

Atomic Mass and Characteristic Constant of Nuclear Ground State (CENPL.MCC) (I)

Su Zongdi Ma Lizhen Zhou Chunmei Ge Zhigang

(Chinese Nuclear Data Center, IAE)

Abstract

Atomic mass and characteristic constants for nuclear ground states are basic data for nuclear physics, and necessary ones for basic researches, theoretical calculations, as well as many applied researches. The atomic mass of exotic nuclei quite far from the valley stability are also very important for astrophysics researches. The above-requirement is paid attention to in our setting up this file. The recent and as many as possible data (such as the half-lives of the new nuclides ^{202}Pt , ^{208}Hg and ^{185}Hf and the mass excess of ^{199}Ir , which were produced and distinguished by Chinese scientists) have been collected, and put into the computer-based data file in brief table format.

1 Contents

This data file, which is a sub-library (Version 1) of Chinese Evaluated Nuclear Parameter Library (CENPL), consists of calculated, and in most cases also measured mass excess ME , atomic mass M , total binding energy B , half-life $T/2$ or abundance AB , spin J and parity P of nuclear ground state, etc. of 4800 nuclides ranging from $Z=0$, $A=1$ to $Z=122$, $A=318$. Most of these data were taken from Refs. [1~4], a few of them were collected and compiled by us, and M , B were derived from ME .

2 Format

Each record of the file contains Z , EL, A , ME , M , B and $T/2$ or AB , J , P . They are defined as follows :

Z : Charge number, column 1~3.

EL : Element symbol, column 5~6.

A : Mass number, column 8~10.

ME : Mass excess $M - A$ and its uncertainty, column 13~28.

Most of mass excesses are the experimental data, compiled by A. H. Wapstra et al. (Ref. [1]). An appended "s" denotes that the value is from systematics (see the contribution of Ref. [1]). An appended "t" denotes that the value is the mass excess calculated by P. Moller et al. (Ref. [2]), using a nuclear mass formula with a finite-range droplet model and a folded-Yukawa single-particle potential.

M : Atomic mass and its uncertainty, column 31~48, the meaning of "s", "t" is the same as above.

B : Total binding energy, column 51~60.

$T/2$ or AB : Half-life or abundance, column 63~80.

These data are given followed by time units ("%" symbol in case of abundance), and then the uncertainty. The uncertainty given is in the last significant figures. For some very short-lived nuclei, level widths rather than half-lives are given, followed by energy units (e. g. eV, keV, or MeV) and then uncertainty if known.

J, P : Spin and parity of ground state, column 83~92.

Some examples are given in Table 1.

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References

- [1] A. H. Wapstra et al., At. Nucl. Data Tables, 39, 281(1988)
- [2] P. Moller et al., At. Nucl. Data Tables, 39, 225(1988)
- [3] Evaluated Nuclear Structure Data File—a computer file of evaluated experimental nuclear structure data maintained by the National Nuclear Data Center, Brookhaven National Laboratory. (File as of March 1991)
- [4] N. E. Holden, Table of the Isotopes, 71st edition (1990)

Table 1 Some examples

Z	EL	A	ME (MeV)		M (micro-u)		B (MeV)	T/2 or	AB	J	P
0	n	1	8.071	0	1008665	0	0.000	10.4	m	2	1/2+
1	H	1	7.289	0	1007825	0	0.000	99.985	%	1	1/2+
1	H	2	13.136	0	2014102	0	2.224	0.015	%	1	1+
1	H	3	14.950	0	3016049	0	8.482	12.33	a	6	1/2+
1	H	4	25.840	380	4027740	410	5.663				2-
2	He	3	14.931	0	3016029	0	7.718	0.000137	%	3	1/2+
2	He	4	2.424	0	4002602	0	28.297	99.999863	%	3	0+
.											
26	Fe	47	-8.402	t	46990980	t	367.416	t			
26	Fe	48	-18.130	110	47980537	120	385.215				0+
26	Fe	49	-24.580	160	48973612	170	399.736	75	ms	10	(7/2-)
26	Fe	50	-34.470	60	49962995	60	417.698				0+
26	Fe	51	-40.217	15	50956826	20	431.516	310	ms	5	(5/2-)
26	Fe	52	-48.331	10	51948115	10	447.701	8.275	h	8	0+
26	Fe	53	-50.943	2	52945311	0	458.385	8.51	m	2	7/2-
26	Fe	54	-56.250	1	53939614	0	471.763	5.9	%	2	0+
26	Fe	55	-57.476	1	54938297	0	481.060	2.73	a	3	3/2-
26	Fe	56	-60.603	1	55934941	0	492.259	91.72	%	15	0+
26	Fe	57	-60.178	1	56935397	0	499.905	2.1	%	1	1/2-
26	Fe	58	-62.151	1	57933279	0	509.950	0.28	%	2	0+
26	Fe	59	-60.661	1	58934878	0	516.531	44.496	d	7	3/2-
26	Fe	60	-61.406	4	59934078	0	525.347	1.5E+6	a	3	0+
.											
92	U	225	27.729	t	225029768	t	1716.354	t	50	ms	30
92	U	226	27.170	30	226029168	30	1724.984	0.5	s	2	0+
92	U	227	28.970	s	227031100	s	1731.256	s	1.1	m	3
92	U	228	29.209	16	228031357	20	1739.088	9.1	m	2	0+
92	U	229	31.181	9	229033474	10	1745.187	58	m	3	(3/2+)
92	U	230	31.600	6	230033924	10	1752.840	20.8	d		0+
92	U	231	33.780	50	231036264	50	1758.731	4.2	d	1	(5/2-)
92	U	232	34.587	4	232037130	0	1765.995	68.9	a	4	0+
92	U	233	36.915	3	233039630	0	1771.739	1.592E+5	a	2	5/2+
92	U	234	38.141	2	234040946	0	1778.584	0.0055	%	5	0+
92	U	235	40.915	2	235043924	0	1783.882	0.720	%	1	7/2-
92	U	236	42.441	2	236045562	0	1790.427	2.3415E7	a	14	0+
92	U	237	45.387	2	237048725	0	1795.552	6.75	d	1	1/2+
92	U	238	47.305	2	238050784	0	1801.706	99.2745	%	15	0+
92	U	239	50.570	2	239054289	0	1806.512	23.50	m	5	5/2+
92	U	240	52.711	5	240056587	10	1812.442	14.1	h	1	0+
92	U	241	55.849	t	241059956	t	1817.376	t			
.											
122		317	255.372	t	317274151	t	2207.807	t			
122		318	257.518	t	318276455	t	2213.732	t			0+