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ATOMIC MASSES 1995

The 1995 atomic mass evaluation
by G. Audi and A.H. Wapstra

Abstract: The 1995 atomic mass evaluation by G. Audi and A.H. Wapstra is documented. The resulting data files containing recommended values of atomic masses, obtained by experiment or systematics, and related data such as reaction and separation energies are described. The data files can be obtained through online services from several nuclear data centers or on magnetic tape, free of charge.

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online: TELNET or FTP: IAEAND.IAEA.OR.AT
username: IAEANDS for interactive Nuclear Data Information System
username: NDSOPEN for FTP file transfer

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Citation guideline:

This database should be quoted in publications as follows:

> G. Audi, A.H. Wapstra, "The 1995 update to the atomic mass evaluation", Nucl. Phys. A595 (Dec. 1995) p.409-480. Data file of Recommended Masses (mass_rmd.mas95) retrieved by ftp (or received on tape) from ..... (date). [or correspondingly]

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
by G. Audi and A.H. Wapstra (December 25, 1995)

A - GENERAL INFORMATION

(November 21, 1995)

I - INTRODUCTION

The table of masses and the table of nuclear reaction and separation energies resulting from the evaluation published in:

> **"THE 1995 UPDATE TO THE ATOMIC MASS EVALUATION"**
> (Ame'95)
>
> by G. Audi and A.H. Wapstra
>
> Nuclear Physics A595 (1995) 409-480.
> (December 25, 1995)

are available electronically at the "Atomic Mass Data Center" (AMDC) and at the Nuclear Data Centers.

Six files from this evaluation can be obtained:

mass_rmd.mas95	Recommended masses
rct1_rmd.mas95	Recommended reaction energies, table 1
rct2_rmd.mas95	Recommended reaction energies, table 2
mass_exp.mas95	Experimental masses
rct1_exp.mas95	Experimental reaction energies, table 1
rct2_exp.mas95	Experimental reaction energies, table 2

Most readers can best use the set of recommended tables (labelled with 'rmd') whereas the more specialized user could with benefit analyze the second set (with label 'exp').

The first file, mass_rmd.mas95, contains the table of masses as printed in the reference above, plus the binding energies, the beta-decay energies and the atomic masses.

The next two files correspond to the table of reaction and separation energies (cf. "The 1993 Atomic Mass Evaluation", part II) in two parts of 6 entries each:

rct1_rmd.mas95	for S2n, S2p, Q(a), Q(2B), Q(ep), Q(B-n)
rct2_rmd.mas95	for Sn, Sp, Q(4B), Q(d,a), Q(p,a), Q(n,a)

The last three files with names mass_exp.mas95, rct1_exp.mas95 and rct2_exp.mas95 are identical to the first three files except for the values resulting from the use of the few deviating experimental data, listed in Table~B of Ame'93 and updated in Table~IV-a of Ame'95.

Values in these files are exact (unrounded) copy of the published ones.

* They can conveniently be used for calculations.

* They should not be copied in a publication as given in these files, but instead, rounded values, as published in the above Journal should be used.

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
by G. Audi and A.H. Wapstra (December 25, 1995)

II - VALUES FOR THE MOST PRECISE CALCULATIONS:

a - values for the most precise masses:

		Mass excess (keV)		Atomic mass (micro-u)	
1	n	8071.32281	0.00215	1008664.92326	0.00221
1	H	7288.96940	0.00064	1007825.03214	0.00035
2	H	13135.71961	0.00104	2014101.77799	0.00036
3	H	14949.79417	0.00149	3016049.26753	0.00106
3	He	14931.20356	0.00138	3016029.30970	0.00086
4	He	2424.91109	0.00095	4002603.24968	0.00100
13	C	3125.01081	0.00095	13003354.83780	0.00099
14	C	3019.89233	0.00374	14003241.98845	0.00400
14	N	2863.41701	0.00083	14003074.00524	0.00086
15	N	101.43823	0.00085	15000108.89844	0.00092
16	O	-4736.99828	0.00147	15994914.62211	0.00153
20	Ne	-7041.92974	0.00192	19992440.17589	0.00198
28	Si	-21492.79309	0.00244	27976926.53273	0.00196
40	Ar	-35039.88974	0.00387	39962383.12324	0.00305

b - values for the correlation coefficients (in nano-amu**2)

n	H	D	3H	3He	4He
4.899380					
-0.083048	0.123414				
0.092465	0.040200	0.132764			
0.014840	-0.000165	0.014699	1.114100		
0.006104	0.002664	0.008774	0.446509	0.733021	
-0.000036	0.000001	-0.000001	0.000000	0.000000	0.999982

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
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III - FORMAT:

All files are 2931 lines long with 124 character per line (originally in fixed format). Headers are 39 lines long.

Record Format:

1 - For mass-files:

Column	Format	Quantity
1:1	a1	fortran control character (a)
2:4	i3	N-Z neutron excess
5:9	i5	N neutron number
10:14	i5	Z atomic number
15:19	i5	A mass number
20:20	1x	
21:23	a3	Chem Symbol
24:27	a4	origin
28:28	1x	
29:39	f11.3	mass
40:48	f9.3	mass accuracy
49:59	f11.3	binding energy
60:68	f9.3	binding energy accuracy
69:72	4x	
73:74	a2	B+ or B-
75:85	f11.3	beta decay energy
86:94	f9.3	beta decay energy accuracy
95:96	2x	
97:110	i3,1x,f10.3	atomic_mass
111:119	f9.3	atomic mass accuracy

2 - For rct-files:

Column	Format	Quantity
1:1	a1	fortran control character (a)
2:4	i3	A mass number
5:5	1x	
6:8	a3	Chem Symbol
9:11	i3	Z atomic number
12:12	1x	
13:30	f10.2,f8.2	energy 1, accuracy 1
31:48	f10.2,f8.2	energy 2, accuracy 2
49:66	f10.2,f8.2	energy 3, accuracy 3
67:84	f10.2,f8.2	energy 4, accuracy 4
85: 102	f10.2,f8.2	energy 5, accuracy 5
103:120	f10.2,f8.2	energy 6, accuracy 6

Notes:

a- Fortran control character: 1 = page feed
0 = line feed

b- decimal point is replaced by # for values derived from systematical trends (see publications).

c- * in place of value means 'not calculable'

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
by G. Audi and A.H. Wapstra (December 25, 1995)

IV - CORRECTIONS AND SUGGESTIONS

If you find errors or omissions in the present documentation, or, if you have a suggestion to make it clearer, please send a message to the following electronic address. Thanks in advance.

internet: audi@frcpn11.in2p3.fr

B - A.M.D.C.

I - COPYING OF FILES THROUGH NETWORKS:

The six files of the Ame'95, along with a documentation file "readme.mas95", may be obtained via an anonymous account on the Atomic Masses Data Center (AMDC) HP-Unix computer through TCP/IP network protocol.

These files are located in the subdirectory pub/AMDC. They may be copied on to the user's computer using the FTP "get" command. The user name of the anonymous account is "anonymous" (enter your e-mail address as the password).

Example:
```
ftp csn-hp.in2p3.fr
user: anonymous
password: your electronic address
cd pub
cd AMDC  (please type AMDC in capitals)
get readme.mas95
get mass_rmd.mas95
quit
```

II - ADDRESS

Address: Atomic Masses Data Center
C.S.N.S.M. (IN2P3-CNRS)
Batiment 108
91405 Orsay campus
(France)

Telephone: +33 (1) 69.41.52.23
Telefax: +33 (1) 69.41.52.68

E-mail: audi@frcpn11.in2p3.fr (internet)

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
by G. Audi and A.H. Wapstra (December 25, 1995)

C - NNDC (USA and Canada)

I - COPYING OF FILES THROUGH NETWORKS:

The six mass files may be obtained via an anonymous account on the NNDC DEC Alpha computer through TCP/IP network protocol.

These six files, along with a documentation file "README.MAS95", are located in the subdirectory SA2:[PUBLIC.MASSES]. These may then be copied on to the user's computer using the FTP "GET" command.

The user name of the anonymous account is ANONYMOUS (Enter your e-mail address as the password):

```
ex:   ftp bnlnd2.dne.bnl.gov
      User (identify yourself to the host): anonymous
      Password: enter your e-mail address as the password
      Command: cd masses
      Command: get mass_rmd.mas95
         Command: quit
```

II - ATOMIC MASSES FROM NNDC ON-LINE SYSTEM:

1 - Access to the On-Line service:

One can access the NNDC (National Nuclear Data Center, Brookhaven National Laboratory, USA) On-Line service through a network or a remote modem. The service is available on an NNDC VAX Alpha computer. Presently, there is no charge for the On-Line service.

Via modem:

The NNDC VAX Alpha computer can be accessed via modem using the telephone number 516-282-2002.

After getting the connect signal, type a carriage return, wait and then type a second carriage return. The VAX login prompt should then appear on your terminal.

Via networks:

* TCP/IP (internet): use the 'TELNET' command to access the computer nodeBNLND2.
  Its address is BNLND2.DNE.BNL.GOV (or 130.199.112.132)

* DECNET: use the 'SET HOST' command with address
  BNLND2 (or 44436 or 43.404)

  The VAX login prompt will appear and you should proceed as follows:

  * Username: NNDC
  * Enter NNDC assigned authorization code (or GUEST):GUEST
    (or your authorization code if you have one)
    The authorization code "GUEST" allows a new user limited amount of CPU time to become acquainted with the system.

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
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2 - Retrievals or Copying of files:

Once you are logged into NNDC online service you can retrieve from various different numerical or bibliographic data bases, or simply copy files containing computer codes, documentation, or mass tables.

In order to copy files containing mass tables youwill proceed as the following:

After successful login select the option FILES. Within this option select the data item MASSES and indicate which of the six files and documentation you will like to copy over to your computer. After the selection of file(s) you will automatically be in SEND option and you will be asked which network you will want to use to transfer your file(s).

After that the system will query you about your destination address, your password (it does not echo), and the file name that you are transferring. The system will respond if the transfer was successful. You can then choose to do further retrievals or logout.

3 - Logout:

When terminating a retrieval session, enter or select LOGOUT.

4 - Authorization:

For authorization for access to NNDC online service, user can supply the necessary information while logged in with 'GUEST' authorization as indicated above or write to NNDC at the following address:

Address: On-Line access
National Nuclear Data Center
Brookhaven National Laboratory
Building 197D
P.O. Box 5000
Upton, NY 11973-5000 (U.S.A.)

Telephone: 516-282-2901
Telefax: 516-282-2806

E-mail: nndc@bnl.gov (internet)
bnl::nndc (hepnet)

Please give your name, postal and e-mail addresses, telephone number, your affiliation, and a personal code of six or fewer characters which will serve as your authorization code.

III - ATOMIC MASSES FROM NNDC WORLD WIDE WEB SITE:

1 - URL: http://www.dne.bnl.gov/nndc.html

2 - Select 1995 Audi-Wapstra Atomic Masses under Programs, Data Files and Manuals.

3 - Click on a file name to view it or shift-click to down-load the file.

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
by G. Audi and A.H. Wapstra (December 25, 1995)

D - NEA-DB (Western Europe, Mexico, Korea, Japan)

I - WORLD WIDE WEB

URL: http://www.nea.fr/
Select Data Bank
Select Experimental data (EXFOR, ... MASSES)
Select File(s) required

II - FTP

Ftp to ftp.nea.fr
ogin ANONYMOUS
password is user's e-mail address
cd data
mget mass* or mget rct* (file names are given in Section A-I)
exit

III - E-MAIL

Send an e-maíl to: nearobot@nea.fr

In the body of the message type

	"index"	to get the list of filenames
or	"get filename"	where filename is one of:

masses-info.txt
mass_rmd_mas95.txt
rct1_rmd_mas95.txt
rct2_rmd_mas95.txt
mass_exp_mas95.txt
rct1_exp_mas95.txt
rct2_exp_mas95.txt

IV - TELNET

1 - Access to the On-Line service:

Logging on: logon as NEADB and give your assigned user name and password or use the GUEST name for a limited time.
Internet: DB.NEA.FR (numeric = 193.51.64.1)

2 - Retrievals or Copying of files:

On logging-on to our On-Line service, the user has to select first the option "Nuclear Data". Under "Nuclear Data" there is a menu called MASSES. When this option is selected, the description of the files and their content will appear on the screen, ending with a question asking: "Which file or files would you like to retrieve?". The selected files will automatically be transmitted to the user home computer.

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3 - Logout:

When terminating a retrieval session, enter or select LOGOUT.

4 - Authorization (not required):

Address: Nuclear Energy Agency - Data Bank
O.E.C.D.
Le Seine Saint Germain
12, boulevard des Iles
92130 Issy-les-Moulineaux
France

Telephone: +33 (1) 45.24.10.71
Telefax: +33 (1) 45.24.11.10

E-mail: nea@nea.fr (internet)

The 1995 UPDATE TO THE ATOMIC MASS EVALUATION
by G. Audi and A.H. Wapstra (December 25, 1995)

E - IAEA (other countries)

I - COPYING OF FILES THROUGH NETWORKS:

The six mass files may be obtained via an anonymous account on the NNDC DEC Alpha computer through TCP/IP network protocol.

These six files, along with a documentation file "README.MAS95", are located in the subdirectory [PUBLIC.MASSES]. These may then be copied on to the user's computer using the FTP "GET" command.

The user name of the anonymous account is ANONYMOUS (Enter your e-mail address as the password):

```
Ex:   ftp iaeand.iaea.or.at
      User (identify yourself to the host): anonymous
      Password: enter your e-mail address as the password
      Command: cd masses
      Command: get mass_rmd.mas95
      Command: quit
```

II - ATOMIC MASSES FROM IAEA ON-LINE SERVICES:

1 - Access to the On-Line service:

Use the TCP/IP (internet) network.
TELNET iaeand.iaea.or.at
Username: IAEANDS
Enter NDS assigned authorization code (or GUEST): GUEST
(or your authorization code if you have one)

2 - Retrievals or Copying of files:

Identical to the system of the US National Data Center.
(see C - II - 2 above)

3 - Logout:

When terminating a retrieval session, enter or select LOGOUT.

4 - Authorization:

As a "GUEST", you will have 30 seconds of CPU allocated. At the end of a GUEST session, you may sign up directly for an authorization code for full access service. Or you may contact the IAEA Nuclear Data Section for assignment of an authorization code.

```
Address:    Nuclear Data Section
            NDIS Manager
            International Atomic Energy Agency
            P.O.Box 100
            A-1400 Vienna, Austria

Telephone:  +43 1 2060 21715
Telefax:    +43 1 20607
Telex:      1-12645 ATOM A

E-mail:     online@iaeand.iaea.or.at (internet)
```