A New Approach to The Ordering Principle Of the Stable Isotopes

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Three distinct systems describe the ordering of the key experimental singularities associated with the atom and nucleus: electron, proton, and neutron.

(1) The first in historical order describes a system of electron shells which close at 2, 10, 18, 36, 54, and 86 electrons. The shells are composed of subunits of 2, 6, 10, and 14 electrons, each capable of two states, known as positive and negative "spin." This system conforms to the spectral patterns of the elements, chemical combining properties, valences, and ionization potentials.

The ordering is consistent with the periods of the Mendeleyev table of the elements. However, it in no way sheds light upon Mendeleyev's almost forgotten starting hypothesis, that, contrary to the ideas of Galileo and Newton respecting mass, the ordering of the elements by atomic weights gives evidence of a periodicity.

Christopher Sloan, 1988

The Moon Model of the nucleus, shown here in a drawing of two of the shells, employs a nesting of four of the five Platonic solids, similar to that conceived by Johannes Kepler to describe the Solar System. The 92 protons of all the naturally occurring elements fill the 46 vertices of two nested dodecahedra in the Moon Model.

A new interpretation of the meaning of Planck's constant suggests a solution to the yet-unsolved question of the ordering of the stable isotopes.

(2) The study leading to the shell model of the nucleus, proposed by Maria Goeppert-Mayer in 1948, was undertaken at the prompting of Dr. Robert Moon and his friend the Nobel chemist James Franck, then collaborating at the Argonne National Laboratory. The hypothesis brings together a mass of evidence respecting the nuclear properties of the isotopes, to establish the existence of shells containing 2, 8, 20, 28, 50, 82, and 126 nucleons. The shells may consist of either neutrons or protons with no clear reason for the choice of one or the other.

The correspondence of the hypothesized shells with such widely varying properties as isotopic abundance, nuclear spin, neutron capture cross section, quadrupole moment and emission properties, are convincing evidence of its, at least partial, validity. However, no reason is offered for the ordering principle. The hypothesis relies upon a variation of the conventionally accepted orbital model for the electron shells. In place of cause, statistical methods associated with attempts to resolve the *n*-body problem of nucleon attractions are substituted.

(3) Moon's nuclear model, formulated in 1986, was, intended in part, as a corrective to the shortcomings of Goeppert-Mayer's work. Moon's model describes proton shells corresponding to a nested sequence of Platonic solids, with singularities at 8, 14, 26, 46, 56, 64, 70, 81, 86, and 92 protons.

The first three members of the series correspond to the elements that seem to be of greatest abundance in the Solar System. Moon's system describes the reason for the 14-member

1 **H** 1/2	2 H 1	3 He 1/2	**4** **He** 0	5	6 Li 1	**7** **Li** 3/2	8	**9** **Be** 3/2	10 B 3	**11** **B** 3/2	**12** **C** 0	13 C 1/2	**14** **N** 1	15 N 1/2	**16** **O** 0
17 O 5/2	18 O 0	**19** **F** 1/2	**20** **Ne** 0	21 Ne 3/2	**22** **Ne** 0	**23** **Na** 3/2	**24** **Mg** 0	25 Mg 5/2	26 Mg 0	**27** **Al** 5/2	**28** **Si** 0	29 Si 1/2	30 Si 0	**31** **P** 1/2	**32** **S** 0
33 S 3/2	34 S 0	**35** **Cl** 3/2	36 S 0 Ar 0	37 Cl 3/2	38 Ar 0	**39** **K** 3/2	**40** **Ar** 0 K _ Ca 2ec	41 K 3/2	42 Ca 0	43 Ca 7/2	44 Ca 0	**45** **Sc** 7/2	46 Ti 0 Ca 2_-	47 Ti 5/2	**48** **Ti** 0 Ca 2_-
49 Ti 7/2	**50** Ti 0 V ec, _- Cr 2ec	**51** **V** 7/2	**52** **Cr** 0	53 Cr 3/2	**54** Cr 0 Fe 0		**56** **Fe** 0	57 Fe 1/2	**58** **Ni** 0 Fe 0	**59** **Co** 7/2	60 Ni 0	61 Ni 3/2	62 Ni 0	**63** **Cu** 3/2	**64** **Zn** 2ec Ni 0
65 Cu 3/2	66 Zn 0	67 Zn 5/2	68 Zn 0	**69** **Ga** 3/2	70 Zn 2_- Ge 0	71 Ga 3/2	72 Ge 0	73 Ge 9/2	**74** **Ge** 0 Se 0	**75** **As** 3/2	76 Ge 2_ Se 0	77 Se 1/2	78 Se 0 Kr 2ec	**79** **Br** 3/2	**80** **Se** 0 Kr 0
Legend:															
58 **Ni** 0 Fe 0	_ Most Abundant Isotope _ Other Stable Species		5	No Stable Species	No Other Stable Isotope	**19** **F** 1/2	Nuclear Spin	226 Ra	_Most Abundant Radio Isotope		Yellow bkground = odd (A) doublet	87 Rb 2_- Sr 9/2	_Long half-life Beta decay	64 Zn 0 Ni 0	_Long Half-life alpha decay

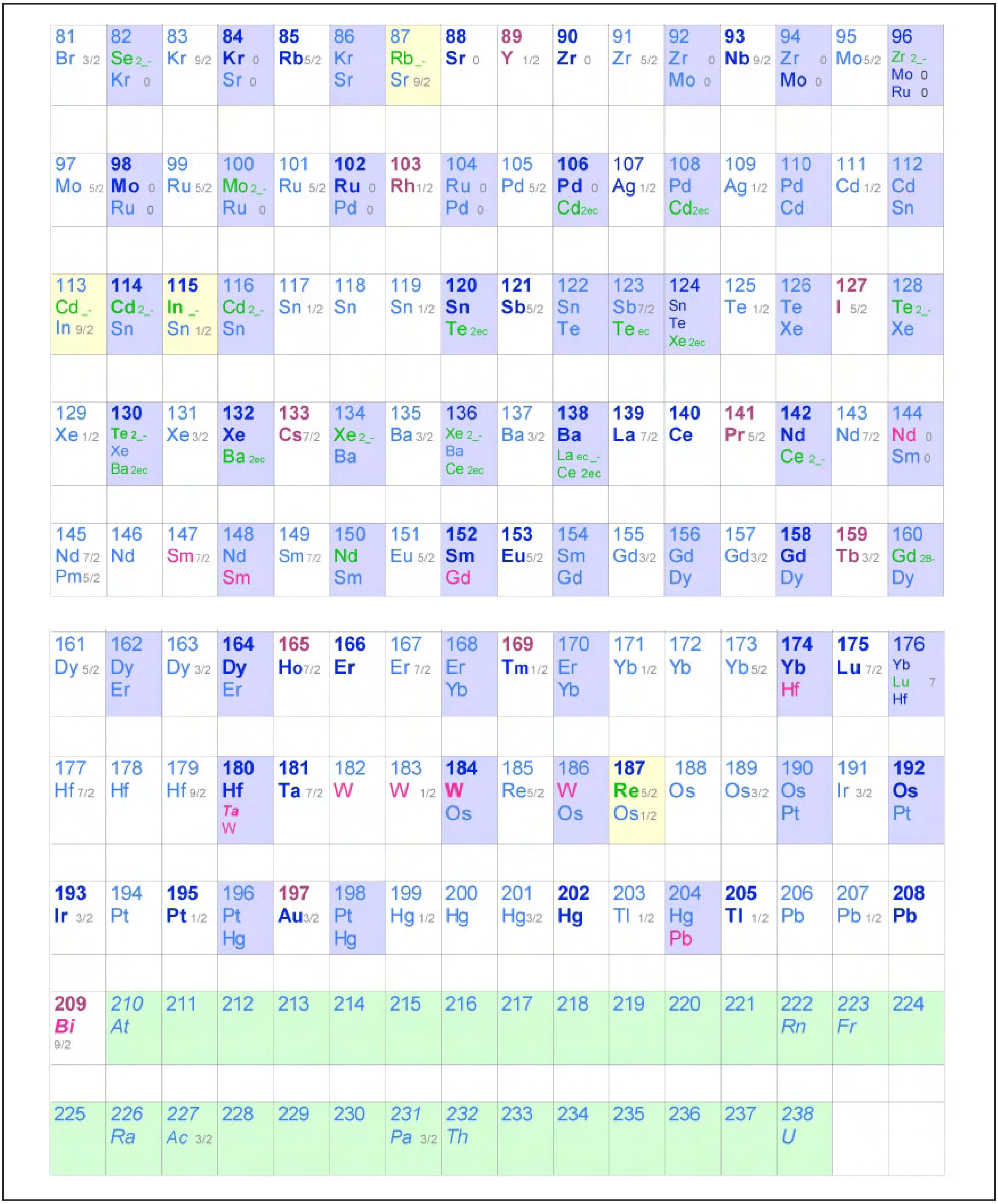
Figures 1 and 2
STABLE ISOTOPES BY MASS NUMBER

This proved to be the most convenient way initially to organize the data of the stable isotopes. It is a useful reference for any discussion of the topic. The charts consist of boxes numbered from 1 to 238, representing the mass number, and arranged for convenience in rows of 16. The stable isotopes are identified by chemical symbol, the most abundant denoted in bold; the other distinctions as noted in the legend.

An accompanying chart (Figure 2, link only) presents only the most abundant isotope of each element in the same format. Some of the basic features are seen at first glance: Two boxes, 5 and 8, are empty. Up to chlorine-35, no two isotopes share the same mass number. Following that, doublets and triplets occur. But, all triplets and many doublets contain radioactive species of very long half-life, (which are thus considered stable).

The tendency to ordering is indicated by coloration. For example, for mass numbers from 11 to 56 the most abundant isotopes of consecutive elements tend to form in couplets of odd-even. After 74-75, this changes to even-odd. When the couplets are separated by a pair of yellow boxes, the members of consecutive pairs are related by an alpha particle.

lanthanide series, and provides an explanation for the fission of the uranium nucleus. The filled shells 8 (oxygen), 26 (iron), 46 (palladium), 64 (gadolinium), and 92 (uranium) correspond to elements of high absolute or relative magnetic susceptibility. The shells tend to fall near the minima of periodic properties such as atomic volume, melting point, and so forth. Certain classifiable properties of the stable isotopes are associated with each of the Moon nuclear shells.



81 Br 3/2	82 Se 2_- Kr 0	83 Kr 9/2	**84** **Kr** 0 Sr 0	**85** **Rb** 5/2	86 Kr Sr	87 Rb _- Sr 9/2	**88** **Sr** 0	**89** **Y** 1/2	**90** **Zr** 0	91 Zr 5/2	92 Zr 0 Mo 0	**93** **Nb** 9/2	94 Zr 0 Mo 0	95 Mo 5/2	**96** Zr 2_- Mo 0 Ru 0
97 Mo 5/2	**98** **Mo** 0 Ru 0	99 Ru 5/2	100 Mo 2_- Ru 0	101 Ru 5/2	**102** **Ru** 0 Pd 0	**103** **Rh** 1/2	104 Ru 0 Pd 0	105 Pd 5/2	**106** **Pd** 0 Cd 2ec	107 Ag 1/2	108 Pd Cd 2ec	109 Ag 1/2	110 Pd Cd	111 Cd 1/2	112 Cd Sn
113 Cd _- In 9/2	**114** **Cd** 2_- Sn	**115** **In** _- Sn 1/2	116 Cd 2_- Sn	117 Sn 1/2	118 Sn	119 Sn 1/2	**120** **Sn** Te 2ec	**121** **Sb** 5/2	122 Sn Te	123 Sb 7/2 Te ec	**124** Sn Te Xe 2ec	125 Te 1/2	126 Te Xe	**127** **I** 5/2	128 Te 2_- Xe
129 Xe 1/2	**130** **Te** 2_- Xe Ba 2ec	131 Xe 3/2	**132** **Xe** Ba 2ec	**133** **Cs** 7/2	134 Xe 2_- Ba	135 Ba 3/2	136 Xe 2_- Ba Ce 2ec	137 Ba 3/2	**138** **Ba** La ec_- Ce 2ec	**139** **La** 7/2	**140** **Ce**	**141** **Pr** 5/2	**142** **Nd** Ce 2_-	143 Nd 7/2	144 Nd 0 Sm 0
145 Nd 7/2 Pm 5/2	146 Nd	147 Sm 7/2	148 Nd Sm	149 Sm 7/2	150 Nd Sm	151 Eu 5/2	**152** **Sm** Gd	**153** **Eu** 5/2	154 Sm Gd	155 Gd 3/2	156 Gd Dy	157 Gd 3/2	**158** **Gd** Dy	**159** **Tb** 3/2	160 Gd 2B- Dy
161 Dy 5/2	162 Dy Er	163 Dy 3/2	**164** **Dy** Er	**165** **Ho** 7/2	**166** **Er**	167 Er 7/2	168 Er Yb	**169** **Tm** 1/2	170 Er Yb	171 Yb 1/2	172 Yb	173 Yb 5/2	**174** **Yb** Hf	**175** **Lu** 7/2	176 Yb Lu 7 Hf
177 Hf 7/2	178 Hf	179 Hf 9/2	**180** **Hf** *Ta* W	**181** **Ta** 7/2	182 W	183 W 1/2	**184** **W** Os	185 Re 5/2	186 W Os	**187** **Re** 5/2 Os 1/2	188 Os	189 Os 3/2	190 Os Pt	191 Ir 3/2	**192** **Os** Pt
193 **Ir** 3/2	194 Pt	**195** **Pt** 1/2	196 Pt Hg	**197** **Au** 3/2	198 Pt Hg	199 Hg 1/2	200 Hg	201 Hg 3/2	**202** **Hg**	203 Tl 1/2	204 Hg Pb	**205** **Tl** 1/2	206 Pb	207 Pb 1/2	**208** **Pb**
209 ***Bi*** 9/2	*210* *At*	211	212	213	214	215	216	217	218	219	220	221	*222* *Rn*	*223* *Fr*	224
225	*226* *Ra*	*227* *Ac* 3/2	228	229	230	*231* *Pa* 3/2	*232* *Th*	233	234	235	236	237	*238* *U*		

The neutron capture cross-sections of the elements making up closed shells are low. The electric quadrupole moments of the closed shells are low and tend to rise to either side. The maximum number of neutrons in the stable isotopes in the first four shells are 10, 16, 32, and 64.

* * *

None of the three orderings can completely describe the system of 280 stable isotopes. Why a particular element exhibits a characteristic number of stable isotopes, falling within a defined mass range, and the reason for the abundance distribution of the isotopes, remain unexplained by any of the three hypotheses. In short, an ordering principle of the stable isotopes, equivalent in conceptual power to Mendeleyev's periodic system of the elements, is still wanting.

My efforts over the past year have caused me to examine a large amount of data related to the atomic and nuclear properties, in the hopes of finding a synthesis, with aid of the more

Shell 1: Cube (first 7 vertices)

Characteristics: N = 1 to 8, (8)
Odd elements: Odd Z/Odd N = 1/1, 3/3, 5/5, 7/7, unique to this shell. 2 stable isotopes (exc. Be-9)
Even elements: All exhibit 2 stable isotopes.

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Odd Z/ Odd N
1	**0**	**H-1**	**99.98%**	**1/2**	2.79285	
1	1	H-2	0.02%	1	0.85744	1/1
2	1	He-3	0.01%	1/2	-2.12762	
2	**2**	**He-4**	**100.00%**			
3	3	Li-6	7.42%	1	0.82205	3/3
3	**4**	**Li-7**	**92.58%**	**3/2**	3.25642	
4	**5**	**Be-9**	**100.00%**	**3/2**	**-1.17790**	
5	5	B-10	19.78%	3	1.80065	5/5
5	**6**	**B-11**	**80.22%**	**3/2**	2.68864	
6	**6**	**C-12**	**98.89%**			
6	7	C-13	1.11%	1/2	0.70241	
7	**7**	**N-14**	**99.63%**	**1**	0.40376	**7/7**
7	8	N-15	0.37%	1/2	-0.28319	

(Z = protons; N = neutrons; A = mass number)

Table 1
PERIODIC TABLE OF THE STABLE ISOTOPES
This is an extension of the one prepared for my previous report ("Neutron Octaves in the Moon Nuclear Model," May 18, 2007). The distribution of neutrons by powers of 2, when the isotopes are arranged according to the shells of the Moon model, may be seen here. It provides the data for Figure 3.

powerful tool of the Moon nuclear model. (Some of these are summarized in the form of appended charts and graphs.) Although I seem to get close with various approaches, I have reached nothing that would unite the three, apparently mutually contradictory, systems summarized above.

Moon vs. Bohr

A recent rethinking of the assumptions behind Moon's efforts has led me to suspect a methodological error in my approaches thus far. My analysis would lead to the conclusion that the conventional picture of atomic electrons, despite its apparent fit to the Mendeleyev table and the data of spectroscopy, is fundamentally flawed. This goes to the question of the relationship of electromagnetic propagation and matter, the emission of radiation by electrons and so forth.

Recall that in Moon's conception, what we have called the Moon model, the Keplerian shells of the nucleus derive from a principle of ordering of space (space quantization), which also governs the configuration of electrons associated with electromagnetic propagation. The ratio of the impedance of free space to the maximum quantum Hall resistance in the solid state (25,812.8 ohms) is twice the fine structure constant (taken as 1/137). Moon interprets this as evidence of a configuration of 68

(Text continued on p. 50)

Shell 2: (Cube, last vertex), Octahedron

Characteristics: N = 8 to 16, (8)
Odd elements: All have 1 isotope; mass number = 2Z+1.
Even elements: All have 3 isotopes; mass numbers = 2Z, 2Z+1, 2Z+2. Most abundant is 2Z.

Z	N	Nuclide	% Abundance	Nuclear Spin	Mag. Moment	Number of Isotopes
8	**8**	**O-16**	**99.76%**			**3**
8	9	O-17	0.04%	5/2	-1.89380	
8	10	O-18	0.20%			
9	**10**	**F-19**	**100.00%**	**1/2**	2.62887	**1**
10	**10**	**Ne-20**	**90.92%**			**3**
10	11	Ne-21	0.26%	3/2	-0.66180	
10	12	Ne-22	8.82%			
11	**12**	**Na-23**	**100.00%**	**3/2**	2.21752	**1**
12	**12**	**Mg-24**	**78.70%**			**3**
12	13	Mg-25	10.13%	5/2	-0.85546	
12	14	Mg-26	11.17%			
13	**14**	**Al-27**	**100.00%**	**5/2**	3.64150	**1**
14	**14**	**Si-28**	**92.23%**			**3**
14	15	Si-29	1/2	-0.55529	4.67%	
14	16	Si-30			3.10%	

(Z = protons; N = neutrons; A = mass number)

Shell 3: Icosahedron

Characteristics: N = 16 to 32, (16)
Odd elements: Prime atomic number species have 2 isotopes; non-prime have 1.
Even elements: Mass number range is 5, (except Ca). After calcium, most abundant isotope is 2Z+4.

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)
15	**16**	**P-31**	**100.00%**	**1/2**	1.13160		
16	**16**	**S-32**	**95.00%**				
16	17	S-33	0.76%	3/2	0.64382		
16	18	S-34	4.22%				
16	20	S-36	0.01%				
17	**18**	**Cl-35**	**75.53%**	**3/2**	0.82187		
17	20	Cl-37	24.47%	3/2	0.68412		
18	18	Ar-36	0.34%				
18	20	Ar-38	0.06%				
18	**22**	**Ar-40**	**99.60%**				
19	**20**	**K-39**	**93.26%**	**3/2**	0.39147		
19	21	K-40	0.01%				
19	22	K-41	6.73%	3/2	0.21487		
20	**20**	**Ca-40**	**96.95%**				
20	22	Ca-42	0.65%				
20	23	Ca-43	0.14%	7/2	-1.31727		
20	24	Ca-44	2.08%				
20	26	Ca-46	0.01%				
20	28	Ca-48	0.19%			(2β-)	6E+18
21	**24**	**Sc-45**	**100.00%**	**7/2**	4.75648		
22	24	Ti-46	7.93%				
22	25	Ti-47	7.28%	5/2	-0.78848		
22	**26**	**Ti-48**	**73.94%**				
22	27	Ti-49	5.51%	7/2	-1.10417		
22	28	Ti-50	5.34%				

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)
23	*27*	*V-50*	0.24%	6	3.34745	(EC, β-)	1.40E+17
23	**28**	**V-51**	**99.76%**	**7/2**	5.15140		
24	26	Cr-50	4.31%			2EC	1.30E+18
24	**28**	**Cr-52**	**83.76%**				
24	29	Cr-53	9.55%	3/2	-0.47454		
24	30	Cr-54	2.38%				
25	**30**	**Mn-55**	**100.00%**	**5/2**	3.45320		
26	28	Fe-54	5.82%				
26	**30**	**Fe-56**	**91.66%**				
26	31	Fe-57	2.19%	1/2	0.09062		
26	32	Fe-58	0.33%				

Shell 4: Dodecahedron

Characteristics: N = 32 to 64, (32)
Odd and even elements: Mass number of lightest isotope is one less than that of heaviest of preceding element—or three less when radioactivity is present (except Y-89 to Zr-90).

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)
27	**32**	**Co-59**	**100.00%**	**7/2**	4.62700		
28	**30**	**Ni-58**	**68.27%**				
28	32	Ni-60	26.10%				
28	33	Ni-61	1.13%	3/2	-0.75002		
28	34	Ni-62	3.59%				
28	36	Ni-64	0.90%				
29	**34**	**Cu-63**	**69.09%**	**3/2**	2.22330		
29	36	Cu-65	30.91%	3/2	2.22330		
30	***34***	***Zn-64***	**48.89%**			**2EC**	**2.80E+16**
30	36	Zn-66	27.81%				
30	37	Zn-67	4.11%	5/2	0.87548		
30	38	Zn-68					

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)
30	40	*Zn-70*	0.62%			2β-	1.30E+16
31	**38**	**Ga-69**	**60.40%**	**3/2**	2.01659		
31	40	Ga-71	39.60%	3/2	2.56227		
32	38	Ge-70	20.52%				
32	40	Ge-72	27.43%				
32	41	Ge-73	7.63%	9/2	-0.87947		
32	**42**	**Ge-74**	**36.73%**				
32	44	*Ge-76*	7.76%			2β-	
33	42	**As-75**	100.00%	3/2	1.43947		
34	40	Se-74	0.87%				
34	42	Se-76	9.02%				. . .
34	43	Se-77	7.58%	1/2	0.53506		
34	44	Se-78	23.52%				
34	**46**	**Se-80**	**49.82%**				
34	48	*Se-82*	9.19%			2β-	1.08 E+20
35	**44**	**Br-79**	**50.54%**	**3/2**	**2.10640**		
35	46	Br-81	49.46%	3/2	2.27056		
36	42	*Kr-78*	0.35%			2EC	2.00E+20
36	44	Kr-80	2.27%				
36	46	Kr-82	11.56%				
36	47	Kr-83	11.55%	9/2	-0.97067		
36	**48**	**Kr-84**	**56.90%**				
36	50	Kr-86	17.37%				
37	**48**	**Rb-85**	**72.15%**	**5/2**	1.35303		
37	50	*Rb-87*	27.85%	3/2	2.75124	β-	4.75E+10
38	46	Sr-84	0.56%				
38	48	Sr-86	9.86%				
38	49	Sr-87	7.02%	9/2	-1.09283		
38	**50**	**Sr-88**	**82.56%**				

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)
39	**50**	**Y-89**	**100.00%**	**1/2**	-0.13742		
40	**50**	**Zr-90**	**51.46%**				
40	51	Zr-91	11.23%	5/2	-1.30362		
40	52	Zr-92	17.11%				
40	54	Zr-94	17.40%				
40	56	*Zr-96*	2.80%			2β-	3.8 E+19
41	**52**	**Nb-93**	**100.00%**	**9/2**	6.17050		
42	50	Mo92	15.84%				
42	52	Mo-94	9.04%				
42	53	Mo-95	15.72%	5/2	-0.91420		
42	54	Mo-96	16.53%				. . .
42	55	Mo-97	9.46%	5/2	-0.93350		
42	**56**	**Mo-98**	**24.13%**				
42	58	*Mo-100*	9.60%			2β-	1.00 E+19
43	54	*[Tc-97]*				EC	2.60E+06
43	56	*[Tc-99]*				β-	2.12E+05
44	52	Ru-96	5.51%				
44	54	Ru-98	1.87%				
44	55	Ru-99	12.72%	5/2	-0.64130		
44	56	Ru-100	12.62%				
44	57	Ru-101	17.07%	5/2	-0.71890		
44	**58**	**Ru-102**	**31.61%**				
44	60	Ru-104	18.58%				
45	**58**	**Rh-103**	**100.00%**	**1/2**	**-0.08840**		
46	56	Pd-102	0.96%				
46	58	Pd-104	10.97%				
46	59	Pd-105	22.23%	5/2	-0.64200		
46	**60**	**Pd-106**	**27.33%**				
46	62	Pd-108	26.71%				
46	64	Pd-110	11.81%				

Shell 5A: Twin Dodecahedron

Characteristics: N = 60 to 82, (22)
Odd and even elements: Mass number of lightest isotope is 3 less than that of heaviest of preceding element.
Even elements: Large number of isotopes from 7 to 10. All show radioactivity (except tin).

Z	N	Nuclide	% Abun-dance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)	Number of Isotopes
47	**60**	**Ag-107**	**51.82%**	**1/2**	-0.11357			2
47	62	Ag-109	48.18%	1/2	-0.13069			
48	58	*Cd-106*	1.22%			2EC	2.60E+17	7
48	60	Cd-108	0.88%					
48	62	Cd-110	12.39%					
48	63	Cd-111	12.80%	1/2	-0.59489			
48	64	Cd-112	24.07%					
48	65	*Cd-113*	12.75%	1/2	-0.62230	β-	9.30E+15	
48	**66**	**Cd-114**	**28.86%**					
48	68	Cd-116	7.58%					
49	64	In-113	4.28%	9/2	5.5289			2
49	**66**	***In-115***	**95.72%**	**9/2**	5.5408	**β-**	**4.41E+14**	
50	62	Sn-112	0.96%					10
50	64	Sn-114	0.66%					
50	65	Sn-115	0.35%	1/2	-0.91884			
50	66	Sn 116	14.30%					
50	67	Sn-117	7.61%	1/2	-1.00105			
50	68	Sn-118	24.03%					
50	69	Sn-119	8.58%	1/2	-1.04729			
50	**70**	**Sn-120**	**32.85%**					
50	72	Sn-122	4.72%					
50	74	Sn-124	5.94%					
51	**70**	**Sb-121**	**57.25%**	**5/2**	3.3634			2
51	72	Sb-123	42.75%	7/2	2.5498			

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)	Number of Isotopes
52	68	Te-120	0.09%			2EC	2.20E+16	8
52	70	Te-122	2.46%					
52	71	*Te-123*	0.87%	1/2	-0.73679	EC	9.20E+16	
52	72	Te-124	4.61%					
52	73	Te-125	6.99%	1/2	-0.88828			
52	74	Te-126	18.71%					
52	76	*Te-128*	31.79%			2β-	2.2E+24	
52	**78**	***Te-130***	**34.48%**			**2β-**	**5E+23**	
53	74	I-127	100.00%	5/2	2.81328			1
54	70	*Xe-124*	0.10%			2EC	1.6E+14	9
54	72	Xe-126	0.09%					
54	74	Xe-128	1.92%					
54	75	Xe-129	26.44%	1/2	-0.777977			
54	76	Xe-130	4.08%					
54	77	Xe-131	21.18%	3/2	0.69186			
54	**78**	**Xe-132**	**26.89%**					
54	80	Xe-134	10.44%					
54	82	Xe-136	8.87%			2β-	2.4E+21	
55	**78**	**Cs-133**	**100.00%**	**7/2**	2.582024			
56	74	Ba-130	0.10%			2EC	3.50E+14	7
56	76	Ba-132	0.09%			2EC	3E+21	
56	78	Ba-134	2.42%					
56	79	Ba-135	6.59%	3/2	0.837943			
56	80	Ba-136	7.81%					
56	81	Ba-137	11.32%	3/2	0.937365			
56	**82**	**Ba-138**	**71.66%**					

Shell 6: Inner Cube

Characteristics: N = 81 to 96, (15)
Odd and even elements: Mass numbers in sequence for Z = 57-60.
Even elements: Radioactivity in every even element. 7 isotopes (except Ce). Alpha emission at Z=62, 64

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)	Number of Isotopes
57	81	*La-138*	0.09%	5	3.7139	EC, β-	1.05E+11	
57	**82**	**La-139**	**99.91%**	**7/2**	2.7832			
58	78	*Ce-136*	0.19%			2ec	7.00E+13	4
58	80	*Ce-138*	0.30%			2ec	9.00E+13	
58	**82**	**Ce-140**	**88.40%**					
58	84	*Ce-142*	11.10%			2β-		
59	**82**	**Pr-141**	**100.00%**	**5/2**	4.136			
60	**82**	**Nd-142**	**27.20%**					**7**
60	83	Nd-143	12.20%	7/2	-1.065			
60	84	Nd-144	23.80%				2.29E+15	
60	85	Nd-145	8.30%	7/2	-0.656			
60	86	Nd-146	17.20%					
60	88	Nd-148	5.70%					
60	90	*Nd-150*	5.60%			2β-	1.1E+19	

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)	Number of Isotopes
61	84	*[Pm-145]*	0.00%					
61	86	*[Pm-147]*	0.00%					
62	82	Sm-144	3.10%					7
62	85	*Sm-147*	15.10%	7/2	-0.8149		1.06E+11	
62	86	*Sm-148*	11.30%				7.00E+15	
62	87	Sm-149	13.90%	7/2	-0.6718			
62	88	Sm-150	7.40%					
62	**90**	**Sm-152**	**26.60%**					
62	92	Sm-154	22.60%					
63	88	Eu-151	47.80%	5/2	3.4718			
63	**90**	**Eu-153**	**52.20%**	**5/2**	**1.5331**			
64	88	*Gd-152*	0.20%				1.08E+14	7
64	90	Gd-154	2.20%					
64	91	Gd-155	14.73%	3/2	-0.2591			
64	92	Gd-156	20.50%					
64	93	Gd-157	15.70%	3/2	-0.3399			
64	**94**	**Gd-158**	**24.80%**					
64	96	*Gd-160*	21.80%			2β-	3.10E+19	

Shell 7: Inner Octahedron

Characteristics: **N = 94 to 106, (12)**
Odd and even elements: ***No radioactivity.***
Even elements: 6 or 7 isotopes. *Odd Elements: only 1 isotope.*

Z	N	Nuclide	% Abundance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)	Number of Istotopes
65	**94**	**Tb-159**	**100.00%**	**158.925**				
66	90	Dy-156	0.06%	155.924				7
66	92	Dy-158	0.10%	157.924				
66	94	Dy-160	2.34%	159.925				
66	95	Dy-161	18.90%	160.927				
66	96	Dy-162	25.50%	161.927				
66	97	Dy-163	24.90%	162.928				
66	**98**	**Dy-164**	**28.20%**	**163.929**				
67	**98**	**Ho-165**	**100.00%**	**164.930**				
68	94	Er-162	0.10%	161.929				6
68	96	Er-164	1.60%	163.929				
68	**98**	**Er-166**	**33.40%**	**165.930**				
68	99	Er-167	22.90%	166.932				
68	100	Er-168	27.00%	167.932				
68	102	Er-170	15.00%	169.936				
69	**100**	**Tm-169**	**100.00%**	**168.934**				
70	98	Yb-168	0.10%	167.934				7
70	100	Yb-170	3.10%	169.935				
70	101	Yb-171	14.30%	170.937				
70	102	Yb-172	21.90%	171.937				
70	103	Yb-173	16.20%	172.938				
70	**104**	**Yb-174**	**31.70%**	**173.939**				
70	106	Yb-176	12.70%	175.943				

Shell 8: Twin Icosahedron

Characteristics: N = 104 to 124, (20)
Odd elements: Two isotopes (except gold). - emission at Z = 71, 73, 75.
Even elements: 5 to 7 isotopes. Alpha emission at Z = 72, 74, 76, 78.

Z	N	Nuclide	% Abun- dance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)	Number of Istotopes
71	104	Lu-175	97.40%	174.941				2
71	105	*Lu-176*	2.60%	175.943		β-	3.73E+10	
72	102	*Hf-174*	0.20%	173.940			2.00E+15	6
72	104	Hf-176	5.20%	175.942				
72	105	Hf-177	18.50%	176.944				
72	106	Hf-178	27.10%	177.944				
72	107	Hf-179	13.80%	178.946				
72	**108**	**Hf-180**	**35.20%**	**179.947**				
73	107	Ta-180m	0.01%	179.942		β-	1.20E+15	2
73	108	Ta-181	99.99%	180.948				
74	106	*W-180*	0.10%	179.947			1.80E+18	5
74	108	*W-182*	26.30%	181.948			8.30E+18	
74	109	*W-183*	14.30%	182.950			1.30E+19	
74	**110**	***W-184***	**30.70%**	**183.951**			**2.90E+19**	
74	112	*W-186*	28.60%	185.954			2.70E+19	
75	110	Re-185	37.40%	184.953				2
75	**112**	***Re-187***	**62.60%**	**186.956**		**β-**	**4.35E+07**	
76	108	*Os-184*	0.02%	183.953			5.60E+13	7
76	110	*Os-186*	1.58%	185.954			2.00E+15	
76	111	Os-187	1.60%	186.956				
76	112	Os-188	13.30%	187.956				
76	113	Os-189	16.10%	188.959				

Z	N	Nuclide	% Abun-dance	Nuclear Spin	Magnetic Moment	Decay Mode	Half Life (years)	Number of Istotopes
76	114	Os-190	29.40%	189.959				
76	**116**	**Os-192**	**41.00%**	**191.961**				
77	114	Ir-191	37.30%	190.961				2
77	**116**	**Ir-193**	**62.70%**	**192.963**				
78	112	*Pt-190*	0.01%	189.960			6.50E+11	6
78	114	Pt-192	0.79%	191.961				
78	116	Pt-194	32.90%	193.963				
78	**117**	**Pt-195**	**33.80%**	**194.965**				
78	118	Pt-196	25.30%	195.965				
78	120	Pt-198	7.20%	197.968				
79	118	Au-197	100.00%	196.967				1
80	116	Hg-196	0.20%	195.966				7
80	118	Hg-198	10.10%	197.967				
80	119	Hg-199	16.90%	198.968				
80	120	Hg-200	13.20%	199.970				
80	121	Hg-201	13.22%	200.970				
80	**122**	**Hg-202**	**29.70%**	**201.971**				
80	124	Hg-204	6.80%	203.974				
81	122	Tl-203	29.50%	202.972				2
81	**124**	**Tl-205**	**70.50%**	**204.975**				

(Text continued from p. 39)

paired electrons, plus one unpaired, operative in the propagation of electromagnetic radiation. The 137 electrons fill the 69 axes (3 × 23) of three saturated palladium structures.

Moon's conception is susceptible of the following interpretation, which gives an intelligible representation for Planck's law. The Planck constant is a measure of *action*, that is, of a quantity of *work* over a period of *time*, or the work exerted by a given *mass* acting at a certain velocity over a given length. The value of the Planck quantum is equivalent to the product of the *mass* of the electron, the *velocity* of light, and the Weber critical *length* into the inverse fine structure constant (137). $h = 137\ m_e \cdot c \cdot \rho$, where h is the action constant, m_e the mass of the electron, c the velocity of light *in vacuo,* ρ the Weber critical length ($= e^2/m_e \cdot c^2$).

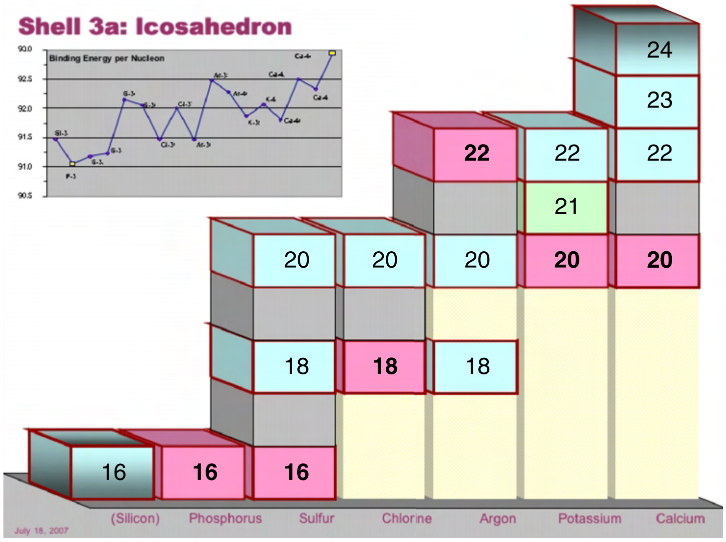
The physical interpretation is that each of the Weber-paired electrons in the configuration of 137 described by Moon, completes one oscillation at a mean velocity c. The result is the minimal measurable action in the extranuclear domain. The Planck energy ($E =$

hν) thus becomes intelligible as the measure of the work done by a configuration of 137 free electrons in the Moon configuration, vibrating at any given frequency.

What must now be considered is the relationship of electromagnetic radiation to its source in the atom or nucleus. For example, since Niels Bohr, the emission of light or other radiation from an excited atom has been explained as a shift in electron orbitals. The orbits were constructed to fit the energy equivalents of the observed radiation. The *ad hoc* assumption was introduced that the orbits must occur in quantized units of angular momentum to suit the Planck law.

In Moon's hypothesis, the radiation is quite intimately connected with the work done by a configuration of 137 electrons. To comprehend the atom, where it appears that a lesser number of electrons are bound in connection with the nucleus, we would like to know the relationship of these to the 137. It appears that the singularities we know through atomic and nuclear chemistry are a modification of what we might suppose as a potential within space for the joining of the electron singularities into three dodecahedra. The excitation of an atom which produces radiation, therefore, must have something to do with the relationship of that spatial potential to its reconfigured form in the atom.

So we overcome the a*bohr* ent.



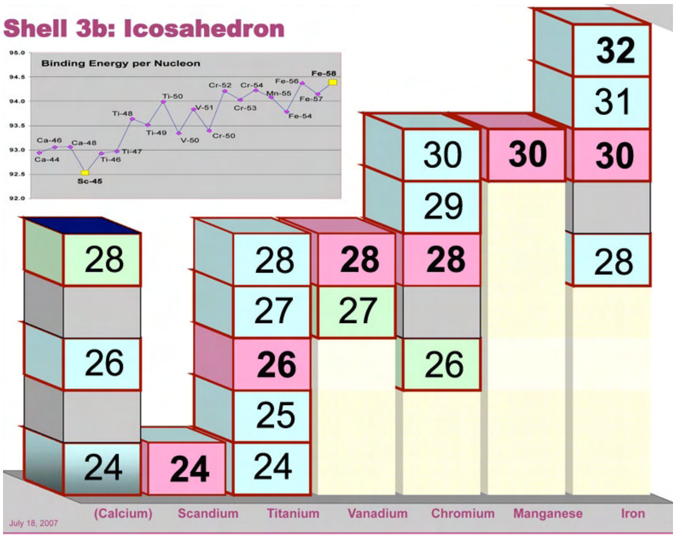


Figure 3
STABLE ISOTOPES BY NEUTRON NUMBER

The chart is an attempt to illustrate the neutron octaves and make evident other features of the ordering by neutrons, rather than mass number. The so-called magic numbers, actually unexplained anomalies in the ordering of neutrons, 20, 28, and 50, are quite evident as extended horizontal displays. The number of isotopes per element, and their mass range, both absolute, and in relation to the other elements is visually apparent.

One unexplained feature is a tendency for the isotopes, above oxygen and of even neutron number, to occur in groups of three; an odd-numbered element is surrounded by two evens, as in Ti-20, V-28, Cr-28 (the numbers here denoting the neutron number).

The Binding Energy per Nucleon graphs were inserted to see if there was a relationship of binding energy to the shells. Shells 2 and 3 begin at valleys in the curve, and end at peaks. Shell 4 might be thought of the same. But the relationship does not hold consistently.

The series is not extended beyond barium. Shells 1, 2, 4 and 5 are links only.

Figure 4 (Click for figures)
ELECTRIC QUADRUPOLE MOMENTS

The quadrupole moments of the elements at closed proton shells in the Moon model occur at low points in the graph. The elements are indicated in yellow. Barium is the completion of the first half of the twin dodecahedron. Ytterbium (Yb) is the completion of the inner cube and octahedron of the lanthanide series. Thallium (Tl-205) marks the completion of the second icosahedron. (The closing of the dodecahedron occurs beyond the range of stable isotopes.)

Figure 5 (Click for figure)
LOG OF MAGNETIC SUSCEPTIBILITY

Oxygen, iron, palladium, gadolinium, and uranium show very high magnetic susceptibility. This chart is revived from studies reported in 2004, as it points to an anomaly expressed by the Moon model respecting a characteristic which is not normally considered nuclear.