the level record for the second-excited state refers *only* to the half-life of the second-excited state.)

Comments for which RTYPE is N, P, or Q must be placed immediately following those records.

3. *Flagged comment* – RTYPE (col. 8) is one of the following: L, G, B, E, A; columns 10-19 contain SYM(FLAG). SYM is the name of the field or a special word (e.g., BAND) describing some common feature of a group of records with the same RTYPE. FLAG is a character in col. 77 of all the records in the data set to which the comment applies. Flagged comments must be placed *before* any L, G, B, E, or A records. The FLAG will consist of one or more different characters enclosed in parentheses. (In general, any EBCDIC character may be used for FLAG, except C and * on some records.)

4. *Comment continuation* – For any COMMENT record, the text of the comment (CTEXT) may be continued on continuation cards starting in col. 10. (For ease of editing and revising comments, it is recommended that CTEXT not extend beyond col. 70.) A string of characters translated as one unit by the NDSLIT Translation Dictionary (Appendix 4) should *not* be split between two cards.

D. Summary

The following figure summarizes the standard one-card formats for all allowed record types.

ORNL NUCLEAR DATA PROJECT									
ENDP STANDARD ONE-CARD FORMATS									
RECORD TYPE	1	2	3	4	5	6	7	8	9
IDENTIFICATION	NUC ID	1	2	3	4	5	6	7	8
FORMAT	NUC ID	1	2	3	4	5	6	7	8
GENERAL COMMENT	NUC ID	1	2	3	4	5	6	7	8
FLAGGED COMMENT	NUC ID	1	2	3	4	5	6	7	8
NORMALIZATION	NUC ID	1	2	3	4	5	6	7	8
PARENT	NUC ID	1	2	3	4	5	6	7	8
Q-VALUE	NUC ID	1	2	3	4	5	6	7	8
LEVEL	NUC ID	1	2	3	4	5	6	7	8
GAMMA	NUC ID	1	2	3	4	5	6	7	8
β^-	NUC ID	1	2	3	4	5	6	7	8
EC	NUC ID	1	2	3	4	5	6	7	8
ALPHA	NUC ID	1	2	3	4	5	6	7	8
END	NUC ID	1	2	3	4	5	6	7	8

** TYPE
 1 = Column 6 is blank or 1 for the first card record
 2 = GNC
 3 = END

IV. RECORDS CONTAINING MORE THAN ONE CARD

A. Card Enumeration

If all the information for a given record type cannot be contained on a single card, then it is possible to use additional cards to describe the record fully. The first card of a record will have the number 1 or a blank in col. 6. Subsequent cards will have characters different from 1 or blank (usually running numbers: 2, 3, etc., up to 9). It is not allowed to have continuation cards for the IDENTIFICATION record, the FORMAT record, the Q-VALUE record, the NORMALIZATION record, or the END record, since these records consist of a single card. (The FORMAT record consists of a single card for each record type for which a special format is described.)

B. Formats for Continuation Cards

The second, third, etc., cards of a record do not have a standard format. The data must be presented in free-field format (Section VIII). For example:

```
138BA2 L B(E2)=0.249 13
240PU2 G L/T=0.730 68 H/T=0.202 68 H+/T=0.060 28
237WF2 Z K=0.490 128 L=0.363 88 P+=0.150 18
```

The data types given on continuation cards are limited to the set of names listed under columns DTYPE for each record type in Appendix I. The data type and the data value may be connected by a relational operator from the following list.

EQ or =	equal to
LE	less than or equal to ($\leq$)
LT or <	less than
GT or >	greater than
GE	greater than or equal to ($\geq$)
AP	approximately equal to ($\approx$)
SY	obtained from systematics
CA	calculated value

The alphabetic representations must contain a blank on either side; i.e., "GT". "AP".

C. COMMENT Continuation

See Section III.C.

V. DETAILED FIELD DESCRIPTIONS

A. NUCID

The standard nucleus identification consists of two to five characters giving the A-value and the chemical symbol of a nucleus, e.g., 9B, 20F, 98RU, 17711F. The nucleus identification must be contained *within* the field defined for it (cols. 1-5 on most cards). The nucleus identification *must* be included on every IDENTIFICATION record. It is strongly recommended that it also be included on every card of a data set except the END record. (When a data set is merged onto the data file, the NUCID is moved to a standard position with the last digit of the A-value appearing in col. 3 of the NUCID field. This field is copied automatically onto every card of the data set except the P-record and the END record.) The data set will be handled correctly if all cards except the IDENTIFICATION record contain blanks in the NUCID field. General comments pertaining to the whole A- (mass) chain evaluation contain only the A-value in the NUCID field.

B. DSID

The content of a data set is described in a standard way in the DSID field of the IDENTIFICATION record. The standards may be described under three general headings: 1) decay data sets, 2) reaction data sets, 3) "adopted" data sets.

1. For a data set describing the results of a measurement of radioactive decay, the DSID field contains three parts separated by one or more blanks – the decaying nucleus, the type of decay, and the word "DECAY"; e.g.,

22NA	B+	DECAY
64Y	B-	DECAY
134I	IT	DECAY (3.7 M)
134I	B-	DECAY (3.7 M)
134I	B-	DECAY (52.6 M)
133BA	EC	DECAY
214AT	A	DECAY
252CF	SF	DECAY

A half-life (in parentheses) may be added to specify the decaying nucleus completely. The decaying nucleus is identified by its standard NUCID (Section V.A).

Five decay types are recognized in the DSID field:

B-	β^- decay
EC	} electron capture and/or β^+ decay (EC is preferred)
B+	
A	α decay
IT	isomeric state decay (γ radiation only)
SF	spontaneous fission

2. For a data set describing results of a nuclear reaction study, the DSID field contains the target and the incoming and outgoing particles, such as

20NE(P,D)	for (p,d)
48CA(A,A')	for (α,α')
109AG(40AR,40AR')	for ($^{40}\text{Ar}, ^{40}\text{Ar}'$)
90ZR(A,4NG)	for ($\alpha,4n\gamma$)
45SC(N,G), E = TH	for (n, γ), thermal n
COUL EX	for Coulomb excitation

The target nucleus and the reacting particle may be given in the standard form (see NUCID, Section V.A). (In rare cases, the target nucleus, if not in its ground state, should be identified by its $T_{1/2}$ or J, in addition to its NUCID.) A reaction energy may be given when desired or needed. The reacting particles may alternatively be taken from the list of abbreviations:

P	proton (1H)
N	neutron
A	α particle (4HE)
D	deuteron (2H)
T	triton (3H)
G	γ ray
MU+ } MU- }	μ meson
PI+ } PI0 } PI- }	π meson
NU	neutrino
E	electron

3. An ADOPTED data set contains the best representation of the present experimental knowledge about the levels of a nucleus and the γ branchings. The data set will be named ADOPTED LEVELS or ADOPTED LEVELS, GAMMAS.

An ADOPTED data set contains a LEVEL record for every level that has been reliably observed. GAMMA records may also be included in an ADOPTED LEVELS data set. If GAMMA records are included, the name of the data set is ADOPTED LEVELS, GAMMAS. If GAMMA records are not included, the name of the data set is ADOPTED LEVELS.

If all level information for a nucleus is contained in a data set for a single experiment, it is not necessary to make an additional ADOPTED data set as well. However, if more than one experimental data set contains level information about the nucleus,

then a separate ADOPTED data set *MUST* be made, even if the ADOPTED data set contains only the Q-VALUE record and a simple ground-state LEVEL record.

An ADOPTED data set always contains (in its IDENTIFICATION record) a reference to the *Nuclear Data Sheets* or similar evaluation where the supporting data have been compared. (This reference may be entered automatically by the computer.)

An ADOPTED data set contains a Q-VALUE record (e.g., as produced by the Atomic Mass Adjustment Program), which includes at least Q_β , S_n , S_p , Q_α , if available.

C. DSREF

References to the main supporting publications or analyses are placed in this field by means of standard Nuclear Data Project reference key numbers. If the data set describes a single measurement, then the key number of the published report of the measurement is sufficient. The DSREF field may include up to three key numbers, each of which refers to a particular publication. Additional key numbers may be placed in COMMENT records.

D. RTYPE

RTYPE is a single-letter code that gives a name to the RECORD type.

<u>RTYPE</u>	<u>Description</u>
Blank	May be IDENTIFICATION record, general COMMENT record, or END record
N	NORMALIZATION record
P	PARENT record
Q	Q-VALUE record
L	LEVEL record
G	GAMMA record
B	B- record
E	EC (or EC + B+) record
A	ALPHA record

VI. UNCERTAINTIES

Every experimental number entered into the data file should have an uncertainty associated with it, if at all possible. Uncertainties may be numeric or non-numeric. Numeric uncertainties may be symmetric or asymmetric.

A. Standard Numeric Uncertainties

The "standard form" for expressing numeric uncertainties is as an integer (usually between 2 and 25) uncertainty in the least significant digit(s) of the experimental number; i.e., $448.7 \pm 0.7 \rightarrow 448.7 \text{ } 7$; $0.3721 \pm 0.0014 \rightarrow 0.3721 \text{ } 14$. The RTYPE for a standard uncertainty is usually formed by adding the prefix D to the RTYPE of the datum; e.g., E, DE; RI, DRI; MV, DMV.

An asymmetric uncertainty may be written in the standard form by including signs: $0.84^{+0.10}_{-0.03} \rightarrow 0.84 \text{ } +10-3$. The convention on asymmetric uncertainties is that they combine algebraically with the datum, such that -3^{+1}_{-4} describes a range from -7 to -2. (Asymmetric uncertainties are used frequently only in the DMR field.)

B. Non-numeric Uncertainties

The non-numeric uncertainties include the symbols for approximate, calculated, systematics, and also the relational operators such as greater than, less than or equal to, etc. The non-numeric uncertainty may be given either as a symbol (if available) or as a two-letter code *in the uncertainty field*:

<u>Symbol</u>	<u>Letter code</u>	<u>Meaning</u>
$\approx$	AP	approximately equal to
$>$	GT	greater than
$\geq$ or $\geq$	GE	greater than or equal to
$<$	LT	less than
$\leq$ or $\leq$	LE	less than or equal to
	SY	systematics
	CA	calculated

VII. UNITS

A. *Half-lives* must include units. Use

FS	=	10^{-15} s
PS	=	10^{-12} s
NS	=	10^{-9} s
US	=	$\mu\text{s} = 10^{-6}$ s
MS	=	10^{-3} s
S	=	second
M	=	minute
H	=	hour
D	=	day
Y	=	year
KY	=	10^3 y
MY	=	10^6 y
GY	=	10^9 y
EV	=	width of level in eV

Computer-standard exponential format may be used. Examples:

$$3.7 \text{ PS} = 3.7\text{E-12 S}$$

$$4.21 \text{ GY} = 4.21\text{E9 Y}$$

B. *Intensity* units are usually defined by the NORMALIZATION record (see Section III.B.4).

C. All *energies* are in keV unless specified otherwise.

D. *Signs* of certain experimental quantities (nuclear moments, Q-values, γ -mixing ratios) are as important as the numbers, themselves. If the sign is known, it should be given explicitly. (If the sign is not known, then the absence of any sign is just as descriptive as the +-.)

VIII. FREE-FORM FIELDS

A free-form field on any card is a region on the card where the input data values are self-descriptive; i.e., the field contains character strings such as EKC = 0.104 5 or BE2 < 0.5. The second, third, etc., cards for any record (when permitted) contain one free-form field between cols. 10-80 (see Section IV.B).

A free-form field contains character strings of the form:

(data type)(operator)(data value).

The "data types" are restricted to the permitted names given under DTYPE in Appendix I for the appropriate record type. The "data value" is a numerical or character-string value. A numerical data value may have an associated uncertainty (Section VI). The "operator" may be a mathematical symbol or its alphabetic representation.

EQ or =	equal to
LE	less than or equal to
LT or <	less than
GE	greater than
GT or >	greater than or equal to
AP	approximately equal to

(The alphabetic representation must include at least one blank on each side; e.g., CEK_LT_27.4, but not CEK_LT27.4.) The character strings (data type + operator + data value) may be separated from each other by one or more blanks.

APPENDIX I

PREPARING FORMAT RECORDS

A. Introduction

If the standard one-card formats described in Section III.B are used, then there is no need to include a **FORMAT** record. A **FORMAT** record is *required* if the data items in a one-card record are too wide for the standard fields or if the data appear in an order different from the standard record or if data of a nonstandard type are to be included on the one-card record. (Use of the **FORMAT** records should be avoided whenever possible.†) Only the first card of a record may have its organization described by a **FORMAT** record. Continuation cards for the record will always contain their own format information (see Section IV.B). A **FORMAT** record may *not* be used for the **IDENTIFICATION** record, a **COMMENT** record, the **NORMALIZATION** record, the **Q-RECORD**, the **END** record, or another **FORMAT** record.

B. Organization of the **FORMAT** Record

The **FORMAT** record will always contain the letter "F" in col. 7 and a character **RTYPE** (see Section V.D) in col. 8 to identify the type of record for which the format is being specified by the **FORMAT** record. The **FORMAT** record consists of a single card for each record type for which a format is described. Continuation cards are not allowed. The text of the **FORMAT** record is contained in cols. 10-80. The text consists of a series of equalities separated by commas or blanks: e.g., $E = 10, DE = 20, J = 23, L = 40$. In general, the form $DTYPE = COL$ in a **FORMAT** record implies that the data of type **DTYPE** are always contained in a field beginning in column **COL** of the **RTYPE** record. By implication, the field width includes all space up to the next larger value of **COL** given for some other data type **DTYPE**.

If a **FORMAT** record is used, care must be taken to avoid conflicting format specifications. The same data type may not be identified with more than one location on the data record; i.e., $E = 10, E = 25$ is in error.

Since each field width is assumed to be the maximum available for the particular data type, it is important to specify the *complete* format of the record **RTYPE**. If the text of the **FORMAT** record for **LEVEL** records is $E = 15, J = 25, T = 40$, then 10 card columns are allowed for **E**, 15 for **J**, and 41 columns are allowed for **T**.

†Most of the standard analysis computer programs of the Nuclear Data Project do *not* operate on nonstandard data sets.

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If any LEVEL record contains other information, e.g., the letter "C" for "unresolved doublet" in col. 77, then a strange value for the half-life (T) will be inferred since the information is within the field defined for "T" type information.

C. Allowed Data Types

Each record type is permitted to contain only a limited (but extendable) set of data types. For example, a GAMMA record is not allowed to contain information of data type DTYPE = J (nuclear spin). Neither may a LEVEL record contain LOGFT information. For each record type, the following table lists the data types permitted as of September 1977.

1. The PARENT Record
2. The Q-VALUE Record

All allowed data types are included in the standard format description in Sections III.B.5 and III.B.6.

3. The LEVEL Record

Allowed data types, E, DE, J, T, DT, L, S, DS, C, MS, Q, are described with the standard formats in Section III.B.7. Additional allowed data types are:

<u>DTYPE</u>	<u>Description</u>
MV	Level energy in MeV
DMV	"Standard" uncertainty in MV (Section VI)
UEV, UKV, UMV	Uncertainty in level energy, expressed in eV, keV, and MeV, respectively
PE	Percent uncertainty in level energy
UE	Uncertainty in level energy, given in same units as the level energy itself
%EC, %SF, %IT, %B-, %B+, %A, %P, %N	Percent decay of the level by electron capture, spontaneous fission, isomeric transition, or emission of a β^- , β^+ , α , proton, or neutron
G	g-factor of the level
MOME1, MOME2, ...	Electric moments: dipole, quadrupole, ...
MOMM1, MOMM2, ...	Magnetic moments: dipole, quadrupole, ...
CONF	Nuclear configuration of the level
F	A "free-form" field (see Section VIII)
BE1, BE2, ...	Reduced electric transition probability (<i>upward</i>) given in units $e^2 \times (\text{barns})^L$, where $L = 1, 2, \dots$ for the transition from the ground state to this level
ISPIN	Isobaric spin

4. The GAMMA Record

Allowed data types, E, DE, RI, DRI, M, MR, DMR, CC, DCC, TI, DTI, C, ORG, END, Q, are described with the standard formats in Section III.B.8. Additional allowed data types are:

<u>DTYPE</u>	<u>Description</u>
MV	Gamma energy in MeV
DMV	"Standard" uncertainty in MV (Section VI)
UEV, UKV, UMV	Uncertainty in γ energy, expressed in eV, keV, and MeV, respectively
PE	Percent uncertainty in γ energy
UE	Uncertainty in γ energy, given in same units as the γ energy itself
BE1, BE2, ...	Reduced electric transition probability (<i>downward</i>) given in units of $e^2 \times (\text{barns})^L$, where $L = 1, 2, \dots$
BE1W, BE2W, ...	Reduced electric transition probability (<i>downward</i>) given in single-particle (Weisskopf) units
BM1, BM2, ...	Reduced magnetic transition probability (<i>downward</i>) given in units of $\mu_N^2 \times (\text{barns})^{L-1}$, where $L = 1, 2, \dots$
BM1W, BM2W, ...	Reduced magnetic transition probability (<i>downward</i>) given in single-particle (Weisskopf) units
CEK, CEL, CEL1, ...	Conversion-electron (ce) intensity for K, L, L_1 , ... conversion
KC, LC, L1C, ...	Theoretical K-, L-, L_1 -conversion coefficient
EKC, ELC, EL1C, ...	Measured K-, L-, L_1 -conversion coefficient
K/L, M/L, L1/L2, ...	Conversion-electron intensity ratios
K/L, L/T, ...	Ratio of K, L, ... ce-intensity to total ($\gamma + \text{ce}$) intensity
PRI, PTI	Percentage uncertainty in RI, TI
URI, UTI	Uncertainty in RI, TI, given in same units as RI, TI
F	A "free-form" field (see Section VIII)

5. The B- Record

Allowed data types, E, DE, IB, DIB, LOGFT, DFT, COIN, UN, Q, are described with the standard formats in Section III.B.9. Additional allowed data types are:

<u>DTYPE</u>	<u>Description</u>
BV	Beta energy in MeV
DMV	"Standard" uncertainty in MV (Section VI)
UEV, UKV, UMV	Uncertainty in β energy, given in eV, keV, MeV, respectively
UE	Uncertainty in β energy, given in same units as energy

The B- Record*Continued*

<u>DTYPE</u>	<u>Description</u>
PE	Percentage uncertainty in β^- energy
EAV	Average energy of the β^- spectrum
F	A "free-form" field (see Section VIII)

6. The EC Record

Allowed data types, E, DE, IB, DIB, IE, DIE, LOGFT, DFT, TI, DTI, COIN, UN, Q, are described with the standard formats in Section III.B.10. Additional allowed data types are:

<u>DTYPE</u>	<u>Description</u>
MV	Energy for <i>electron capture</i> to a level, given in MeV
DMV	"Standard" uncertainty in MV (Section VI)
UEV, UKV, UMV	Uncertainty in capture energy, given in eV, keV, MeV, respectively
UE	Uncertainty in capture energy, given in same units as the energy itself
PE	Percentage uncertainty in capture energy
EAV	Average energy of the β^+ spectrum
CK, CL, CM, CN +	Fraction of decay by electron capture from the K, L, M, N + O + ... shells. (K, L, M, N + are also acceptable as DTYPE and have the same meaning.)
F	A "free-form" field (see Section VIII)

7. The ALPHA Record

All allowed data types are included in the standard format description in Section III.B.11.

APPENDIX 2

COMPUTER PROGRAMS

The following Nuclear Data Project computer programs were designed to operate on data sets prepared in the standard format, as described in this manual. The fields required by the more commonly used programs are described briefly below.

A. NDSLIST – Produces tables for publication in *Nuclear Data Sheets*.†

All the data records (except for the PARENT record) may be included in the tables. Numeric data are usually listed in order of energy. General data set comments and record comments with blanks in cols. 10-19 appear at the head of the table. Flagged comments appear as footnotes. Record comments appear as footnotes if they are placed at the head of the data set; they appear in the "comments" section of the table if they are placed immediately following a data record. Information on data continuation cards appears in the "comments" section (see examples in Appendix 3).

B. PLOT PROGRAM – Produces drawings for *Nuclear Data Sheets*.

Data on continuation cards, comments, and numeric uncertainties (except for Q-cards) are ignored.

In general, levels are presented as horizontal straight lines, and radiations appear as arrows. All are drawn to scale. Question mark (?) in col. 80 produces dashed lines or arrows; S in col. 80 produces dotted lines or arrows. Separation energies (SN, SP) on the Q-VALUE record appear as dotted lines. An "M" in col. 78 on the LEVEL record (for isomeric state) produces a heavy horizontal line. Ground states (0 or blank in cols. 10-19 of the LEVEL record) appear as heavy lines. Levels whose energies are not known relative to the ground state, but whose energies are known relative to each other, may be written for ENSDF as x , $x + 270$, $x + 750$, etc. These levels will be plotted at the scaled energy of the number contained in the energy field: i.e., 0, 270, 750, etc.

Non-numeric uncertainties usually appear in the standard fashion: i.e., before the value. CA (for calculated) produces parentheses around the corresponding number. SY produces the word "SYST" on Q-value uncertainties.

Q on the Q-VALUE record in adopted levels data sets is used to plot to scale the g.s. levels of different nuclides of a mass-chain.

†*Nuclear Data Sheets* (1973-present), Academic Press, Inc., New York and London.

For plotting reaction data sets, if L is given for any level, then L and S are plotted for all levels, unless J is explicitly requested.

In plotting EC (electron capture) information, E, IB, IE, and LOGFT are plotted; TI is ignored.

In plotting GAMMA records, MR is always ignored. Several options are available for presenting gamma transition intensities (such as relative photon intensities, relative total ($\gamma + ce$) intensities, absolute intensities per 100 decays of the parent). TI or RI and CC fields on the GAMMA record and BR and NR or NT fields on the NORMALIZATION record are used for the calculations. (The corresponding uncertainties are used for rounding-off.)

The letter "C" in cols. 78-79 (on GAMMA records) produces "coincidence dots" on gamma arrows. A "C" in col. 77 (on ALPHA, B-, and EC records) produces a coincidence dot (on end of arrow) for α , β , ϵ arrows (see example in Appendix 3).

C. LOGFT - Calculates log ft's, ϵ/β^2 , ϵ_K , ϵ_L , ϵ_M , average β energies and the corresponding uncertainties.

The following fields are used for the calculations: E, DE, T, DT, QP, DQP, of the PARENT record; TI, DTI, UN in the EC and B- records (if TI is blank on the EC record, then IB + IE is used instead); E and DE in the LEVEL record of the daughter nucleus; BR, NB in the NORMALIZATION record (if NB is left blank, TI or IB + IE is assumed to be in % of parent decays).

D. ALPHA HF - Calculates α -decay hindrance factors.

The fields used are NUCID, E, T, QP of the PARENT record; E of the LEVEL record; IA of the ALPHA record; BR of the NORMALIZATION record. For odd-A and odd-odd nuclei, the radius parameter has to be given on a record type comment at the head of the data set; for example,

Col.	(7)	(19)	(20)
	CA	HF	RO = 1.505

E. GTOL (Gamma to Level) - Calculates "best" level energies by least-squares adjustment (taking account of recoil correction), as well as the intensity balance at each level. Adjusted level energies are used to calculate γ -ray energies; discrepancies with input are flagged.

The following fields are used: E, DE, RI, DRI, CC, DCC, TI, DTI, Q on GAMMA records of placed gammas. Questionably placed gammas ("?" in col. 80) and non-numeric uncertainties are ignored in the calculations.

F. HSICC (Internal Conversion) – Calculates CC (total conversion coefficient) and other conversion coefficients.

Fields used are E (M, MR, DMR if known) in the GAMMA record; NUCID in the ID record.

G. MEDLIST (Medical Application List) – Calculates K, L X-ray intensities and Auger conversion-electron radiations.

Fields used are E, DE, RI, DRI, TI on first GAMMA cards; KC, LC, MC+, K/T, L/T on second GAMMA cards; IB, IE, TI on first B- and EC cards; CK, CL, CM+ (K, L, and M+, respectively, are also acceptable and have the same meaning) on second EC cards; EAV on second B- and EC cards; NR, BR, NB on NORMALIZATION record.

APPENDIX 3

SAMPLE DATA SET INPUT/OUTPUT

A. ENSDF Input

```

205TL 205MG B- DECAY 71HI01,77SCIN
205MG P 0 1/2- 5.20 M 10 1530 8
205TL B 3.022 10 1.00
205TL1CB DB FROM MASS ADJUSTMENT (77HA00) QA=-9.0E+2 11; THUS,
205TL2CB A DECAY IS IMPOSSIBLE. Q* FOR 205MG IS NOT KNOWN
205TL3CB BUT IS EXPECTED TO BE NEGATIVE (BASED ON B SYST);
205TL4CB THEREFORE, 205MG DECAYS 100% BY B- DECAY.
205TL1C THE DECAY SCHEME IS BASED ON THE G DATA OF 71HI01, THE B- DATA
205TL2C OF 77SCIN AND 53BU00, BG OF 53BU00, AND GG OF 71HI01. DB IS BASED
205TL3C ON ABSOLUTE RI(203.7G)=2.2% 10 (77SCIN).
205TL1CL THE 205TL LEVELS OBSERVED IN 205MG B- DECAY ARE IN
205TL2CL GOOD AGREEMENT WITH THE LOW-LYING ADOPTED LEVELS
205TL3CL (EXCEPT FOR THE 923.00 (7/2)+ LEVEL WHICH IS NOT
205TL4CL OBSERVED HERE). THE 1210.7 LEVEL MAY BE THE AP 1210
205TL5CL LEVEL SEEN IN (T,P); IF THAT IS SO, ITS JPI IS 1/2+.
205TL1CL E FOR BEST LEVEL ENERGIES AND UNCERTAINTIES SEE
205TL2CL "ADOPTED LEVELS"
205TL1CG THE G BRANCHINGS OBSERVED IN 205MG B- DECAY ARE IN
205TL2CG FAIR AGREEMENT WITH THOSE OBSERVED IN (N,N'G) AND
205TL3CG (G,G'). THE 599.4G WAS NOT OBSERVED HERE; ITS
205TL4CG INTENSITY IS ESTIMATED BY COMPILERS ON THE BASIS
205TL5CG OF RI IN (N,N'G) (ASSUMING G(THETA) IS ISOTROPIC).
205TL CG E(0) ASSIGNMENT TO 205MG IS UNCERTAIN
205TL CG E FROM 71HI01
205TL CG BI FROM 71HI01 UNLESS STATED OTHERWISE
205TL CG N BASED ON CE DATA OF 77SCIN
205TL CG RI(A,B) WEIGHTED AVERAGE OF 71HI01 AND 77SCIN
205TL CG N(B) E2 IS SUGGESTED BY 205TL(N,N'G)
205TL1CB ID THE INTENSITY MAY BE OVERESTIMATED BECAUSE OF POSSIBLE
205TL2CB UNOBSERVED LOW-ENERGY G'S FEEDING LEVELS (SEE KUBIE PLOTS
205TL3CB 77SCIN)
205TL G 1230.0 10 0.023 10
205TL L 0 1/2+ STABLE
205TL B 1520 15 96 2 5 271 15
205TL CB E(B-) FROM 77SCIN, ALLOWED SHAPE (53BU00,77SCIN)
205TL L 203.7 3/2+ 1.46 M3 0
205TL CL T FROM 71SE35, 67HA05
205TL G 203.74 3 100 N1+E2 +1.56 15 0.000 AC
205TL CG BB FROM COUL. EX. (73KR02)
205TL CG E FROM 72BA53
205TL B 1324 3.2 15 6.47 2 C
205TL CB E FROM 53BU00
205TL CB ID FROM RI(203.7G)=2.2% 10 AND CC(203.7)=0.44
205TL L 619.3 5/2+
205TL CL J FROM COUL. EX.
205TL G 415.6 3 0.59 E (N1) A
205TL2 G K/L=5.7 2 (77SCIN)
205TL G 618.6 7 0.090 20 IF E2 B
205TL B 0.016 7 8.7 2 0.018 10
205TL L 1140.9 (3/2)+
205TL CL J FROM 205TL(P,P')
205TL G 937.2 6 0.093 20
205TL G 1101.1 15 0.045 20
205TL B 0.0030 16 7.7 2
205TL L 1210.7
205TL B 0.0069 AP 7.0 AP ?
205TL G 599.4 5 0.010 2 S
205TL G 1010.7 0.031 10 Q ?
205TL G 1210.7 0.28 5 Q ?

```

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B. NDSLIST Output

NUCLEON DATA SHEETS

****1 levels from ****y β -decay 7W101, 77Sc10

the decay scheme is based on the γ data of 7W101, the β -data of 77Sc10 and 53Ru00, $\beta\gamma$ of 53Ru00, and $\gamma\gamma$ of 7W101. $I\gamma$ -normalization is based on absolute $I\gamma(203.7\gamma)=2.25$ 10 (77Sc10).

the ****1 levels observed in ****y β -decay are in good agreement with the low-lying adopted levels (except for the 923.00 (7/2)⁺ level which is not observed here). The 1210.7 level may be the $\pi(1210)$ level seen in (n,p): if that is so, its $J\pi$ is 1/2⁺.

E(level) γ	$J\pi$	$T_{1/2}$	Comments
0.0	1/2 ⁺	stable	
203.7	1/2 ⁺	1.05 ns 0	$T_{1/2}$: from 715b35, 67b05
679.3	5/2 ⁺		$J\pi$: from Coul. Ex.
1100.9	(3/2) ⁺		$J\pi$: from ****1(p,p')
1210.7			

γ for best level energies and uncertainties are "adopted levels"

β -radiations from ****y β -decay 7W101, 77Sc10

the decay scheme is based on the γ data of 7W101, the β -data of 77Sc10 and 53Ru00, $\beta\gamma$ of 53Ru00, and $\gamma\gamma$ of 7W101. $I\gamma$ -normalization is based on absolute $I\gamma(203.7\gamma)=2.25$ 10 (77Sc10).

ES	$I\beta$	Log ft	Comments
(320)7	= 0.0049	= 7.0	
(790)	0.0020 16	7.7 2	
(979)	0.016 7	8.7 2	
1320	1.2 15	6.07 2	ES: from 53Ru00
1520 15	96 2	5.271 15	ES: from $I\gamma(203.7\gamma)=2.25$ 10 and $\pi(203.7\gamma)=0.00$ $E(\beta^-)$ from 77Sc10, allowed shape (53Ru00, 77Sc10)

γ the intensity may be overestimated because of possible unobserved low-energy γ 's feeding levels (see forie plots 77Sc10)

γ (****1) from ****y β -decay 7W101, 77Sc10

the decay scheme is based on the γ data of 7W101, the β -data of 77Sc10 and 53Ru00, $\beta\gamma$ of 53Ru00, and $\gamma\gamma$ of 7W101. $I\gamma$ -normalization is based on absolute $I\gamma(203.7\gamma)=2.25$ 10 (77Sc10).

branching: from some adjustment (77Sc10) $\beta\pi=9.0 \times 10^{-4}$ 11; then, a decay is impossible. $\beta\pi$ for ****y is not known but is expected to be negative (based on β syst); therefore, ****y decays 100% by β -decay.

the γ branchings observed in ****y β -decay are in fair agreement with those observed in (n,n' γ) and (p,p' γ). The 599.0 γ was not observed here; its intensity is estimated by comparison on the basis of $I\gamma$ in (n,n' γ) (assuming $\gamma(0)$ is isotropic).

$E\gamma$	$I\gamma\%$	Built-0	δ	σ	Comments
203.70 1	100%	81+82	+1.56 15	0.000	δ : from Coul. Ex. (73Mc02) $E\gamma$: from 720a53

Continued on next page (footnotes at end of table)

NUCLEAR DATA SHEETS

 γ (000T1) from 0000g β^- decay 770101, 773c10 continued

E γ	I γ	Unit	δ	α	Comments
815.6 3	0.396 8	(81)			K/L=4.7 2 (773c10)
(599.8 5)	(0.310 2)				
610.6 7	0.0906 20	if E2		0.010	
937.2 6	0.093 20				
1010.7 8	0.031 10				
1141.1 15	0.005 20				
1210.7 8	0.20 5				
1230.8 10	0.023 10				

1 for absolute intensity per 100 decays multiply by 0.022 10
 2 assignment to 0000g is uncertain
 3 from 770101
 4 from 770101 unless stated otherwise
 5 based on cc data of 773c10
 6 weighted average of 770101 and 773c10
 7 E2 is suggested by 000T1(n,n' γ)
 8 γ -ray not placed in level scheme

C. PLOT Output

- English Alphabet
Greek Alphabet
Mathematics
Isotopes
Proper Names
Key Numbers
Configurations

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NUCLEAR DATA SHEETS
NUCLIST TRANSLATION DICTIONARY

ENDSF INPUT	NUCLIST OUTPUT	ENDSF INPUT	NUCLIST OUTPUT
ENGLISH ALPHABET	english alphabet	CELL	Cell
A	a	CE(LI)	Co(Li)
AV	avg Ep	COT	qT
A-U	A-U	CWIDTH	qT
A=73	A=73	CWIDTH(Q) **2	qT ² (Q)
A2, A4	A ₂ , A ₄	CS	q-a-
BR	branching	H	h
BUR	branching uncertainty	HP	HP
B=	B=	HI	HI
DEL	B(EL)	B=	B=
DEL2	B(E2)	B(	B(
C	C	I	I
CCBA	CCBA	ICE	Ico
CRC(THETA)	coT(θ)	ICE/IC	Ico/Iy
CR,CEL,CEN	co(θ),co(L),co(M)	ICE(H)	Ico(H)
L/T,L/T	co(θ)/(1+co),co(L)/(1+co)	IT DECAY	IT decay
CEL1,CEL2,CEL3	co(L ₁),co(L ₂),co(L ₃)	IT-DECAY	IT-decay
CEL12	co(L ₁₂)	IT=	IT=
CEN1,CEN2...	co(θ ₁),co(θ ₂)...	IA,IB,IC	Ia,Iβ,Iγ
CIRC	circ	ID=	Iδ=
CONF	configuration	ID-	Iδ-
COUL. EX.	Coul. EX.	NI	Iγ
CP	CP	NU	Iγ-normalization
C25	C25	IE	Ia
C.H.	C.H.	I(θ)	I(θ)
D	d	TI	I(γco)
DSA	DSA	WT	I(γco)-normalization
DSAN	DSA	I(BC)	I(c)
DSBA	DSBA	IAB	IAB
DSIA	DSIA	IBS	IBS
D-Q	D-Q	IMPAC	IMPAC
E	e	I-E.	i.e.
ED,EP,ET	Eδ,Ep,Et	J	J
EL	EL	JO	J ₀
EA,EB,EC	Ea,Eb,Eγ	JPI	J _p
L,THETA	L,θ	K	K
T(THETA)	T(θ)	KK	K X-ray
E G I	E2I	KEV	keV
E GT I	E>I	KG	KG
E LR I	E<I	IKC	(K X-ray) γ
E LT I	E<I	KLL	KLL
E>I	E>I	KOE	Koe
E<I	E<I	KTY	KTY
E=I	E=I	KLA,KLB	Ka X-ray,Kβ X-ray
E AP I	E=I	KPI	K _p
E1,E2...	E1,E2...	K:L:M:NO	K:L:M:NO
E{	E{	L	L
ECZ	E(co)	XL	L X-ray
EV	E(θ)	LN	LN
E(BC)	E(a)	LOGPT	log ft
E(3HE)	E(3He)	XLA1,XLA2	La, X-ray,Lα, X-ray
E(160)	E(160)	XLB1,XLB2	Lβ, X-ray,Lβ, X-ray
E(180)	E(180)	XLC1,XLC2	Lγ, X-ray,Lγ, X-ray
EV	eV	L1,L2,L3	L1,L2,L3
E.G.	e.g.	LP	L(θ)
F	F	LP	L(p)
FD-1	f _n -1	L(2θ)	L(2θ)
FURN	FURN	N	n
G-FACTOR	g-factor	NAC	neutronic
G=I	g=I	NU	nb
G AP I	g=I	NU/SD	nb/sr
G LR I	g<I	NEV	NeV
G GR I	g>I	N-SHELL	N-shell
G(2+)	g(2+)	N-SUBSHELL	N-subshell
G(3-)	g(3-)	N=	n=
GDB	GDB	N+	N+
QGB	QGB	N1,N2,NL	N1,N2,NL
		N1*,N2*,...	N1*,N2*,...

EUSOP INPUT

H(
 H/
 H
 HAI
 HAZ000
 H0/50
 H00
 H00
 H-SHELL
 H-S00SHELL
 H00G
 H0C
 H0
 H2P
 H2PG
 H+
 H-2
 H+
 H<
 H/
 H
 P
 P-WIDTH
 P0C
 P0C
 P00A
 P0
 P0G
 P0, P1, P2...
 P1/2, P3/2...
 P(
 Q
 Q00E2
 Q0
 Q-
 Q
 Q+2
 S
 SP
 SYST
 SYST.
 S+
 S'
 S(
 S/
 ISPIB
 TEMP
 ISPIBZ
 T1/2
 T
 T+
 T/
 (T)
 T
 V
 U
 U.U.
 X
 XC
 Y
 Z

GREEK ALPHABET

ALPHA
 CC
 A DECAT
 A SYST
 A-SYST
 AG
 A'
 ALP=73
 AL AP 73

HOSLIST OUTPUT

H(
 H/
 H
 HAI
 H0, H0.
 H0/00
 H00
 H00
 H-shell
 H-subshell
 H00Y
 H0Y
 H0
 H2P
 H2PY
 H+
 H-2
 H+
 H<
 H/
 H
 P
 P-width
 P0C
 P0Y
 P00A
 P0
 P0Y
 P0, P1, P2...
 P1/2, P3/2...
 P(
 Q
 Q
 Q+
 Q-
 Q
 Q+
 S
 SP
 syst
 syst.
 S+
 S'
 S(
 S/
 T
 T
 T+
 T/
 (T)
 T
 V
 U
 U.U.
 X
 XY
 Y
 Z

greek alphabet

a
 a
 a decay
 a syst
 a-syst
 ay
 a'
 a=73
 a=73

EUSOP INPUT

ALPHA > 0.73
 H2PG
 HCC
 HCC
 HCC, HLC, HNC
 LC
 LVC, L2C, L3C
 LVC
 HCC, HNC
 HCC
 HCC, H2C
 HCC
 HCC
 ALPHA (226G)
 ACE
 AXH
 DELTA
 D
 DCE (T)
 DC
 D2, D3, D4, D5, D6, D7
 D(L)=0
 D+0
 (D0)=2
 C000A
 C
 CCE
 C-W000 P000
 CC
 CCG
 C(
 C(THETA)
 C(THETA, H, T)
 C(THETA, H, TEMP)
 C/H
 C'S
 WIDTH(
 WIDTH (0)
 WIDTH (C0)
 DELTA
 DE AP X
 DE
 DIA
 DID
 DOI
 DOI
 DTI
 DIE
 DI
 DI
 DI
 DQA
 DS
 DT
 DCC
 D00
 D0Y
 D0Y
 D00
 DELTA(H=2)/<H=2>
 H0
 EPSILON
 EC
 ED (E2)
 CK, CL, CH
 CL/CK
 ECL/ECR
 THETA
 KAPPA
 LAMBDA
 MU
 MU001
 UB

HOSLIST OUTPUT

a > 0.73
 a20Y
 a (exp)
 a (H)
 a (H) exp, a (L) exp, a (H) exp
 a (L)
 a' L1, a (L2), a (L3)
 a (H)
 a (H) exp, a (H) exp
 a (H+...)
 a (H1), a (H2)
 a (H)
 a (H+...)
 a (226Y)
 a (CC0)
 a (X) X-X0Y
 D
 D
 Dce (T)
 DT
 D2, D3, D4, D5, D6, D7
 D (L) 0
 D+0
 (D0) 2
 C
 C
 C
 C-W000 P000
 CC
 CCG
 C(
 C (THETA)
 C (THETA, H, T)
 C (THETA, H, TEMP)
 C/H
 C'S
 WIDTH(
 WIDTH (0)
 WIDTH (C0)
 DELTA
 DE AP X
 DE
 DIA
 DID
 DOI
 DOI
 DTI
 DIE
 DI
 DI
 DI
 DQA
 DS
 DT
 DCC
 D00
 D0Y
 D0Y
 D00
 DELTA(H=2)/<H=2>
 H0
 EPSILON
 EC
 ED (E2)
 CK, CL, CH
 CL/CK
 ECL/ECR
 THETA
 KAPPA
 LAMBDA
 MU
 MU
 MU
 MU

ENSDF INPUT	WDSLIST OUTPUT	ENSDF INPUT	WDSLIST OUTPUT	ENSDF INPUT	WDSLIST OUTPUT
UB/SR	ub/sr	4.7E+4	4.7=10 ⁴	COROLIS	Coriolis
US	us	1A,2A,3A	1a,2a,3a	COSTER	Coster
UB	u	1B,2B,3B	1b,2b,3b	COULOMB	Coulomb
PI	v	1G,2G,3G	1g,2g,3g	CURIE	Curie
BWO	p	2WC2	2wc2	DE BOER	de Boer
SIGMA	e	2FW	2fw	DOPPLER	Doppler
TAU	v	2PA	2pa	FERMI	Fermi
PHI	q	A2PG	2pay	FESHBACH	Feshbach
CHI	x	2PAC	2pay	FRENCH	French
PSI	q	2PG,3PG,...	2py,3py,...	GALLAGHER	Gallagher
OMEGA	v	2(L)	2(L)	GAMOW	Gamow
		2(L)-POLE	2(L)-pole	GAUSSIAN	Gaussian
MATHEMATICS	mathematics	SPING	spy	GLENDENNING	Glendenning
		27 S	27 s	HAGER	Hager
SIT	SIT	82<N LE 90	82<N590	HAUSER	Hauser
SIT-BRANCHING	SIT-branching	37a.2G,312G	37a.2y,312y	KNIGHT	Knight
SIT-DECAY	SIT-decay	2100B,7a.3B	2100b,7a.3b	KRONIG	Kronig
SIT=	SIT=	3721A,2762.5A	3721a,2762.5a	KURIE	Kurie
11	1a	(R**2),X**3,Y**4	(R ²),I ³ ,Y ⁴	LEGENDRE	Legendre
1B	1b	<R**2>	<r ² >	LORENTZIAN	Lorentzian
1EC	1e	1Q-1	1Q-1	ROSS	Ross
<	<			ROSSBAUER	Rossbauer
<=	=	ISOTOPES	isotopes	ROSZKOWSKI	Roszkowski
LE	=			RILSSON	Rilsson
>	>	1H	1H	RORDHEIN	Rordhein
>=	=	4HE	4He	RASHUSSEN	Rasussen
GE	=	12C	12C	ROSE	Rose
+	+	102PD	102pd	SEEGER	Seeger
-	-	209BI	209bi	SELTZER	Seltzer
+-	=	25704	25710a	TELLER	Teller
=	=			WEISSKOPF	Weisskopf
AP	a	PROPER NAMES	proper names	WINTHER	Winther
WE	e				
(UP)	(1)	ALAGA	Alaga	REFERENCE	reference
I=Y	I=y	AUGER	Auger	KEY NUMBERS	key numbers
I AP Y	I=y	BERKELEY	Berkeley		
I AP Y	I=y	BIEDENHARN	Biedenbarn	67BAGR	67BaGr
I = Y	I = y	BOHR	Bohr	68AJLA	68AjLa
2+4,3E-4	=10 ⁴ ,3=10 ⁻⁴	BORN	Born	69PO04	69Po04
1E+4	1=10 ⁴	BREIT-WIGNER	Breit-Wigner	72BUZZ	72BuZZ
1 E+4	1 =10 ⁴	COMPTON	Compton	72NOWA	72NoWa

ENSDF INPUT

WDSLIST OUTPUT

CONFIGURATIONS

configurations

CONF=(H,ULJ)
 CONF=(H,ULJ,-1)
 CGJP=(H,169/2)
 CONF=(H,369/2,+3,23/2-)
 CONF=(H,3P1/2,-1)
 CONF=((200PB 3-)(P,ULJ,+X,J))J
 CONF=((200PB 3-)(P,1H9/2))15/2+
 CONF=(P,169/2)
 CONF=((P,1H9/2,+2,0+)(H,275/2,-3,11/2-))25/2-
 CONF=(P,36° ?,+3,23/2-)

configuration=(v ulj)
 configuration=(v ulj)-1
 configuration=(v 1q_{9/2})
 configuration=(v 3q_{9/2})⁺³_{23/2-}
 configuration=(v 3p_{1/2})⁻¹
 configuration=((200pb 3-)((v ulj)*X)J)J
 configuration=((200pb 3-)(v 1h_{9/2}))15/2+
 configuration=(v 1q_{9/2})
 configuration=((v 1h_{9/2})⁺²₀₊(v 2f_{5/2})⁻³_{11/2-})25/2-
 configuration=(v 3q_{9/2})⁺³_{23/2-}