

Fractional and Unitary Electric Charges I: Classical Foundations of Quantum Effects

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Abstract

Numerical value of the atom's electrical/electromotive charge emerges naturally upon expressing its definitive e-m oscillation frequency ν as an exponent of eight, 8^ν ('octave quantum'). This simple procedure realizes, for each element, accurate values of the established quantum numbers. It is revealed that unlike others, the spin quantum number $\pm\frac{1}{2}$ is not an 'octave quantum', it actually turns out an exponent of a field coupling that manifests atomic mass. Octave quanta of frequencies of atoms of the second and third (invisible unknown) elements of nature's chemical periodicity, "blackton" B1 and "boston" B3, ($8^{\frac{1}{2}}, 8^{\frac{2}{3}}$) manifest observational fractional one-third $\frac{1}{3}$ and two-third $\frac{2}{3}$ electrical charges normally associated with 'quarks'. Based on the concept of 'octave quantum' the author uses periodic arrangement of the chemical elements to present a unique account of established quantum numbers, it facilitates a deeper insight into factors responsible for unusual valences commonly encountered among transition elements. It is concluded that the ease with which the procedure reproduces established quantum numbers strongly suggests an intrinsic classical origin of observational quantum characteristics.

Keywords: electromagnetism, fractional electric charge, oscillation frequency, quarks, valence

1. Introduction

Nature appears quite mysterious but if you studied it hard enough it has a way of letting you into some of its secrets.

Certain forms of matter in the raw state have been known possibly from antiquity to possess the property we now associate with electricity; the history of development of electricity is widely documented, Wikipedia.org: Electricity. To date, however, the causality of electricity remains widely open to speculation; one could go through a doctorate course in Chemistry or Physics without understanding the fundamental causality of the effect. After over ten years of investigating the atom we think we are now in a position to give a fundamental account of electricity from atomic perspectives. Here we attempt to account for electrical characteristics of the atom based on the chemical periodicity.

Much of the time our investigations consistently point to the cosmic vacuum field as the seat of most, probably all, interactions that manifest observational effects; interestingly, with so much progress made at the high-end science and technology, mainstream is yet to come to terms with existence of the cosmic e-m material vacuum field, a subject with which we have actively been engaged since 2012. We now have evidence which shows clearly that spatial periodic arrangement of e-m radiation frequencies of atoms of the chemical elements determines chemical reactivity, form, geometric structure, and properties of matter; indeed, one could say that spatial periodic arrangement of causal e-m frequencies of the elements is the fundamental determinant of our physical reality. If the e-m field of the cosmic vacuum were structureless, reality as we know it would not exist since there would be no division into individual units which we call elements, the entire field would itself constitute a single 'element', an end in itself, devoid of differentiation – a 'dead' end. If, on the other hand, the e-m cosmic field was arranged differently, say it was divided into twelve 12 groups and 12 periods, the chemical elements would be entirely different in geometric structure, form and chemical reactivity; in other words, we would be living in an entirely different world. Much of our conscious existence depends on the division of the e-m cosmic field into eight spatial groups and eight periods, we investigate the subject.

2. Data Presentation

2.1 Intrinsic Periodic Nature of the Atom's Electromagnetic e-m Oscillation Frequency

Values of frequencies of the elements' atomic e-m radiation ν/Hz are presented in Table 1, the table is reproduced for ease of reference from Obande (2015b; p.84). The values are fitted into the familiar 8-fold spatial periodic arrangement in Tables 2(a) and (b) re-expressed in powers of eight, i.e., $\nu = 8^x * g/\text{Hz}$, where index x indicates the noble gas' ν value of the period, the operator $*$ scales (multiplies) the principal octave harmonic note into octet overtones or resonances along the period and g gives the periodic group number. The values in Tables 2(a) and 2(b) provide clear indications that the atom's harmonic oscillation is responsible for its electrical character. The values look absolutely uneventful, they give no hint of possible connection to the atom's electrical character, however, if expressed as exponents of eight, 8^v , as shown in Tables 2(a) and (b), they immediately take on an entirely different but quite familiar appearance, the details are presented.

Table 1. Nature's atomic e-m frequencies ν/Hz

A^*_N	Atom	ν	A_N	Atom	ν	A_N	Atom	ν	A_N	Atom	ν	A_N	Atom	ν	A_N	Atom	ν
1	e-	1	21	Cg	512	41	P	163840	61	Br	3932160	81	Cs	67108864.0	101	Re	658887028.4
2	Bl	2	22	D	1024	42	S	196608	62	Kr	4194304	82	Ba	134217728.0	102	Os	689391057.5
3	Bs	4	23	T	1536	43	Cl	229376	63	Rb	4194304	83	La	201326592.0	103	Ir	719895086.5
4	A	8	24	H	2048	44	Ar	262144	64	Sr	8388608	84	Ce	227137693.5	104	Pt	750399115.6
5	Jm	8	25	L	2560	45	K	262144	65	Y	12582912	85	Pr	252948795.1	105	Au	780903144.7
6	En	16	26	Ha	3072	46	Ca	524288	66	Zr	16777216	86	Nd	278759896.6	106	Hg	811407173.8
7	Ey	24	27	Ng	3584	47	Sc	786432	67	Nb	20971520	87	Pm	304570998.2	107	Tl	841911202.9
8	Ah	32	28	He	4096	48	Ti	1048576	68	Mo	25165824	88	Sm	330382099.7	108	Pb	872415232.0
9	Bd	40	29	Li	4096	49	V	1310720	69	Tc	29360128	89	Eu	356193201.2	109	Bi	872415232.0
10	De	48	30	Be	8192	50	Cr	1572864	70	Ru	33554432	90	Gd	382004302.8	110	Po	939524096.0
11	Rm	56	31	Be	12288	51	Mn	1835008	71	Rh	33554432	91	Tb	407815404.3	111	At	1006632960.0
12	Bt	64	32	C	16348	52	Fe	2097152	72	Pd	37748736	92	Dy	433626505.9	112	Rn	1073741824.0
13	Mc	64	33	N	20480	53	Co	2097152	73	Ag	41943040	93	Ho	459437607.4	113	Fr	1073741824.0
14	Pn	128	34	O	24576	54	Ni	2359296	74	Cd	46137344	94	Er	485248708.9	114	Ra	2147483648.0
15	Vt	192	35	F	28672	55	Cu	2621440	75	In	50331648	95	Tm	511059810.5	115	Ac	3221225472.0
16	Ou	256	36	Ne	32768	56	Zn	2883584	76	Sn	54525952	96	Yb	536872912.0	116	Th	3758096384.0
17	Tr	320	37	Na	32768	57	Ga	3145728	77	Sb	54525952	97	Lu	536872912.0	117	Pa	4294967296.0
18	Bz	384	38	Mg	65536	58	Ge	3407872	78	Te	58720256	98	Hf	567374941.1	118	U	4831838208.0
19	Hl	448	39	Al	98304	59	As	3407872	79	I	62914560	99	Ta	597878970.2	119	Np	5368709120.0
20	G	512	40	Si	1E+05	60	Se	3670016	80	Xe	67108864	100	W	628382999.3	120	Pu	5905580032.0
															121	Am	6442450944.0

* A_N = Nature's mass number (formerly, Russell's)

2.2 Electro-Chemical Periodic Space Groups

Table 2(a) presents a holistic overview of the atom's electrical character. The table's chemical group labeling follows Russell and Russell (R&R (1981))'s convention whereby elements such as K, Ca and Sc belong to 'R' (red) group and their conjugates, Br, Se and As belong to 'B' (blue) group. The convention derives from the notion that the chemical periodicity CP depicts the complete e-m spectrum and the two blocks of groups correspond to the spectrum's red and blue ends respectively.

- (i) defined in a 9×9 matrix, the R&R or *nature's periodic arrangement* is much more compact and symmetric than the conventional table; it starts at the middle of period 1 to yield an incomplete

(half) first period and ends also at the middle of period 9 to yield an incomplete (half) ninth period; the two incomplete halves together form a ‘shadow’ tenth to yield a cyclic periodicity $1 \rightarrow 2 \rightarrow 3 \cdot \cdot \rightarrow \cdot \cdot \cdot 9 \rightarrow 1$ that results in a continuous matrix flow; it gives rise to observational cyclic (steady-state) universe, Obande (2019b), Di Valentino et al. (2020);

- (ii) it has three R groups to the left of the center and three ‘B’ groups to the right making the central group a common hybrid fourth 4(R+B);
- (iii) the 2D plan view sketches a 3D sphere dissected vertically at the middle in such a way that the end of one half fits perfectly into the beginning of the other; it again spells a *closed* universe, Di Valentino et al. (2020), Obande (2018) that is visibly reflected in the rainbow;
- (iv) the plan view is ‘Z’ shaped, if hinged at its center it would rotate clockwise in the face of an air stream, reversal of the stream direction would cause similar reversal of the rotation direction;
- (v) transition elements are neatly packed around the central group in seven unequal segments that start with Ti and end with Pu, the segments are sequentially centered by two invisible elements, Ah and Ou and seven visible elements, H, C, Si, Co, Rh, Lu and Am respectively.

Table 2(a). Periodicity of electromagnetic frequencies of the chemical elements

1R	2R	3R	4(R+B)	3B	2B	1B	0
				1	2	3	4
				Ab(e-)	Bl	Bs	A
				$8^0 \times 1$	$8^{3/2} \times 2$	$8^{3/2} \times 4$	$8^1 \times 8$
5	6	7	8	9	10	11	12
Jm	En	Ek	Ah	Bn	De	Rm	Bt
$8^1 \times 1$	$8^1 \times 2$	$8^1 \times 3$	$8^1 \times 4$	$8^1 \times 5$	$8^1 \times 6$	$8^1 \times 7$	8^2
8	16	24	32	40	48	56	64
13	14	15	16	17	18	19	20
Mc	Pn	Vt	Ou	Tr	Bz	Hl	G
$8^2 \times 1$	$8^2 \times 2$	$8^2 \times 3$	$8^2 \times 4$	$8^2 \times 5$	$8^2 \times 6$	$8^2 \times 7$	8^3
64	128	192	256	320	384	448	512
21	22	23	24	25	26	27	28
Cg	D	T	H	Rs	Hn	Ng	He
$8^3 \times 1$	$8^3 \times 2$	$8^3 \times 3$	$8^3 \times 4$	$8^3 \times 5$	$8^3 \times 6$	$8^3 \times 7$	8^4
512	1,024	1,536	2,048	2,560	3,072	3,584	4096
29	30	31	32	33	34	35	36
Li	Be	B	C	N	O	F	Ne
$8^4 \times 1$	$8^4 \times 2$	$8^4 \times 3$	$8^4 \times 4$	$8^4 \times 5$	$8^4 \times 6$	$8^4 \times 7$	8^5
37	38	39	40	41	42	43	44
Na	Mg	Al	Si	P	S	Cl	Ar
$8^5 \times 1$	$8^5 \times 2$	$8^5 \times 3$	$8^5 \times 4$	$8^5 \times 5$	$8^5 \times 6$	$8^5 \times 7$	8^6
45	46	47	53	59	60	61	62
K	Ca	Sc	a	b	As	Se	Br
$8^6 \times 1$	$8^6 \times 2$	$8^6 \times 3$	$8^7 \times 1$	$8^7 \times$	$8^7 \times 1.750$	$8^7 \times 1.875$	$8^7 \times 2$
				1.63			
63	64	65	71	77	78	79	80
Rb	Sr	Y	c	d	Sb	Te	I
$8^7 \times 2 \times 1$	$8^7 \times 2 \times 2$	$8^7 \times 2 \times 3$	$8^8 \times 2$	$8^8 \times 2 \times 1.63$	$8^8 \times 2 \times 1.750$	$8^8 \times 2 \times 1.875$	$8^8 \times 4$

81	82	83	e	97	f	109	110	111	112
Cs	Ba	La		Lu		Bi	Po	At	Rn
$8^8 \times 4 \times 1$	$8^8 \times 4 \times 2$	$8^8 \times 4 \times 3$		$8^9 \times 4$		$8^9 \times 4 \times 1.63$	$8^9 \times 4 \times 1.750$	$8^9 \times 4 \times 1.875$	8^{10}
113	114	115	g	120					
Fr	Ra	Ac		Am					
$8^{10} \times 1$	$8^{10} \times 2$	$8^{10} \times 3$		$8^{10} \times 6$					

Group 3R Transition Elements

Group 3B Transition Elements

- a. Scandium series: Ti, V, Cr, Mn, Fe
- b. Arsenic series: Ni, Cu, Zn, Ga, Ge
- c. Yttrium series: Zr, Nb, Mo, Tc, Ru
- d. Antimony series: Pd, Ag, Cd, In, Sn
- e. Lanthanum series: Ce, Pr, Nd, Pm, Sm, Eu,
Gd, Tb, Dy, Ho, Er, Tm, Yb
- f. Bismuth Series: Hf, Ta, W, Re, Os,
Ir, Pt, Au, Hg, Tl, Pb
- g. Actinium series: Th, Pa, U, Np,

3. Discussion

3.1 Fractional Electric Charge Causality

The data in Table 2 clearly reveal that atomic electric charge indeed results from *physical* rotation of the quantum e-m packet. Table 2(a) is a shortened form of 2(b) in which *g* values of the transition elements are fully recovered. The atom, like all natural inertial objects, rotates, Obande (2019); one rotational direction is conventionally ‘positive’ and the opposite direction corresponds automatically to ‘negative’ charge. Sadly, the positive direction, although correctly recognized as positive charge, carries the contradictory tag ‘anti-matter’; no modern scientific position can be further from the truth, Stone (2021). Referring to the positron as ‘antimatter’, i.e., negating matter, is grossly in error, Anderson, C. A. (1933); its opposing stance is nature’s economic device for electrical conjugation. It is not appreciated that an anti-matter *cannot* exist, not even as a transient, in a matter world. Matter and so-called anti-matter are like two sides of a coin, it is one and the same object simply turning in opposite directions to facilitate electrical conjugation. All chemical (not only ionic) compounds can be generalized as belonging to the electrical coupling $e^- + e^+ = e_2 + \gamma$, i.e., charge coupled to its opposite yields neutral (molecular) matter plus radiated reaction energy; *nothing is annihilated rather, matter’s charged/radical form is converted to neutral (molecular) form*. All couplings in nature, be it chemical, biological, geological, or cosmological, et cetera, are of contra-rotating electrical halves. Therefore, under normal circumstances, the ‘anti-matter’ must, in every respect, be same as matter except as it pertains to an opposite direction of angular rotation, Ahmadi et al. (2016), Belyakov (2010), Smorra, C. et al. (2017), Anderson, E. K. et al. (2023). The prefix ‘posi-’ is quite appropriate for anti-matter as in ‘positron’ for anti-electron.

Nature’s premier element, ‘alberton’ Ab, identifies with the electron e-, Obande (2016b); this *element* comes with a baggage of curiosities, we find that: i) it is dominantly visible whereas, with the exception of deuterium D and tritium T, all other sub-hydrogen *elements* (no ‘elementary’ particles) are invisible and notoriously inaccessible; ii) unlike neighboring members of the (half) first period, electron’s zero exponent, of course, does not imply zero electric charge. The value 8^0 provides a clue indicating that while the exponent truly gives an accurate value of mass number, it may not always be the case with electric charge value. For the elements $B_l \equiv 8^{1/3} = 2 \text{ Hz}$ and $B_s \equiv 8^{2/3} = 4 \text{ Hz}$, we reason as follows: setting the electron aside as a special case, elements in the (half) first period are geometrically incomplete (i.e., immature), they seem structurally special in some yet-to-be-determined respect thus incapable of coupling as fully-grown B group elements. These objects are, however, able to execute the ‘fractional’ rotations that spell their charges. Structural or geometric maturity is first attained at the first noble gas alphanon, A, $v = 8^1 = 8 \text{ Hz}$. Notice again that, in this case as in e^- , the unitary exponent $x = 1$ has nothing to do with electric charge. As is well known, the noble gas has no charge, the reason being that its quantum packet rotates as a rigid body, in effect it has no internal *tension*; internal tension manifests atomic mass, gravitation, electrical nature, Macken (2011) and a host of other effects Obande

(2016a, 2019a, 2021, 2022, 2023). In summary, we find that the **1/3** and **2/3** charges carried by the first and second (unknown, invisible) elements Bl and Bs refer to truly fractional charges; the subject is slightly deeper but a more detailed account would digress and exceed the target scope of this brief report.

It is relevant in concluding this section to note that atomic mass evolves in geometric (logarithmic) progression of the e-m radiation frequency, $\nu/Hz = 1, 2, 4, \dots, 32, \dots, 256, 512, \dots, 32768, \dots, 6.443 \times 10^9$, Obande (2016b, 2023). It reveals that growth rate achieves through an embedded system in which the preceding atom is encased within the structure of its successor; in effect, *every lower mass element is contained within the structures of succeeding higher mass elements*. Thus, apart from the electron, the 1/3 and 2/3 charge species must be encountered in an investigation of the nucleus of *every element* provided the energy regime of the probe was sufficient.

3.2 Geometric Distribution of the Wave-packet

Values of x and g in the expression $\nu = 8^x * g$, Table 2(a), show the following interesting features:

a) Group B periods are raised a step above group R's to lower the latter relative to the former with the result that periods 1R to 8R are respectively co-linear with 2B to 9B; it makes the following (visible) elements electrical equi-potentials or mated pairs: Li:F, Na:Cl, K:Br, Rb:I and Cs:At.

b) In $\nu = 8^x * g$ the exponent x gives the periodic number, $*$ is an operator that builds the groups in octets unto the octave harmonic note of the noble gas, and g is group number. Counting from the red end of the color spectrum, we have, $g = 1, 2, 3, 4, 5, 6, 7, 8$ which corresponds to the group numbering: 1R, 2R, 3R, 4(R+B), 5B, 6B, 7B, and 8, notice that the noble gas is not recognized as an element as explained, its wave packet is tensionless. The no. 8, of course, gives the complete octave period and the fundamental note of the next (higher) octave; it reproduces the octet overtones of its period. The ingenuity of the arrangement lies in the device which effects relative displacement of the two blocks of group right from beginning to the end of the periodicity. It facilitates the process of gradually raising the octet overtones from one group to the next along the period and from one period to the next. The process is repeated until it gets to the tenth octave harmonic, $8^{10} Hz$ here, the pitch gets so high it becomes absolutely unsustainable, at this point the e-m flux channels spontaneously into the first (half) period to begin another cycle. Endless repetitions of these cycles sustain our steady-state universe Di Valentino et al. (2020); Obande (2018).

Table 2(b). Periodicity of electromagnetic frequencies of the chemical elements – full length

Atom	z_n	Noble gas Multiple	Freq. $\nu.s^{-1}$	Atom	z_n	Noble gas multiple	Freq. $\nu.s^{-1}$	Atom	z_n	Noble gas Multiple	Freq. $\nu.s^{-1}$
e-	1	8^0	1	S	42	$8^5 * 6$	196608	La	83	$8^9 * 1.5$	201326592
Bl	2	$8^{1/3}$	2	Cl	43	$8^5 * 7$	229376	Ce	84	$8^9 * 1.69231$	227137693.5
Bs	3	$8^{2/3}$	4	Ar	44	8^6	262144	Pr	85	$8^9 * 1.88461$	252948795.1
A	4	8^1	8	K	45	$8^6 * 1$	262144	Nd	86	$8^9 * 2.07692$	278759896.6
Jm	5	$8^1 * 1$	8	Ca	46	$8^6 * 2$	524288	Pm	87	$8^9 * 2.26923$	304570998.2
En	6	$8^1 * 2$	16	Sc	47	$8^6 * 3$	786432	Sm	88	$8^9 * 2.46154$	330382099.7
Ey	7	$8^1 * 3$	24	Ti	48	$8^6 * 4$	1048576	Eu	89	$8^9 * 2.65385$	356193201.3
Ah	8	$8^1 * 4$	32	V	49	$8^6 * 5$	1310720	Gd	90	$8^9 * 2.84615$	382004302.7
Bd	9	$8^1 * 5$	40	Cr	50	$8^6 * 6$	1572864	Tb	91	$8^9 * 3.03846$	407815404.5
De	10	$8^1 * 6$	48	Mn	51	$8^6 * 7$	1835008	Dy	92	$8^9 * 3.23077$	433626505.9
Rm	11	$8^1 * 7$	56	Fe	52	8^7	2097152	Ho	93	$8^9 * 3.42308$	459437607.4
Bt	12	8^2	64	Co	53	$8^7 * 1$	2097152	Er	94	$8^9 * 3.61538$	485248708.9
Mc	13	$8^2 * 1$	64	Ni	54	$8^7 * 1.125$	2359296	Tm	95	$8^9 * 3.80769$	511059810.5
Pn	14	$8^2 * 2$	128	Cu	55	$8^7 * 1.25$	2621440	Yb	96	$8^9 * 4.00001$	536870912.0
Vt	15	$8^2 * 3$	192	Zn	56	$8^7 * 1.375$	2883584	Lu	97	$8^9 * 4.00001$	536870912.0
Ou	16	$8^2 * 4$	256	Ga	57	$8^7 * 1.5$	3145728	Hf	98	$8^9 * 4.22727$	567374941.1

Tr	17	$8^2 * 5$	320	Ge	58	$8^7 * 1.625$	3407872	Ta	99	$8^9 * 4.45455$	597878970.2
Bz	18	$8^2 * 6$	384	As	59	$8^7 * 1.625$	3407872	W	100	$8^9 * 4.68182$	628382999.3
HI	19	$8^2 * 7$	448	Se	60	$8^7 * 1.75$	3670016	Re	101	$8^9 * 4.90909$	658887028.4
G	20	8^3	512	Br	61	$8^7 * 1.875$	3932160	Os	102	$8^9 * 5.13636$	689391057.5
Cg	21	$8^3 * 1$	512	Kr	62	$8^7 * 2$	4194304	Ir	103	$8^9 * 5.36364$	719895086.5
D	22	$8^3 * 2$	1024	Rb	63	$8^7 * 2 * 1$	4194304	Pt	104	$8^9 * 5.59091$	750399115.6
T	23	$8^3 * 3$	1536	Sr	64	$8^7 * 2 * 2$	8388608	Au	105	$8^9 * 5.81818$	780903144.7
H	24	$8^3 * 4$	2048	Y	65	$8^7 * 2 * 3$	12582912	Hg	106	$8^9 * 6.04545$	811407173.8
L	25	$8^3 * 5$	2560	Zr	66	8^8	16777216	Tl	107	$8^9 * 6.27272$	841911202.9
Ha	26	$8^3 * 6$	3076	Nb	67	$8^8 * 1.25$	20971520	Pb	108	$8^9 * 6.5$	872415232
Ng	27	$8^3 * 7$	3584	Mo	68	$8^8 * 1.5$	25165824	Bi	109	$8^9 * 6.5$	872415232
He	28	8^4	4096	Tc	69	$8^8 * 1.75$	29360128	Po	110	$8^9 * 7$	939524096
Li	29	$8^4 * 1$	4096	Ru	70	$8^8 * 2$	33554432	At	111	$8^9 * 7.5$	1006632960
Be	30	$8^4 * 2$	8192	Rh	71	$8^8 * 2 * 1$	33554432	Rn	112	8^{10}	1073741824
B	31	$8^4 * 3$	12288	Pd	72	$8^8 * 2 * 1.125$	37748736	Fr	113	$8^{10} * 1$	1073741824
C	32	$8^4 * 4$	16384	Ag	73	$8^8 * 2 * 1.25$	41943040	Ra	114	$8^{10} * 2$	2147483648
N	33	$8^4 * 5$	20480	Cd	74	$8^8 * 2 * 1.375$	46137344	Ac	115	$8^{10} * 3$	3221225472
O	34	$8^4 * 6$	24576	In	75	$8^8 * 2 * 1.5$	50331648	Th	116	$8^{10} * 3.5$	3758096384
F	35	$8^4 * 7$	28672	Sn	76	$8^8 * 2 * 1.625$	54525952	Pa	117	$8^{10} * 4$	4294967296
Ne	36	8^5	32768	Sb	77	$8^8 * 2 * 1.625 * 1$	54525952	U	118	$8^{10} * 4.5$	4831838208
Na	37	$8^5 * 1$	32678	Te	78	$8^8 * 2 * 1.75$	58720256	Np	119	$8^{10} * 5$	5368709120
Mg	38	$8^5 * 2$	65536	I	79	$8^8 * 2 * 1.8481779$	62014560	Pu	120	$8^{10} * 5.5$	5905580032
Al	39	$8^5 * 3$	98304	Xe	80	$8^8 * 4$	67108864	Am	121	$8^{10} * 6$	6442450944
Si	40	$8^5 * 4$	131072	Cs	81	$8^8 * 4 * 1$	67108864				
P	41	$8^5 * 5$	163840	Ba	82	8^9	134217728				

c) The whole number groups 1 to 7 result in the following electrical couplings: $1+7 = 2+6 = 3+5 = 4 + 4 = 8$, it accounts for the basis of the ‘old octet rule’. The full spectrum of charge is: 0, +1, +2, +3, +4 -0, -4, -3, -2, -1, 0, it couples as: $+1+-1 = +2+-2 = +3+-3 = +4+-4 = 0$ and of course, results to ionic compounds with a clear indication that *opposite charges couple to yield neutral matter; anti-matter is an integral part of, not in conflict with matter.*

d) Effect of the relative shift of the group becomes more prominent with the transition elements TEs; Sc, a group 3R element registers as expected with $\nu = 8^6 * 3$, however, its immediate neighbor Co registers with $\nu = 8^7 * 1$ implying a pseudo-group 1 element or a false alkali metal. Co, of course, belongs with the central group of elements among which we have: Ah, Ou, H, C, Si, Co, Rh, Lu and Am, they are electrical hybrids, elements in which the two contra-rotating electrical halves are innately embedded, they thus contain both male (R group) and female (B group) electrical halves. In principle they should have maximum valence ± 4 but in practice this may not be feasible for a number of reasons most especially geometric constraints.

A slight digression: it is interesting to find here an interpretation of hybrid characteristic in the atom. The implications for all living matter are enormous, we cannot address the subject here beyond stating the obvious fact that a hybrid atom would have the potential to pass on the trait to living matter; it would account for observational statistical biological effects of hermaphroditism.

Co’s frequency $\nu = 8^7 * 1$ signals the start of a new subgroup for which the element appears to act as an alkali metal; the effect disrupts the ‘neatness’ of the whole-number periodic grouping with superposed mixed numbers. It creates subgroups superposed on the existing groups as shown in Table 2(a) labeled (a) to (g) and bordering both sides of the central group. Observe that each subgroup (a) to (g) is a composite *single* group expanded through the actions of *g* to accommodate its TEs. The effect alters indicative *g* values of periods 7, 8 and 9 elements,

particularly those of groups 3B, 2B and 1B, i.e., As to Br, Sb to I, and Bi to At. It redefines the characteristic valences. We think it might be responsible for valences of the TEs; for instance, we find the following g -values for As, Se and Br: 1.63, 1.750, 1.875 instead of 3, 2, and 1 respectively. After Br's $v = 8^7 * 1.875$ the noble gas Kr has $v = 8^7 * 2^1$, in this fashion subsequent noble gas frequencies are $Xe, v = 8^8 * 2^2$ and $Rn, v = 8^9 * 2^3 = 8^{10} Hz$. Interestingly, the operator $*$ leaves the electrical character of corresponding R group elements intact, its second operation always corresponds to the group number and leaves the electrical character unaffected, e.g, for Rb, Sr and Y, we have: $v = 8^7 * 2 * 1$; $8^7 * 2 * 2$ and $8^7 * 2 * 3$, which correspond respectively to the group numbers 1, 2 and 3.

3.3 Valence and Bonding

The fact that in the form: 8^v , numerical value of the atom's e-m radiation realized established periodicity and quantum numbers would confirm what has been known all along – that atoms exist as wave octals or octets. However, a connection to wave harmonics and overtones had never been made explicit. In other words, for all its seeming mystery, complexity, meaninglessness and concerns, nature is simply not just waves, it is a cosmic philharmonic orchestra! It makes it so very amusing; we examine the physical details.

Results of several independent investigations into the atom's structure culminated in today's highly successful quantum description. Bohr's assumption, that electrons cycling the nucleus in orbits of quantized 'stationary states' do not collapse into the nucleus, can be taken as a good starting point; his results were published in 1913 in a three-part paper, Bohr (1913a; 1913b; 1913c). The Bohr model, however, failed to account for observational splitting of spectral lines in the presence of magnetic fields, an effect discovered earlier by Zeeman (1897). Similar splitting under the influence of an electrical field was assumed and subsequently discovered by Stark (1913). To account for these effects Schrodinger (1926) came up with a quantum wave model whose wave equation provides a much needed 3-D picture of the atom and in the same year Uhlenbeck and Goudsmit (1926) reported that the atom *physically* rotates.

Bohr's 1-D model describes only the atom's size as set by number of electrons orbiting the nucleus; in other words, it describes only the principal quantum number, n . On the other hand, Schrodinger's wave equation describes the atom in three dimensions, it thus yields three quantum numbers corresponding to the atom's three spatial coordinates; this made it possible to describe the state of the atom with three quantum numbers: principal n , angular l and magnetic m_l . Despite the seeming beauty and logic of its mathematical framework, description of the fourth, the spin quantum number, m_s , still appears questionable, particularly in the light of the present results. Quantum mechanics' description, which explains away physical rotation as some unknown 'intrinsic property' of the atom, compels the submission that physics is yet to come to terms with the reality of atomic physical rotation; nothing in observational reality suggests existence of a cosmic speed limit. In what follows we examine the quantum numbers qns with a view to indentifying existence or otherwise of correspondences between quantum mechanics qm's and the present empirical description of the atom.

3.3.1 Quantum Numbers and Wave Packet Spatial Distribution of e-m Oscillation Frequencies

The four quantum numbers qns: principal \mathbf{n} , azimuthal or orbital \mathbf{l} , magnetic \mathbf{m}_l and spin \mathbf{m}_s , are well described in the literature, Purdue University, Wikipedia, here we explore existence of correspondences, if any, between quantum number qn values generated in the present empirical procedure and those derived from theories of quantum mechanics qm.

a) Principal Quantum Number \mathbf{n}

According to qm theory, \mathbf{n} refers to total number of shells or energy levels of electron occupation of the atom. The number turns out here to correspond to the atom's total number of chemical groups as one counts serially along the period from the alkali metal (group 1R) to the noble gas (group 0). In other words, \mathbf{n} reflects the *total* number of *electro-geometric EGM groups* into which the naturally occurring chemical elements in our observational cosmos can be classified, Obande (2017b). Values in Tables 2(a) and (b) accord with a close correlation between qm's theoretical and the present empirical descriptions of the atom; it constrains the numerical value of \mathbf{n} to within the range $0 < \mathbf{n} \leq 8$. We use the term 'electro-geometric' in reference to electrical and geometrical nature of the atom, Obande (2017b), it gives an apt description of the rotating, spatially distributed e-m packets that constitute the atom; the distribution of course manifests bonding capacity while the rotating force field manifests moving charge or electricity.

Notice that, both in qm and in the present empirical procedure, numerical values of *all* quantum numbers are realized within the value of \mathbf{n} ; in other words, all other qns are essentially different perspectives of \mathbf{n} , the implication of this realization is of crucial importance to a consideration of the quantum state.

b) Azimuthal (Angular Momentum) or Orbital Quantum Number l

Empirically, the number 4 demarcates the R (positive) and B (negative) electrical groups of elements into two equal halves separated by a central 0 (hybrid) group to give a total of ten (10) chemical groups, the noble gas group 0 and epicenter group 0 inclusive. According to qm, the orbital qn refers to the subshell and has the value $l = 0, 1, 2, 3, \dots, n - l$. An infinite number of subshells or orbitals is theoretically feasible, they refer to overtones or resonances, i.e., multiples, divisions or subdivisions as in the case of the TEs. Much to its credit, qm predicts only four (4) subshells denoted with the lower case letters: s, p, d, f. We find that *only* four letters are necessary and sufficient to describe the quantum state of each electron in every known natural (stable, non-transient) chemical element; e.g., electron orbital occupancy of one of the heaviest natural elements Am, does not exceed $n = 6, l = 5$, and $p = 6$, Obande (2016b). There is a perfect correlation between the numerical limit of l and what we call ‘symmetry group SG’ in a previous report of the ‘coupling geometry’ Obande (2017b). Nature seems content with 4 main atomic subshells, it corresponds to the ‘number value’ of the cube as well as the (inscribed) circle; however, in order to accommodate the TEs, subshells of seven elements, Sc, As, Y, Sb, La, Bi and Ac are each further subdivided.

c) Magnetic Quantum Number, m_l

Quantum mechanics says that m_l , describes orbital orientation [distribution?] of the wave packet in coordinate space, the effect causes spectral line splitting under the influence of magnetic or electric field; l 's value varies within the range $-l \dots 0 \dots +l$, the link to n is obvious. An interesting correlation exists between the theoretical range of l 's values and the range of electrical groups; in our investigation, we have: 0, -4, -3, -2, -1, 0, +1, +2, +3, +4, 0, the epicentral zero corresponds to the 5th periodic group while those at the extremities are coincident; thus, the figures are ten (10) in number, i.e., $|m_l| = 10$, a maximum value of ten orbital orientations, Obande (2016a). However, qm's theoretical description gives $n = 6, l = 5$, i.e., $m_l = 0, -5, -4, -3, -2, -1, 0, +1, +2, +3, +4, +5, 0$, making $|m_l| = 12$, i.e., a maximum of twelve orbital orientations. At the moment we are unable to account for the difference between empirical 10 and qm's theoretical 12 groups, we are in no position to comment on quantum mechanics. It is quite interesting to observe that the modulus $|m_l|$ seems reflected in shapes of various natural objects such as flower petals and cells within a wide range of fruits (10 in oranges), several other instances abound, Golubev (2016; 2014).

d) Spin Quantum Number m_s

The literature says that: m_s is called the spin qn because electrons behave *as if they were* spinning in either a clockwise or anticlockwise fashion; one also finds the statement: “The name spin comes from *geometrical spinning* of the electron about an axis, as proposed by Uhlenbeck & Goudsmit (1926). However, this *simplicistic* picture was quickly realized to be *unrealistic*, because it would require the electron *to rotate faster than the speed of light*. It was therefore replaced by a *more abstract* quantum mechanical description [emphases ours]. We contend that there is no observational evidence to support the conjecture that nature puts a limit on the electron's speed, a brief address of the subject is anticipated. The fact is that the electron physically rotates as reported long ago and explained more recently, Obande (2019a); therefore, if the temptation to compromise objectivity in favor of abstract mathematics could be resisted, analytical consistency would require that we sought m_s value in observational effects of nature, not necessarily within the ambit of the present investigation.

Atomic mass value emerges from linear correlations of the atom's waveform rotational parameters, i.e., $\tau = k(\omega/r)^{1/2}$ where τ is longitudinal strain on the e-m transverse radiation ($v s^{-1}$), ω is angular speed, $rad s^{-1}$, and r is radius in m (consistency demands r , i.e., distance, be expressed in radians and translocation in $rad s^{-1}$), the coefficient $k = 1.038 \times 10^{-5} (rad s^{-1} m^{-1})^{1/2}$, is atomic waveform mass constant in MeV; it is the wave equivalent of the more familiar particulate matter mass constant 931,494 MeV, Obande (2016b). We contend again that the numerical value $1/2$ appearing in qm analysis of rotation refers to the exponent of the linear correlation whose coefficient realizes empirical mass constant. Schematic representation of the atom looks like an hour (sand) glass, it comprises two conical halves joined at the apices and rotating in opposite directions conventionally interpreted as “spin up” \uparrow and “spin down” \downarrow , see [Obande (2018), p. 71]. The same causal agent responsible for rotational coefficient of field parametric correlations yielding atomic mass constant in MeV cannot reasonably be dissociated from the rotational constant $1/2$ appearing in $m_s = \pm 1/2$. Nature does not wastefully multiply causalities for its varied but related effects, The Blog of the blog of the cosmos (2016).

Error Sources

Results of this investigation rely heavily upon accuracy of the atom's e-m frequency ν value; for now, there is no purely theoretical framework for this value; indeed, the present effort is targeted to lead ultimately to development of a viable framework. Observe in Tables 2(a) and (b) that a common ν value defines the alkali metal and its

preceding noble gas, the situation is less than satisfactory but unavoidable at the moment. If ever a purely theoretical approach would be found it could open up much needed possibilities for clearer understanding of the role of the noble gas in matter's fabrication.

Further studies

We are well aware that what has been achieved here is quite rudimentary; three possible follow-up research directions are immediately conceivable:

i) A program for ν value

The ν value was obtained manually with the aid of a scientific pocket calculator, accuracy of the value to the tenth decimal place is not in doubt but all that has been achieved is a 2-D picture of the subject; there is need to develop a program that takes a number of factors into account, one that can routinely generate a 3-D picture to facilitate visualization of Schrödinger's quantum state. Indeed, ideally, one would expect such a program to be able to reveal angular distribution and orientation of the wave packet and reproduce observational electronic configuration of an element regardless of mass number, i.e., electronic configuration of a many-electron atom.

ii) Hypothetical worlds

For purely academic interest, one may wish to probe the characteristics of a hypothetical world whose elements comprised n groups and n periods where n can have any imaginable numerical value.

iii) Elemental quark population

The results open the possibility for semi-empirical evaluation of the number of quarks in the nucleus of an element; however, the subject is fraught with uncertainties: a) unknown physical domain of the element whose plasma is investigated; b) inability to insulate the two quarks of our visible periodicity U_p^o from interference with their counterparts in the three other coincident worlds, U_p^*, U_p', U_w^* , unknown to researchers, this issue is key to observational myriad of species encountered in experimental particle physics, an example is observational electron generations for which some 13 mass values are known; c) unknown nature of atomic mass evolution, i.e., does the ν value (or mass) of an element result from successive accumulation of preceding elements or is it a matter of direct geometric progression of the electron's unitary frequency? To test the present results it may be sufficient to verify that the electron does not contain a quark in its composition, with $\nu = 1.0 \text{ Hz}$ it precedes the two quark objects of $\nu = 2$ and 4 Hz .

Summary

- Fundamentally, the atom is a wave octet.
- Like all natural objects, the atom *physically* rotates.
- Electrical characteristics of the atom emerge spontaneously if its e-m oscillation frequency ν values are expressed as exponents of eight, 8^ν and fitted to the chemical periodicity.
- Fractional electromotive $1/3$ and $2/3$ charges conventionally associated with "quarks" trace to rotation of the second and third (unknown invisible) elements, i.e., $B1 \equiv 8^{1/3} = 2 \text{ Hz}$ and $Bs \equiv 8^{2/3} = 4 \text{ Hz}$.
- Expressed in the form $8^x * g$, its radiation frequencies reproduce the atom's quantum mechanical characteristics, exponent x gives the element's period, operator $*$ multiplies the wave octets along the chemical groups, and the function g gives the numerical value of the group; for non-transition elements g is a whole number digit that varies from 1 to 8 while for transition elements it takes mixed number values superposed on the digits.
- The noble gas' inertness is traceable to the fact that it rotates as a rigid-body thus, it has no internal stress, i.e., electric charge.
- The "natural" periodic table is interpreted to imply matrix flux from the last to the first period, it manifests cyclic or steady state universe as indicated in the rainbow.
- It is argued that antimatter is matter's conjugate, both are not in mutual opposition but conjugation. The coupling: $e^+ + e^- = e_2 + \gamma$ does *not* describe *annihilation* but '*neutralization*' of charged species to yield molecular matter e.g., $H_{(g)}^+ + H_{(g)}^- = H_{2(g)} + \Delta$.
- The 'brilliant' theoretical framework for spin qn leading to the value $\pm 1/2$ is doubtful. Unlike other qns, the exponent $8^{1/2}$ does not yield a value of the atom's radiation frequency. Furthermore, quantitative analysis of the quantum waveform traces the scalar $1/2$ to exponent of linear correlations yielding atomic mass.

- It is reasoned that the ease and accuracy with which the procedure reproduced numerical values of the established q_n suggest that the transactional explanation of spin quantum number m_s would need to be revisited in the interest of philosophical consistency.
- Finally, it is concluded that results of the present investigation provide compelling lines of evidence in support of emergence of quantum phenomena from classical foundations of the atom.

4. Conclusion

The research project, under which this investigation was conducted, set out with the supposedly simple goal to investigate the possibility of charting a classical (Newtonian) mechanics passage into the atom's heart. In several instances, the results have been incredible; however, in the present case, the results have not only been amazing they have been enlightening. Many theoretical physicists might be ready to bet that quantum mechanical description of the atom could not possibly emerge from a dismissive simplistic chemical-principle based classical investigation; but here we are, presented with a most compelling evidence. While compiling the report we came across the submission of the International Collaboration that investigated the atom's "non-pointness" Chen et al. (2023) knowledge of which dates back to Born (1935), maybe even further back. We have nothing to say here other than that having submitted the evidence, we hope the establishment and/or some better-known physicist(s) would take the trouble to scrutinize/critique our procedure; only when verified would it be reasonable to draw the several interesting conclusions, most notably, the strong implication that intrinsically, the quantum world has an incredibly simple classical foundation.

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