Twin Vortex Theory - A Revolutionary Grand Unified Theory

by

Anthony H. Davis, MA(Cantab), MICE, CEng

Abstract

A new Theory is proposed based on the kinetic properties of three-dimensional space which is assumed to exhibit the characteristics of an ideal fluid. The evolution of the universe from null space to complex structures is discussed in detail.

Stable wave structures within the fluid are identified and folded in three dimensions using the principles of symmetry to create photons, sub-atomic particles, and atomic nuclei. The Theory dispenses with most of the quark particles of quantum chromodynamics, and requires just one lepton, the photon.

The strong and weak nuclear forces are explained as manifestations of the standard electromagnetic fields. Logical models are presented for wave-particle duality, interference effects and other probabilistic characteristics of matter. A sound theoretical basis is presented for the Heisenberg Uncertainty Principle and the Pauli Exclusion Principle.

The structure and properties of all the atomic nuclei are discussed in detail and the Theory is extended to cover molecules, lattices and crystals. The Theory is closely integrated with experimental observations.

The Theory unifies gravitation with electromagnetism and reconciles the apparently incompatible theories of quantum mechanics and relativity with more general field theory. It also discusses why misconceptions within the discipline of mathematics have previously hindered progress towards a unified theory.

The Author

The author is a retired consulting engineer who was an active partner in CEP International for 21 years, until ill health forced him to retire in 2001. As a consultant, he has had extensive hands-on experience of structural modelling, computer aided design, and mathematical methods in computing.

21 Geometry of the Neutron

The neutron comprises a proton (which is itself four antidown quarks and a down quark) plus an electron. The spin on the electron is equivalent to three down quarks. Hence the TVT neutron can be visualised as four positive antidown quarks and four negative down quarks distributed symmetrically on the face of an octahedron.

The neutron is electrically neutral and it is also chemically inert because it is not associated with orbiting electrons. The arrangement is extremely stable because the electrostatic bonds bend around the surface of the particle with low curvature. The high density of the neutron is generated by the twelve curved internal electrostatic bonds.

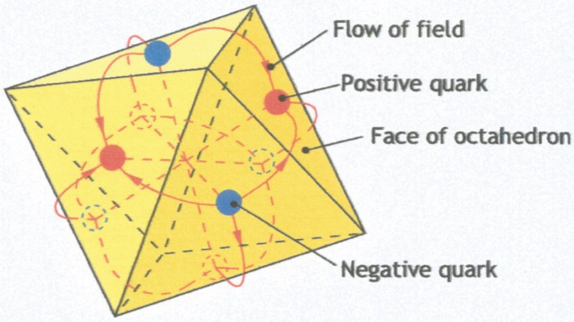


Figure 11 - The TVT Neutron

The Atomic Nuclei

22 The TVT Nucleon

In the terminology of the Periodic Table, atomic nuclei are conventionally described as consisting of neutrons (with zero charge) plus protons (each with unit electrical charge). In TVT, atomic nuclei are visualised as arrays of positively and negatively charged nucleons arranged in symmetrical shells whose structure is determined by the symmetrical shapes listed in Appendix A.

The shells fill sequentially from the smallest to the largest and each shell carries a net positive charge. The nucleons are held in place solely by the electrostatic fields generated by the funnel vortices which are attached to the nucleons. The physical size of the nucleus is determined by the limiting energy density of matter which is a constant.

23 The Tetrahedral Nuclei

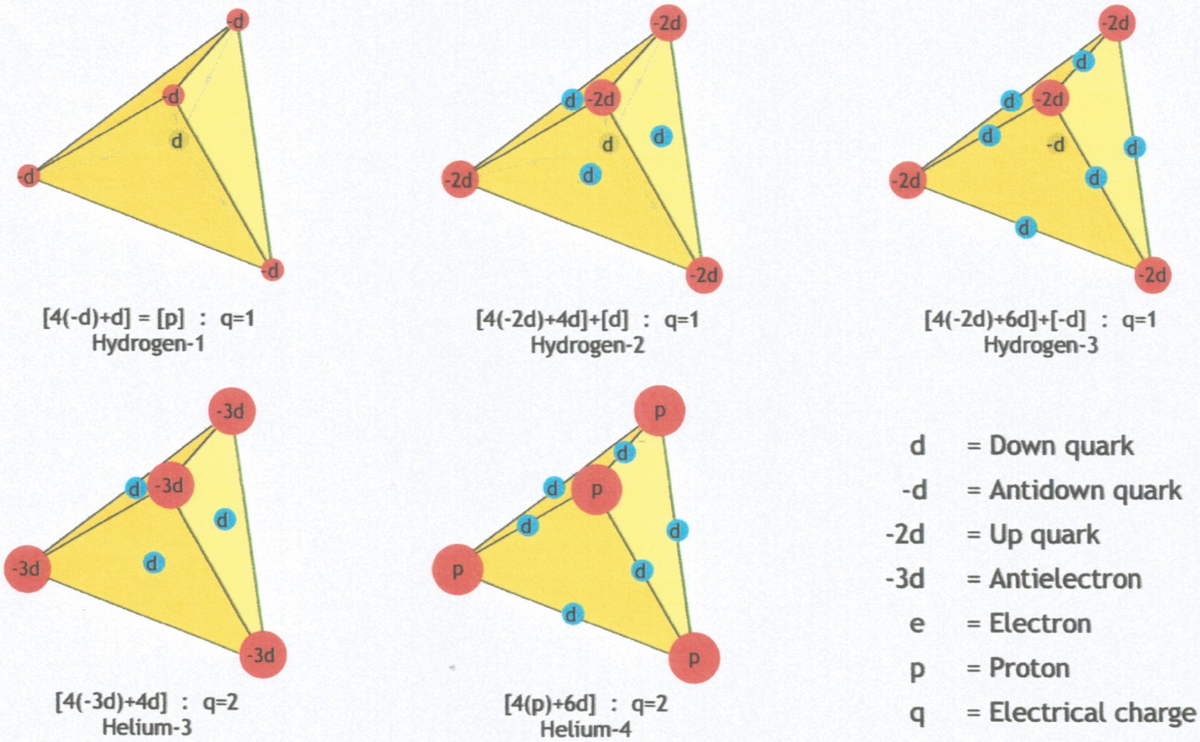


Figure 12 - The Tetrahedral Atomic Nuclei

The lightest and most abundant isotope of hydrogen, hydrogen-1, contains a single proton whose structure has already been discussed. The tetrahedral arrangements which feature in the outer shells are shown diagrammatically in Figure 12.

24 Stability of Atomic Nuclei

Appendix B demonstrates the correlation between nuclear structure and stability which increases with decreasing mass/nucleon. The nuclei which are more stable than their immediate neighbours are highlighted in red - for example, H-3 and He-4,which have tetrahedral structures. In these nuclei, the field lines of the vertex quarks are aligned with the edges of the tetrahedron and field curvature is low. He-4 has the lowest mass/nucleon of the pair because it does not contain a central quark with its associated curved field lines.

The smaller nuclei generally have high values of mass per nucleon because their field lines are highly curved. The mass per nucleon decreases from a maximum for the smallest H-1 nucleus to a minimum at Fe-56 which has a dodecahedral outer shell, a double icosahedral intermediate shell and a treble He-4 inner shell. For nuclei which are larger than Fe-56, curvature becomes less significant and the increasing length of the field lines causes a gradual reduction in stability with increasing size.

It can be seen from Appendix B that an increase in the size of the outer shell is always associated with a decrease in mass per nucleon. It is also apparent that multiple shells with identical arrangement of nucleons are more stable than single shells and this is also reflected in a low value for mass per nucleon. The multiple shells actually contain large nucleons. For example, the 3x[4p+6d] shell of the O-16 nucleus is structured as [4(3p)+6(e)] where the 3p nucleon contains one electron and four antielectrons.

Multiple shells with the same geometry but different arrangement of nucleons are unstable. Hence Be-7 is unstable because it contains asymmetric tetrahedral shells. C-14 is unstable because there are no nucleons at the vertex positions of the octahedral shell.

25 Change Points in Nuclear Structure

The model correctly predicts that the ratio of 'neutrons' to protons increases as the nuclei become larger. The shells within the nuclei fill in a logical sequence and several of the change points in nuclear structure are clearly identified.

At carbon-12, the outer shell arrangement changes from tetrahedral to an octahedron with a linear axis of symmetry. This geometrical property influences the electron orbitals associated with carbon-12 and permits the formation of long chain molecules and hexagonal structures. Silicon-28 and sulphur-32 have similar structures which are capable of forming hexagonal and octagonal rings respectively.

Changes in the structure of the outer shell also occur at scandium-45 and yttrium-89 which define the first elements in the transitional metal series. At yttrium the outer shell configuration changes to a Bucky Ball which is the largest of the symmetrical shapes. For the larger atomic nuclei, step changes in configuration can occur in the penultimate shell.

At the start of the lanthanoids, the outer shell changes to a Bucky Ball and for uranium-232 all the other shells are triple sets with the exception of the He-4 shell which also has low mass per nucleon.

26 The Standard Model of Particle Physics

The Standard Model of Particle Physics proposes that forces are mediated by a group of particles called 'bosuns'. The bosuns include the photon, the gluon, and the electroweak W and Z bosuns. Except for the photon, the evidence for the existence of these bosuns is largely theoretical.

TVT requires only the existence of vortices which can be arranged as stable symmetrical structures to model the photons, leptons, quarks, electrons, and all the atomic nuclei.

Appendix A

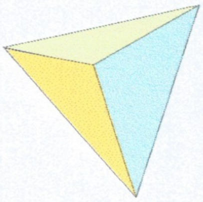
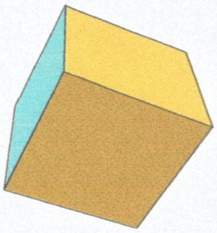
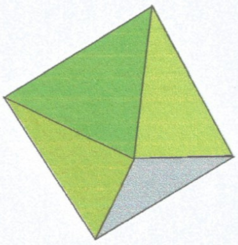
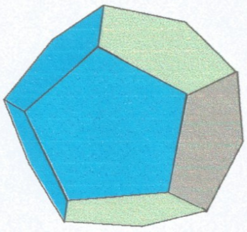
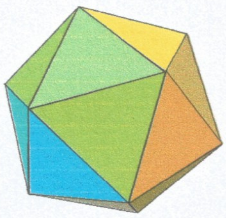
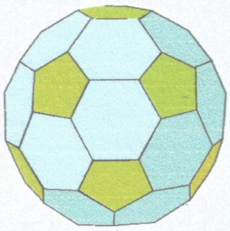
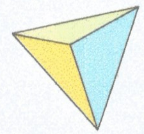
Shape		Vertices V	Faces F	Edges E	Angle between Faces	Angle between Edges
Tetrahedron		4	4	6	70.53	60
Cube		8	6	12	90	90
Octahedron		6	8	12	109.47	60
Dodecahedron		20	12	30	116.57	108
Icosahedron		12	20	30	138.19	60
Bucky Ball		60	32	90	138.19 142.62	Hexagon = 60 Pentagon = 72

Table 1 - The Platonic Solids and the Bucky Ball

Atomic Number	Element Isotope			Relative Mass		
Z	Ref.	A	N	M	M/A	Arrangement of Nucleons
0	n	1	1	1.0092	1.0092	[4(-d)+4d] = [n]
0	3n	3	3			[4(-3d)+4(3d)]
1	H-1	1	0	1.0078	1.0078	[4(-d)+d] = [p]
1	H-2	2	1	2.0140	1.0070	[4(-2d)+4d]+[d]
1	H-3	3	2	3.0160	1.0053	[4(-2d)+6d]+[-d]
2	He-3	3	1	3.0160	1.0053	[4(-3d)+6(d)]
2	He-4	4	2	4.0026	1.0007	[4p+6d]
3	Li-6	6	3	6.0151	1.0025	[4e+6d]+[H-2]
3	Li-7	7	4	7.0160	1.0023	[6p+4e]+[p]
4	Be-7	7	3	7.0169	1.0024	[4p+6d]+[He-3]
4	Be-9	9	5	9.0122	1.0014	[6p+4e]+[He-3]
4	Be-10	10	6	10.0130	1.0013	[6p+4e]+[He-4]
5	B-10	10	5	10.0129	1.0013	[6p+4e]+[He-3]+[p]
5	B-11	11	6	11.0093	1.0008	[6p+4e]+[He-4] +[p]
6	C-12	12	6	12.0000	1.0000	[12p+6e]
6	C-14	14	8	14.0032	1.0002	[12p+8e]+[2p]
7	N-14	14	7	14.0034	1.0002	[12p+6e]+[H-2]
8	O-16	16	8	15.9949	0.9997	[12p+6e]+[He-4]
9	F-19	19	10	18.9984	0.9999	[12p+6e]+[Li-7]
10	Ne-20	20	10	19.9924	0.9996	[12p+6e]+2x[He-4]
11	Na-23	23	12	22.9898	0.9996	[12p+6e]+[B-11]
12	Mg-24	24	12	23.9850	0.9994	2x[12p+6e]
13	Al-27	27	14	26.9815	0.9993	2x[12p+6e]+[H-3]
14	Si-28	28	14	27.9769	0.9992	2x[12p+6e]+[He-4]
15	P-31	31	16	30.9738	0.9992	2x[12p+6e]+[Li-7]
16	S-32	32	16	31.9721	0.9991	2x[12p+6e]+2x[He-4]
17	Cl-35	35	18	34.9689	0.9991	2x[12p+6e]+[B-11]
18	Ar-40	40	22	39.9624	0.9991	2x[12p+6e]+2x[6p+4e]+[He-4]
19	K-39	39	20	38.9637	0.9991	3x[12p+6e]+[He-3]
20	Ca-40	40	20	39.9640	0.9991	3x[12p+6e]+[He-4]



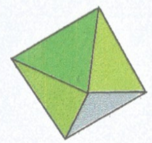
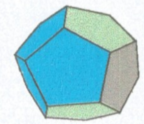


Table 2a - The Atomic Nuclei (up to Z = 20)

Atomic Number	Element Isotope			Relative Mass		
Z	Ref.	A	N	M	M/A	Arrangement of Nucleons
21	Sc-45	45	24	44.9559	0.9990	[20p+12e]+2x[12p+6e]+[p]
22	Ti-48	48	26	47.9479	0.9989	[20p+12e]+2x[12p+6e]+[H–3]+[p]
23	V-51	51	28	50.9440	0.9989	[20p+12e]+2x[12p+6e]+[6p+4e]+[p]
24	Cr-52	52	28	51.9405	0.9989	[20p+12e]+2x[12p+6e]+[6p+4e]+[2p]
25	Mn-55	55	30	54.9380	0.9989	[20p+12e]+2x[12p+6e]+[6p+4e]+[He-4]+[p]
26	Fe-56	56	30	55.9349	0.9988	[20p+12e]+3x[12p+6e]
27	Co-59	59	32	58.9332	0.9989	[20p+12e]+3x[12p+6e]+[H-3]
28	Ni-60	60	32	59.9310	0.9989	[20p+12e]+3x[12p+6e]+[He-4]
29	Cu-65	65	36	64.9278	0.9989	2x[20p+12e]+2x[12p+6e]+[p]
30	Zn-66	66	36	65.9260	0.9989	2x[20p+12e]+2x[12p+6e]+[2p]
31	Ga-69	69	38	68.9256	0.9989	[30p+12e]+3x[12p+8e]+[H-3]
32	Ge-72	72	40	71.9221	0.9989	[30p+12e]+3x[12p+8e]+2x[H-3]
33	As-75	75	42	74.9216	0.9990	[30p+12e]+3x[12p+8e]+[8p+6e]+[p]
34	Se-77	77	43	76.9199	0.9990	[30p+12e]+3x[12p+8e]+[8p+6e]+[H-3]
35	Br-81	81	46	80.9162	0.9990	[30p+12e]+3x[12p+8e]+[8p+6e]+2x[H-3]+[p]
36	Kr-84	84	48	83.9118	0.9990	[30p+12e]+3x[12p+8e]+[8p+6e]+[6p+4e]+[He-4]
37	Rb-85	85	48	84.9118	0.9990	2x[20p+12e]+3x[12p+6e]+[8p+6e]+[p]
38	Sr-88	88	50	87.9056	0.9989	2x[20p+12e]+3x[12p+6e]+[12p+8e]
39	Y-89	89	50	88.9058	0.9989	3x[20p+12e]+2x[12p+6e]+[He-4]+[p]
40	Zr-91	91	51	90.9056	0.9990	3x[20p+12e]+2x[12p+6e]+[He-4]+[He-3]
41	Mb-93	93	52	92.9064	0.9990	3x[20p+12e]+2x[12p+6e]+[Li-6]+[He-3]
42	Mo-96	96	54	95.9047	0.9990	3x[20p+12e]+3x[12p+6e]
43	Tc-98	98	55	97.9072	0.9991	2x[30p+20e]+[30p+12e]+[He-4]+[He-3]+[p]
44	Ru-101	101	57	100.9056	0.9991	2x[30p+20e]+[30p+12e]+2x[He-4]+[He-3]
44	Ru-102	102	58	101.9043	0.9991	2x[30p+20e]+[30p+12e]+[12p+6e]
45	Rh-103	103	58	102.9055	0.9991	2x[30p+20e]+[30p+12e]+[12p+6e]+[p]
46	Pd-102	102	56	101.9056	0.9991	[30p+12e]+3x[20p+12e]+[12p+8e]
46	Pd-106	106	60	105.9035	0.9991	[30p+12e]+3x[20p+12e]+2x[8p+6e]
46	Pd-110	110	64	109.9051	0.9991	2x[30p+20e]+[30p+12e]+[12p+6e]+[8p+6e]
47	Ag-107	107	60	106.9051	0.9991	2x[30p+20e]+[30p+12e]+[12p+6e]+[8p+6e]+[p]
48	Cd-112	112	64	111.9028	0.9991	2x[30p+20e]+[30p+12e]+[12p+6e]+[8p+6e]+[6p+4e]

Transitional Metals (Z = 21 to Z = 30)



Transitional Metals (Z = 39 to Z = 48)

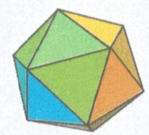
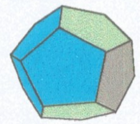


Table 2b - The Atomic Nuclei (from Z = 21 to Z = 48)

Atomic Number Z	Element Isotope Ref.	A	N	Relative Mass M	M/A	Arrangement of Nucleons
49	In-115	115	66	114.9039	0.9992	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+[He-4]+[p]
50	Sn-119	119	69	118.9033	0.9992	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+[6p+4e]+[H-3]
51	Sb-123	123	72	122.9042	0.9992	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+2x[6p+4e]+[p]
52	Te-128	128	76	127.9045	0.9993	[30p+20e]+3x[20p+12e]+[12p+6e]+2x[8p+12d]+[6p+4e]+[He-4]
53	I-127	127	74	126.9045	0.9992	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+2x[6p+4e]+[He-4]+[p]
54	Xe-131	131	77	130.9051	0.9993	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+2x[6p+4e]+[6p+4e]+[H-3]
55	Cs-133	133	78	132.9054	0.9993	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+3x[6p+4e]+[He-4]+[p]
56	Ba-136	136	80	135.9046	0.9993	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+3x[6p+4e]+2x[He-4]
56	Ba-137	137	81	136.9058	0.9993	[30p+20e]+2x[20p+12e]+2x[12p+6e]+2x[8p+12d]+3x[6p+4e]+[6p+4e]+[H-3]
57	La-139	139	82	138.9063	0.9993	[60p+32e]+3x[20p+12e]+2x[8p+6e]+[H-3]
58	Ce-140	140	82	139.9053	0.9993	[60p+32e]+3x[20p+12e]+2x[8p+6e]+[He-4]
59	Pr-141	141	82	140.9076	0.9993	[60p+32e]+3x[20p+12e]+2x[8p+6e]+[He-4]+[p]
60	Nd-144	144	84	143.9120	0.9994	[60p+32e]+3x[20p+12e]+2x[8p+6e]+2x[He-4]
61	Pm-145	145	84	144.9127	0.9994	[60p+32e]+3x[20p+12e]+2x[8p+6e]+2x[He-4]+[p]
62	Sm-150	150	88	149.9173	0.9994	[60p+32e]+3x[20p+12e]+2x[8p+6e]+[6p+4e]+2x[He-4]
63	Eu-153	153	90	152.9212	0.9995	[60p+32e]+3x[20p+12e]+2x[8p+6e]+2x[6p+4e]+[He-4]+[p]
64	Gd-156	156	92	155.9221	0.9995	[60p+32e]+3x[20p+12e]+2x[8p+6e]+2x[6p+4e]+2x[He-4]
64	Gd-157	157	93	156.9240	0.9995	[60p+32e]+3x[20p+12e]+2x[8p+6e]+2x[6p+4e]+2x[He-4]+[H-2]
65	Tb-159	159	94	158.9253	0.9995	[60p+32e]+3x[20p+12e]+2x[8p+6e]+2x[6p+4e]+2x[He-4]+[H-3]
66	Dy-162	162	96	161.9268	0.9995	[60p+32e]+3x[20p+12e]+2x[8p+6e]+3x[6p+4e]+2x[He-4]
67	Ho-165	165	98	164.9303	0.9996	[60p+32e]+3x[20p+12e]+2x[8p+6e]+3x[6p+4e]+2x[He-4]+[H-3]
68	Er-167	167	99	166.9320	0.9996	[60p+32e]+3x[20p+12e]+3x[8p+6e]+2x[6p+4e]+2x[He-4]+[He-3]
69	Tm-169	169	100	168.9342	0.9996	[60p+32e]+3x[20p+12e]+3x[8p+6e]+2x[6p+4e]+3x[He-4]+[p]
70	Yb-173	173	103	172.9382	0.9996	[60p+32e]+3x[20p+12e]+3x[8p+6e]+3x[6p+4e]+2x[He-4]+[He-3]
71	Lu-175	175	104	174.9408	0.9997	[60p+32e]+3x[20p+12e]+[12p+8e]+2x[8p+6e]+3x[6p+4e]+2x[He-4]+[p]
72	Hf-178	178	106	177.9440	0.9997	[90p+60e]+[60p+32e]+2x[12p+6e]+[He-4]
73	Ta-181	181	108	180.9480	0.9997	[90p+60e]+[60p+32e]+2x[12p+6e]+[6p+4e]+[p]
74	W-184	184	110	183.9525	0.9997	[90p+60e]+[60p+32e]+2x[12p+6e]+[6p+4e]+[He-4]
75	Re-185	185	110	184.9530	0.9997	[90p+60e]+[60p+32e]+2x[12p+6e]+[6p+4e]+[He-4]+[p]
76	Os-190	190	114	189.9584	0.9998	[90p+60e]+[60p+32e]+2x[12p+6e]+2x[6p+4e]+[He-4]
77	Ir-191	191	114	190.9606	0.9998	[90p+60e]+[60p+32e]+2x[12p+6e]+2x[6p+4e]+[He-4]+[p]
78	Pt-195	195	117	194.9648	0.9998	[90p+60e]+[60p+32e]+2x[12p+6e]+3x[6p+4e]+[He-3]
79	Au-197	197	118	196.9666	0.9998	[90p+60e]+[60p+32e]+2x[12p+6e]+3x[6p+4e]+[He-4]+[p]
80	Hg-201	201	121	200.9703	0.9999	[90p+60e]+[60p+32e]+2x[20p+12e]+2x[He-4]+[He-3]

Lanthanoids

Transitional Metals



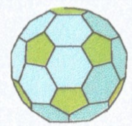


Table 2c - The Atomic Nuclei (from Z = 49 to Z = 80)

Atomic Number	Element Isotope		Relative Mass				
Z	Ref.	A	N	M	M/A	Arrangement of Nucleons	
81	Tl-203	203	122	202.9723	0.9999	[90p+60e]+[60p+32e]+2x[20p+12e]+[12p+6e]+[p]	
82	Pb-207	207	125	206.9759	0.9999	[90p+60e]+[60p+32e]+2x[20p+12e]+[12p+6e]+[He-4]+[n]	
83	Bi-209	209	126	208.9804	0.9999	[90p+60e]+[60p+32e]+2x[20p+12e]+[12p+6e]+[He-4]+[H-3]	
84	Po-209	209	125	208.9824	0.9999	[90p+60e]+[60p+32e] +2x[20p+12e]+[12p+6e]+[He-4]+[He-3]	
85	At-210	210	125	209.9871	0.9999	[90p+60e]+[60p+32e] +2x[20p+12e]+[12p+6e]+[He-4]+[He-3]+[p]	
86	Rn-222	222	136	222.0176	1.0001	[90p+60e]+[30p+20e]+2x[20p+12e]+2x[12p+6e]+3x[8p+12d]+[6p+4e]+2x[He-4]	
87	Fr-223	223	136	223.0197	1.0001	[90p+60e]+[30p+20e]+2x[20p+12e]+2x[12p+6e]+3x[8p+12d]+[6p+4e]+2x[He-4]+[p]	
88	Ra-226	226	138	226.0254	1.0001	[90p+60e]+[30p+20e]+2x[20p+12e]+2x[12p+6e]+3x[8p+12d]+[6p+4e]+3x[He-4]	
89	Ac-227	227	138	227.0277	1.0001	[90p+60e]+3x[20p+12e]+2x[12p+8e]+3x[12p+6e]+2x[8p+12d]+[p]	
90	Th-232	232	142	232.0381	1.0002	[90p+60e]+3x[20p+12e]+[12p+8e]+3x[12p+6e]+2x[8p+12d]+3x[6p+4e]	
91	Pa-231	231	140	231.0359	1.0002	[90p+60e]+2x[60p+32e]+2x[8p+6e]+[H-3]	
92	U-232	232	140	232.0372	1.0002	[90p+60e]+2x[60p+32e]+2x[8p+6e]+2x[H-3]	
92	U-233	233	141	233.0396	1.0002	[90p+60e]+2x[60p+32e]+2x[8p+6e]+2x[H-3]+[n]	
92	U-234	234	142	234.0409	1.0002	[90p+60e]+2x[60p+32e]+2x[8p+6e]+2x[H-3]+[2n]	
92	U-235	235	143	235.0439	1.0002	[90p+60e]+2x[60p+32e]+2x[8p+6e]+2x[H-3]+[3n]	
93	Np-237	237	144	(237)	(1.000)	[90p+60e]+2x[60p+32e]+3x[8p+6e]+[H-3]	
94	Pu-244	244	150	(244)	(1.000)	[90p+60e]+2x[60p+32e]+3x[8p+6e]+[6p+4e]+[4p+4e]	Actinoids
95	Am-243	243	148	(243)	(1.000)	[90p+60e]+2x[60p+32e]+3x[8p+6e]+[6p+4e]+[H-3]	
96	Cm-247	247	151	(247)	(1.000)	[90p+60e]+2x[60p+32e]+3x[8p+6e]+2x[6p+4e]+[n]	
97	Bk-247	247	150	(247)	(1.000)	[90p+60e]+2x[60p+32e]+3x[8p+6e]+2x[6p+4e]+[p]	
98	Cf-251	251	153	(251)	(1.000)	[90p+60e]+2x[60p+32e]+3x[8p+6e]+2x[6p+4e]+[He-4]+[n]	
99	Es-252	252	153	(252)	(1.000)	[90p+60e]+2x[60p+32e]+3x[8p+6e]+2x[6p+4e]+[He-3]+[H-3]	
100	Fm-257	257	157	(257)	(1.000)	[90p+60e]+2x[60p+32e]+2x[12p+8e]+2x[8p+6e]+[6p+4e]+[n]	
101	Md-258	258	157	(258)	(1.000)	[90p+60e]+2x[60p+32e]+2x[12p+8e]+2x[8p+6e]+[6p+4e]+[H-2]	
102	No-259	259	157	(259)	(1.000)	[90p+60e]+2x[60p+32e]+2x[12p+8e]+2x[8p+6e]+[6p+4e]+[He-3]	
103	Lr-262	262	159	(262)	(1.000)	[90p+60e]+2x[60p+32e]+2x[12p+8e]+3x[8p+6e]+[He-3]+[p]	
104	Rf-267	267	163	(267)	(1.000)	[90p+60e]+2x[60p+32e]+2x[12p+8e]+3x[8p+6e]+[6p+4e]+[He-3]	
105	Db-268	268	163	(268)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+2x[12p+8e]+[H-3]+[n]	
106	Sg-271	271	165	(271)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+2x[12p+8e]+[6p+4e]+[n]	
107	Bh-272	272	165	(272)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+2x[12p+8e]+[6p+4e]+[H-2]	Transitional Metals
108	Hs-270	270	162	(270)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+2x[12p+8e]+2x[He-3]	
109	Mt-276	276	167	(276)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+2x[12p+8e]+[Be-10]+[H-2]	
110	Ds-281	281	171	(281)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+3x[12p+8e]+[H-3]+[H-2]	
111	Rg-280	280	169	(280)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+3x[12p+8e]+[He-3]+[p]	
112	Uub-285	285	173	(285)	(1.000)	[90p+60e]+2x[60p+32e]+[30p+20e]+3x[12p+8e]+[6p+4e]+[He-3]	
113	Uut-284	284	171	(284)	(1.000)	[90p+60e]+2x[60p+32e]+2x[30p+20e]+[12p+6e]+[H-2]	
114	Uuq-289	289	175	(289)	(1.000)	[90p+60e]+2x[60p+32e]+2x[30p+20e]+[12p+6e]+[6p+4e]+[n]	
115	Uup-288	288	173	(288)	(1.000)	[90p+60e]+2x[60p+32e]+2x[30p+20e]+[12p+6e]+[H-3]+[He-3]	
116	Uuh-293	293	177	(293)	(1.000)	[90p+60e]+2x[60p+32e]+2x[30p+20e]+[12p+6e]+[8p+6e]+[He-3]	
117	Uus						
118	Uuo-294	294	176	(294)	(1.000)	[90p+60e]+2x[60p+32e]+2x[30p+20e]+2x[12p+6e]	

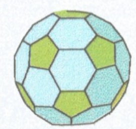


Table 2d - The Atomic Nuclei (from Z = 81 to Z = 118)