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On the Fundamental Physical Constants: II. Field Coupling Geometry

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Abstract

We show that the chemical periodic group is geometric and that the fundamental constant FC is an intrinsic physical property of the atom, it is geometric, an invariant 3-D slice of spacetime that constitutes internal structure of the atom.

1. Introduction

Successful reproduction of values of absolute atomic mass, relative atomic mass and the fundamental constants, Obande (2016a), (2017) and Consiglio (2015), provide compelling evidences in support of the "wave-only" atom, Hobson (2013), Macken (2011). According to this concept the atom is exclusively e-m wave only with no particulate matter whatsoever. The concept has incredible implications, most importantly, it implies that physical properties of the isolated atom are essentially its simple harmonic motion SHM parameters hence, given the oscillation frequency of an element, its intrinsic physical properties can, in principle, be precisely evaluated, Obande (2015a), (2015b). When fully developed, the concept would facilitate unprecedented access to the exact details of the atom's internal structure and inner workings and open up a subject that has eluded physics from inception to date.

Notably, the concept identifies condensed matter with *wave-only essence*; among the ennormous implications, i) it relieves uncertainty and permits application of classical wave mechanics to the boson and the fermion fields; i.e., it affirms that the atom is absolutely deterministic and fully describable with classical Newtonian mechanics at the microscopic (quantum) and macroscopic (condensed matter) levels; some recent research findings are likely to open the long over-due channel of support for quantum determinism, Tan et al. (2017), Colangelo et al. (2017); ii) it facilitates quantification of any desired property of the atom with the unique advantage that the result presents the atom 'as-is' not 'as-might-be'; iii) it points to the all-important "Theory of Everything" identifying the theory with the simple classical equation of the atom's bosonic and fermionic energies, i.e., $h\vartheta = mc^2$; iv) it makes physical properties of the cosmic vacuum field readily accessible and presents the vacuum as, indeed, seat of the most interesting physics, Wheeler, (1986). In continuation of our investigation of the wave-only concept, we present here evidence showing that the fundamental physical constants are much more than fixed mathematical quantities.

2. Procedure

Details of the procedure are outlined in the first part of this report Obande (2017); briefly, equipped with accurate ϑ values, atomic mass retrieves with $m = h\vartheta/c^2$, Obande (2016a) and tensile properties obtain from the atom's SHM parameters through the established classical formalism, Obande (2015a), (2015b). Linear correlation of these parameters achieves with log-log plots; the parameters of interest, of course, include: oscillation frequency ϑ, atomic mass m, radius r, density ρ, angular speed ω, centripetal force F, elastic modulus ϵ, stress σ and strain rate τ. It turned out that the physical parameter seems to "respond" to its role as a dependent or independent variable and does this in a totally remarkable way strongly suggestive of geometric influence.

3. Results and Discussion

3.1 Geometrization of Electricity

The linear correlation exponents (k-values) of Tables 2 and 3 of Obande (2017), Part I, are fully accountable if we assume that the interaction occurs within a hybrid envelope comprising a sphere inscribed in a cube such that radius of the sphere coincides precisely with midpoint of each side of the cube. The parametric force field defines within this envelope, examination of the k-values suggests as follows: i) force fields of ϑ, m, r, ω and τ are radially

distributed within the sphere; ii) centripetal force field F is planar and orthogonal to the e-m flux's rotational axis, it defines within the cube; iii) field modulus ϵ is a spherical envelope, and iv) density ρ and stress σ force fields are cubically distributed. Given this gross picture, all seventy two couplings in the tables are accountable.

Since it is a dynamic envelope, the force field is a vector quantity, characteristic scalars such as rest mass m and spatial dimension r result from specific vector sums/products of the interaction. Furthermore, definition of the interacting profiles within a specified geometric space implies that *electricity and geometry are inseparably intertwined* in matter, we coin the term "electro-geometrics" (EGM) to describe the effect.

3.2 The Linear Correlation Exponent k

The k-values cover the range +4…+1, 0, -1…-4 including ratios of the integers; they are reminiscent of combinations of the quantum numbers n = 1 to 4; m_ℓ = +ℓ, …+1, 0, -1, … -ℓ, and m_s = ±½, they also correspond with the chemical periodic groups 1 to 4. The values reveal remarkable symmetries, e.g., ϑr = rϑ; $\vartheta/F^{0.5} = 1.7 \times 10^9$ but $F/\vartheta^2 = 3.5 \times 10^{-19}$; rτ =0.31842 but τr = 3.1482, et cetera. Expressibility as coefficients of π strongly suggest geometric origin of these values and identifies k with spatial symmetry groups SGs. The sphere inscribed cube accommodates a total of four SGs only, each refers to a quadrant or a combination. Thus, k/SG = ±1 denotes a parametric interaction between two force field envelopes located or distributed in one quadrant; the fields are projected from mutually opposite ± diagonals of the cube to effect coupling. The ± notation signifies electrically mated pairs, one direction is a geometrical mirror image of the other; conventionally, they are associated with opposite electric charges. SG/k = ±2 implies angular, usually orthogonal, distribution of the parametric force field; k/SG = ±3 is trigonal distribution, while SG/k = ±4 refers to full (maximum) distribution of the force field in all four quadrants, it results in conventional filled shell structure which manifests rings in x-ray diffraction. The position is illustrated in Table 1; it depicts the natural periodicity folded in half vertically, the seamless correspondence between k, p, v, e- and n is made clearly evident. Table 2 is an expanded version of Table 1, it illustrates the natural periodicity NP of the chemical elements; a detailed comparison of the NP and conventional periodicity CP cannot be accommodated here, an independent report is in view. Briefly, i) both periodicities recognize the existence of a group zero to which is assigned the noble gases; notably, SG = 0 indicates that the element lacks the electro-geometric potential for bonding, i.e., its defining parametric force fields completely lack vector orientation and spatial symmetry; ii) the NP includes a central group zero to reflect electrical neutrality of the centrally symmetric SG ±4; iii) the mirror reflectivity of elements in conventional A and B blocks is not normally evident for which reason the conventional arrangement produces eight instead of the nine (i.e.,+4 -0-−4) chemical groups.

Table 1. Periodic group, valence, charge and correlation exponent – symmetry groups

Quantum no./periodic group (n/p)	-	1	2	3	4	Central
k-value/Symmetry group (SG)	0	±1	±2	±3	±4	+4 0 -4
Valence/charge (v/e-)	0	±1	±2	±3	±4	±9
Force field (flux) vector distrib.	0	A	b	c	d	E

Key (2-D): a = linear; b = planar; c = trigonal/spherical; d = tetragonal/cubic; e = perfectly cubic.

Table 2. Outline of the full spread of the natural periodicity of the chemical elements

Chemical group	0	1	2	3	4	5	6	7	8	9	0
Mirror reflect./charge	0	+1	+2	+3	+4	0	-4	-3	-2	-1	0
Color code/e-m spec.	0	1R	2R	3R	4R	0(R +B)	4B	3B	2B	1B	0

Notably, the NP consists of *four groups only* as shown in Table 1, these are duplicated to reflect left and right handedness of the vector orientation equivalent to positive (+) and negative (-) electric charges. The two contrary directions are centered by their couple to give the central neutral group R+B where R and B stand respectively for red and blue ends of the e-m spectrum. We summarise the preceding positions:

i) the exponent k of linear correlation of e-m field parameters that define the isolated atom relates to the chemical periodic group, it also identifies with spatial symmetry group SG; in effect k traces chemical periodicity to geometric symmetry and identifies valence (*combining power*) with electro-geometric potential;

ii) the eight-group periodic arrangement of the chemical elements is essentially a four-group arrangement (i.e., ±1 to ±4) wherein the mirror reflection (±) pair denoting opposite vector orientations is each accorded independent rather than complementary status;
iii) parameter p's SG identifies if p couples as a variant; its exponent varies with the invariant according to its group, thus:
a) SG = ±1 denotes linear (i.e., diametrical) 2-D vector distribution/orientation with clear distinction between vertical, lateral or diagonal direction, we assign symmetry group I;
b) SG = ±2 generally denotes any 2-D planar vector distribution but, with specific reference to centripetal force F, SG II refers to orthogonal distribution of the force field vector to the flux envelope's rotational axis;
c) SG = ±3 denotes 2-D isosceles triangular vector distribution, symmetry group III;
d) SG = ±4 denotes 2-D tetragonal (cubic) vector distribution, symmetry group IV and,
e) SG = $\pm n_1/n_2$, where integer $n_2 \neq 0$ (i.e., fraction), reflects relative occupancy of the coupled space.

The fraction n_1/n_2 explains as follows: only two possibilities exist in a binary coupling, a parameter is either an invariant or a variant. The invariant, of course, has unit exponent, therefore, value of the variant's exponent must be such as to preserve, in the geometry of the coupled space, the higher of the two symmetries or its closest analogue. If parameter x_1 of a lower symmetry k_1 couples with x_2 of a higher symmetry k_2, we get the quantitative expression

$$x_1 = ax_2^{(k_1/k_2)},\ k_1 < k_2 \tag{1}$$

it is as though the higher symmetry group k_2 *divides into* appropriate number of units each of which couples with a unit of the lower; in other words, it reflects fractional occupancy of the higher by the lower symmetry force field. If, however, the higher profile force field x_2 is the invariant then we get

$$x_2 = bx_1^{(k_2/k_1)} \tag{2}$$

and this is as though the lower symmetry variant *multiples onto* the capacity of the higher invariant (observe, of course, that a and b in (1) and (2) correspond to the FCs). For instance, r and ϵ couple to give $r\epsilon^{0.333}$and ϵr^3. Pictorially, differences between the two envelopes $r\epsilon^{0.333}$ and ϵr^3 would appear not in the angular distribution but possibly in the shape and/or size of the coupled flux envelope. The chemical bonding analogy of this example would read $r\epsilon_{0.333}$ and ϵr_3, as in, say, $ClP_{0.333}$ and PCl_3; chemical fractional species such as $P_{0.333}$ must be quite rare if they existed but they are a common geometric outcome of field parametric interaction. Given the above background, we examine the geometric context of the fundamental constants FCs.

3.3 Fundamental Constants as 3-D Spacetime Slices

Normally, the FC conceives in the numerical context, indeed, the context informs ceaseless attempts to define it with mathematical expressions, Schonfeld & Wilde (2012), Kirakosyan (2015), Consiglio (2016); here, we present evidence of geometric implication. The investigation reveals that space is magnetic, a "magnetism-space (m-s)" envelope coexists with and is orthogonal to the mass-energy (m-e) envelope. In other words, space equates to magnetism exactly the same way mass equates to energy. We are yet to investigate the subject but there is reason to believe that geometry relates to magnetic character of quantum space much the same way as it relates to electric character of quantum mass; an inverse magnetic flux/spatial extent relationship may not be ruled out. Three-dimensional space is a *coupled* geometric envelope within which an electrical couple manifests matter, the two: mass–electric flux and space-magnetic flux are mutually orthogonal. An image of the relative orthogonal positioning of the two envelopes credited to Danny Farro Science Consortium and Max Planck Institute for Extraterrestial Physics posted by Newatlas.com (2016) provides an exceptional cosmic scale illustration of the two envelopes. Check the public domain, it shows a horrizontal elliptic magnetism-space (m-s) envelope enclosing a similarly vertical elliptic mass-energy (m-e) envelope. Notably, the image is the primitive structure of (our) reality, it applies across the board from the atom to the cosmos and manifests wave-particle duality. On atomic scale, the m-s envelope manifests *wave* and the m-e envelope manifests *particle,* the duo are practically inseparable as one does not exist (is not defined) without the other; an attempt at their separation should produce all manner of illusions. On cosmic scale, the m-s envelope manifests the vacuun field and m-e envelopes manifest geophysical structures. The image is the ultimate mega structure of the universal wave-particle (f/b) pair, it is the collection of all accessible condensed matter astrophysical structures in their collective vacuum envelope; here, we examine the atomic scale picture.

Field parametric coupling is driven by two potentials: i) electrical balance and ii) geometric symmetry. On the one hand, geometric symmetry derives from the fact that the sphere and the cube are nature's most economic dimensional stable structures; all natural couplings effect with the goal to attain either of the two forms, their hybrid or closest approximation within a given set of constraints. On the other hand, electrical balance, of course,

achieves through union of two opposite charges, in practice, it amounts to union of two opposed angular momentum vector fields to attain a (neutral) scalar. Each vector field is an electro-geometric conjugate of the other, comparable to bolt and nut; in coupling, the two halves intertwine to exhaust their mutual turning potentials or moments. Given the preceding, we outline the geometry of the FCs as codified in the k-values.

i. Coupling of a group I independent variable with a group I variant and vice-versa results in parametric and angular momentum vector orientation reversibility, i.e., the interaction is commutative, e.g., $\vartheta/m = m/\vartheta$; $rm = mr$; $r\tau = \tau r$; $r\omega = \omega r$; in this case, either way the interaction produces the same profile or FC. If, however, the interaction is non-commutative, two profiles, corresponding to two different FCs, result, often these are inverse functions with observational divergences, e.g., in Table 2 of Part 1 we have, $\vartheta/\omega = 1/2\pi$ and $\omega/\vartheta = 2\pi$, either way the interaction gives a linear spatial dimension but, $\vartheta/\tau = 5.89 \times 10^{-14}$ m/s and $\tau/\vartheta = 1.7 \times 10^{13}$, i.e., the former yields radiation ($\vartheta/\tau = 0.504\pi c^o$) but the inverse suggests a value (2.417×10^{14}) presently mistaken for energy-frequency relationship.
ii. Coupling of a group I invariant with variants of other groups produces an exponent on the variant which is a fraction of the variant's group, see eq. (1); e.g., ϑ couples with: F to give $\vartheta/F^{0.5}$; ϵ to give $\vartheta/\epsilon^{0.333}$ and ρ to give $\vartheta/\rho^{0.25}$.
iii. Coupling of a group II, III or IV invariant with variables of other groups produces an exponent on the variant which is a ratio of the invariant's to the variant's group, see eq. (2); e.g., 1) F couples with: ϑ to give F/ϑ^2; ϵ to give $F/\epsilon^{2/3}$, and σ to give $F/\sigma^{2/4}$; 2) ϵ couples with: ϑ to give ϵ/ϑ^3; F to give $\epsilon/F^{3/2}$, and σ to give $\epsilon/\sigma^{3/4}$; 3) ρ couples with: ϑ to give ρ/ϑ^4; F to give ρ/F^2; ϵ to give $\rho/\epsilon^{4/3}$, and σ to give ρ/σ. The last example, ρ/σ, reveals that parameters of same symmetry group couple linearly, i.e., the corresponding vector orientations map one-on-one; a good example in chemistry is found with elements of group IVA, these belong to the centrally symmetric (R+B) SG IV of the natural periodicity, they self combine with one another to give some of the strongest bonds e.g., diamond C_n and carborundun SiC.
iv. Coupling with field radius r is always hyperbolic thus, we have $rF^{0.5}$, Fr^2; $r\epsilon^{0.33}$, ϵr^3; $r\rho^{0.25}$, ρr^4; the parameters may exchange positions with no effect on orientation of the resultant envelope, it results in orthogonal distribution of the envelopes and produces the most perfect hyperbolic functions with foci located precisely at the origin and the curves as axes (they would make ideal college teaching materials).

The permittivity constant ε and electron Compton wavelength λ_c were cited as examples of effect of geometry on identity of the FC in a previous article, Obande (2015b); we review the preceding with same examples plus some additions: i) $= \epsilon_p/\sigma_p^{0.75} = 7.94\,x\,10^{-12}\ \ F\,m^{-1}$; ii) $\lambda_c = r_p\sigma_p^{0.25} = 2.51\,x\,10^{-12}\,m$; iii) $1.83\pi/r_{e(p)} = \sigma_p/\epsilon_p^{1.333} = 6.31\,x\,10^{14}\,m^{-1}$, and iv) $\Gamma_p/\pi = \sigma_p r_p^4 = 3.867\,x\,10^{-47}$ kg m^3 (rad/s)^2. These are, of course, couplings of stress field σ with force fields of ϵ and r, (Table 2 of Part 1); they interpret as follows:

a. In i), the invariant ϵ couples with the variant σ; pictorially, the higher profile cubic σ field imposes on the lower profile spherical ϵ field a trigonal configuration and 'multiplies' i.e., fills it up, to form a 2-D triangular planar distribution of force fields. We think it yields a regular hexagon in 3-D. Quantitatively, it presents σ with exponent ¾, meaning that the flux envelope of the couple $\epsilon \cap \sigma$ occupies $270^o/360^o$ of its electro-geometrics potential $\epsilon \cup \sigma$; the arrangement gives observational permittivity constant ε. In plain words, the analysis says that if you were to solidify ε by some means you would get a trigonal prismatic or hexagonal spacetime envelope!
b. In ii), the invariant linear r field couples with a variant cubic σ field, σ imposes on the radial field tetragonal distribution into 4 envelopes, each locates at the end of cubic diagonals. In 2-D it gives four field envelopes distributed at the apices of a square plane quite reminiscent of $d_{xy}\ or\ d_{x^2-y^2}$ orbital; in 3-D it gives a regular octagon. Now, dimensional analysis reveals closely similar units for ε and λ_c, Obande (2015b), (2017) ; we have: $\varepsilon/(m_p^{0.25}\,\omega_p^{0.5}\,r_p^{0.75}\,\pi^{0.75})$ and $\lambda_c/(m_p^{0.25}\,\omega_p^{0.5}\,r_p^{0.75}\,\pi^{-0.5})$, i.e., ε and λ_c differ only by an orientation of $\pi^{0.75}$ which yields ε and $\pi^{-0.5}$ that manifests λ_c; the former gives rise to electrical effects and the latter to spatial dimension. It underscores the crucial role electro-geometry plays in defining the FC, chemical reactivity and, indeed, geometry of all natural forms.
c. In iii), a variant lower profile, spherical ϵ, multiplies onto the higher profile, cubic σ, to give the exponent $k_2/k_1 = 4/3$, the 2-D geometry comprises a sphere inscribed in an isosceles triangle, in 3-D, it gives a triangular prism, or a body-centered polygon or some other exotic form having a central structure symmetrically surrounded by a polygonal/circular force field envelopes reminiscent of d_{z^2} orbital.
d. In iv), a variant lower profile r multiplies onto the higher σ to give a 1 x 4 square plane similar to b) above.

Observe that $r_p\sigma_p^{0.25}$ manifests length (λ_c) but the converse $\sigma_p r_p^4$ manifests torque (Γ), the difference is in the nature of the force field that centers the coupled envelope and that at the ends of the diametric or diagonal arms. In $r\sigma^{0.25}$ the σ field packets locate at the diagonal ends, each with its vector oriented in opposite direction to its neighbor

(swastika like), the moments cancel out. Similarly, the radial orientations of the r fields at the centre also cancel out; it results in a net scalar λ_c. In σr^4, however, the two parameters exchange positions; an *undivided* σ field is now at the center and it imparts a permanent intrinsic turning moment or torque on the envelope. *This torque (stress) field centering the atom is unknown to physics*, Cross (2015), its values are $\Gamma_w = 9.80272 \times 10^{-25}$ and $\Gamma_p = 1.21486 \times 10^{-46}$ kg m^3 (rad/s)^2 for the boson (wave) and fermion (particle) respectively, it gives *intrinsic spin* to all e-m envelopes, Obande (2017), see notation no.23 in the appendix.

3.4 Electro-Geometric Force Fields Drive Intra- and Inter-Atomic Bonding

Tables 1 and 2 show the correspondences between the chemical periodic group p, valence v, charge e, the first four principal quantum numbers n = 1 to 4, and the correlation coefficient k. In Section 3.2(iii) we show that k refers to spatial symmetry and identifies p, v, e and n with geometric quanta. Since all chemical bonds achieve through interaction of the force fields, they have electrical and geometric potentials as common driving forces; the detail would require illustrative sketches and explanatory notes far exceeding the limitations of a journal article. The evidence is unambiguous that intra-atomic parametric coupling PC and inter-atomic bonding, i.e., chemical reaction CR, are both driven by same potentials or force fields; indeed this is true across the board from atomic (chemical) to cosmic (physical) couplings. In its simplest description, CR is driven by the need to fill a principal shell, i.e., attain an octet of bonding electrons; this would seem to refer only to an electrical driving force but, EGM reveals strong geometric implication. Electro-geometrics balance of reactants leads to a geometric form which, ideally, would be a sphere, a cube or a perfect mixture (hybrid) of both. Thus, given a set of conditions, CR may lead to a crystalline solid as in NaCl wherein the reactants are perfectly matched electro-geometrically. Exactly the same situation holds for intra-atomic force fields interaction to produce the fundamental constant FC, it could lead to perfect or imperfect crystalline form; in other words the FCs come in different geometric forms much like condensed matter crystals. Sadly, this would seem pretty speculative until physics developed a technique that could reveal the FC envelope. In order to prove a correspondence between PC and CR, it is necessary to show, at least, that the k-values map one-on-one to chemical periodic groups, i.e., quantitatively, k = SG or, chemical periodicity corresponds to spatial symmetry; for now, we attempt to achieve this through qualitative comparison of the SGs with conventional atomic orbitals.

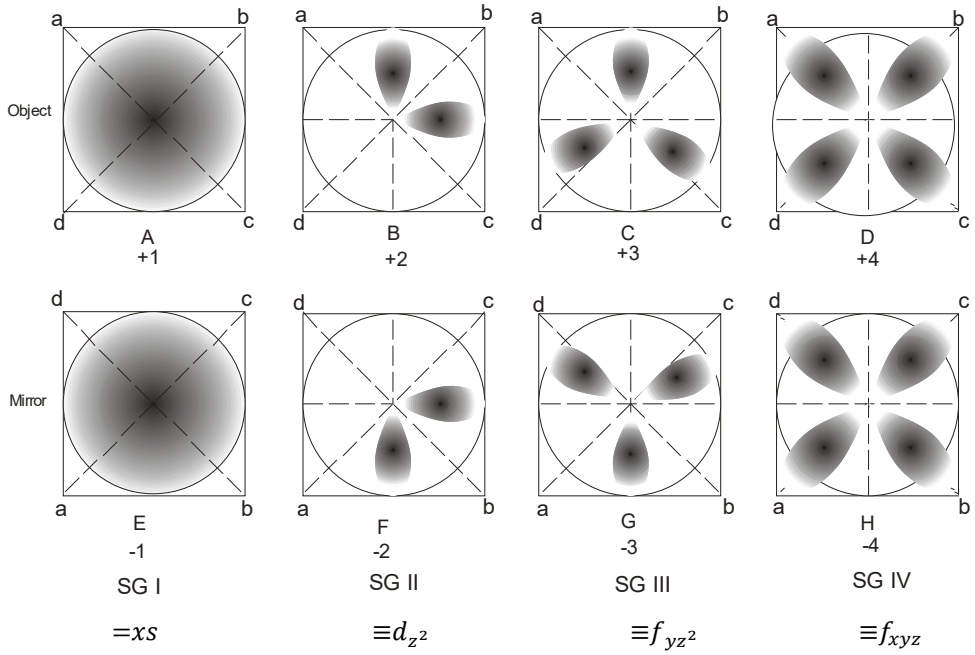

Figure 1. The four symmetry groups (SGs) of Nature (Color online)

A. Figure 1

Two-dimensional sketches of the electro-geometrics symmetry groups are presented in Figs. 1 A to H; they are paired mirror images, i.e., the pairs: Fig. 1A & 1E, 1B & 1F, 1C & 1G and 1D & 1H are electrical mirror images. In conventional periodicity the objects, Figs. 1A to 1D, and the mirror images, 1E to 1H, would belong to the "A" and "B" periodic groups respectively; we explained above that natural periodicity denotes the two groups with the

letters "R" and "B" respectively implying that the chemical elements divide into the red and blue halves of the e-m spectrum, this has been demonstrated, see Table 1, Obande (2016b); the subject is profound as the division cuts across the entirety of reality from the microcosm to the macrocosm, it informs universality of discrete conformal invariance. We explain Fig. 1 in the context of conventional electron configuration; the comparison is based on Wikipedia's online presentation "Atomic orbital". Observe that the sketches are 2-D outlines of the sphere inscribed cube.

i) Figures 1A & 1E: Symmetry group SG I (n = x, ℓ = x-1, m = 0; ≡ xs-orbital) x = 1 to 9.

Based on the criterion for determining the parameter's SG, section 3.2 (iii), we identify field ϑ, m, r, ω and τ with SG I, i.e., k = ±1= SG I; the 2-D (plan) view is a perfect circle, and based on existing knowledge of flux density distribution, it is shaded with increasing intensity towards the center, however, the epicenter is a microscopic hole. Notably, SG I corresponds perfectly to conventional s-orbital, the object and its mirror image are identical, they couple to give the perfect sphere or cube; the best natural examples may be found in the shape of isolated masses such as found in mitotic cell rounding stage, Chee, (2017) and in celestial bodies like stars and their satellites. However, other force fields, notably centripetal force field, do contribute to the geometry of celestial bodies. In condensed matter SG I also gives some of the most perfect cubes, e.g., NaCl.

ii) *Figures 1B & 1F: symmetry group SG II* (n = 3, ℓ = 2, m = 0, ≡ $d_{z^2}orbital$)

Centripetal force is the only field in SG II. The object's plan view is L-shaped, if combined with clockwise lateral π-rotation of its mirror image, it reproduces the d_{z^2} orbital; the profile is a perfect hyperbola, i.e., centripetal force field is planar and orthogonal to spin axis of the flux, e.g. Saturn's rings. If rotated 2π about two perpendicular axes the hyperbola, of course, gives the perfect sphere of the 1s orbital, it manifests gravitation (see Part I). In solids, SG II gives cubic forms as in $CaCl_2$. It may be noted that all correlations with r are also hyperbolic but often these are planar not cubic.

iii) *Figures 1C & 1G: symmetry group SG III* ($n = 4, \ell = 3, m = \pm 1, \equiv f_{yz^2}\ orbital$)

Field modulus alone belongs to this group. We assign k = ±3 to isosceles triangle based on the correlation exponent when ϵ couples as a variant to a lower SG, e.g., $r\epsilon^{0.333}$, $\vartheta/\epsilon^{0.333}$ and $F/\epsilon^{0.667}$ implying that SG III's 2-D view is a trigonal even distribution of the flux modulus, if combined with its mirror image, it approximates the f_{yz^2} orbital. In 3-D it gives rise notably to hexagonal forms, e.g., $AlCl_3$ (Al_2Cl_6) but possibility for other polygons cannot be ruled out.

iv) *Figure 1D & 1H: symmetry group SG IV* ($n = 4, \ell = 3, m = \pm 2, \equiv f_{xyz}\ orbital$)

Flux density ρ and stress field σ are the only members of SG IV. The 2-D view is four flux envelopes distributed at diagonal apices of the cube, except for longitudinal inversion, the object and its mirror image are identical. It corresponds to group IV of the natural periodicity, i.e., R+B (Table 2), and includes the visible elements H, C, Si, Co, Rh, Lu and Am (we are unable to comment here on assignment of H to group IV in the natural periodicity). In 3-D, the object combines with its mirror image to give the strongest bonds, examples of diamond and carborundun have already been cited. SG IV elements combine with lower groups to give regular polygons, e.g., SiO, cubic; SiO_2 (quartz) hexagonal, while SiO_2 (tridymite) is rhombic.

B. Figure 2

In 1909 the French polymath, M. Gustav Le Bon, published a book detailing the results of some highly innovative studies on the atom, Google digitized F. Legge's translation of the 3rd edition of the copy with the University of California, the digitized copy is available online, Le Bon (1909). In what follows we attempt to illustrate the remarkable similarities between the symmetry groups in Fig. 1 and some results of purposeful manipulation of radioactive decay rays (RDR). Le Bon's choice to utilize RDR to map what we term "electro-geometrics" EGM profiles or 3-D spacetime slices cannot be bettered; the rays are incomparably suitable for the purpose because they simultaneously illustrate mass-energy (m-e) and magnetism-space (m-s) envelopes. They consist of microcosmic fermionic matter, mostly α and β particles, each cocooned within its bosonic casing like an embryo in its amniotic sac, c.f the Newatlas.com (2016) image. The high ionizing power facilitates the images in Figs. 2 A, B and C; it is clear that electric discharge or magnetic lines of force would not give the same profiles; we discuss them in terms of electro-geometrics.

i) Figure 2A

It is a radial distribution of radiation characteristic of 2-D profile of SG I; indeed, it achieves through reversal of the process that manifests mass; we have in this case a situation in which the centrifugal force of rotation exceeds the gravitational centripetal force, m-e/m-s packets are thrown off in radioactivity, Obande (2015a). Ionized particles (air, water vapor and dust particles) in the vicinity of the radioactive body facilitate demarcation of what

appears to be individual rays but in reality each jet could comprise, thousands, millions, or even billions of individual charged particles each enclosed in its bosonic sac; were it otherwise, mutual repulsion of the charged particles would have created a foggy smoke instead of the well defined boundaries. Notably, Figure 2A provides visual evidence of material manifestation of symmetry group I, corresponding to the 1s orbital.

ii) Figure 2B

The figure has no equivalent in the EGM symmetry group but it does, to an extent, mimic n = 2, ℓ = 1, m = ±1, p_x orbital. We present Figs. 2B and 2C to illustrate the similarity between spacetime envelopes and magnetic fields; if forced together spacetime envelopes repel exactly as like magnetic poles, the effect is instructive. If forced to interpenetrate, spacetime envelopes may compress but would not curve, because the emanations are projectiles (atomic bullets) not magnetic currents; they do not flow (curve) back to the opposite pole. On the one hand, Fig. 2B illustrates the natural process of onset of cell division which normally precedes mitosis and leads to the cell rounding stage of Fig. 2F; on the hand, it also illustrates the principle of magnetic levitation and demonstrates that

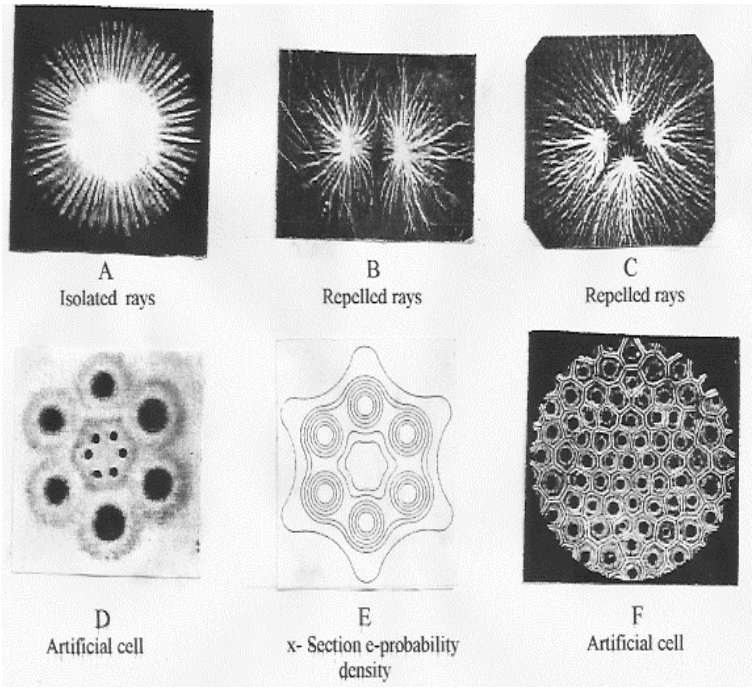

Figure 2. A to C - radioactivity radiations; D and F molecular artificial cells and E cross-section of electron probability density of benzene (*credit: A,B,C,D and F Google and University of California*) (Color online)

3-D spacetime blocks (i.e., the FCs!) are mutually as non-interpenetrable as solid condensed matter, in other words, they are as "hard" as visible material objects.

iii) Figure 2C

In a way, the figure resembles symmetry group IV, it is an artifice produced by the experimental set up; however, it does provide material analogue of the n = 3, ℓ = 2, m = ±2 *dxy,* or $d_{x^2-y^2}$ orbital and clearly demonstrates differences/similarities between magnetic flux and spacetime envelope.

iv) Figure 2D & 2E

The two figures are identical, they both differentiate between H and C shell contours yet the technologies that produced them may be worlds apart; Fig. 2D uses chemical reaction while Fig. 2E is a computer simulation, both show the contours of constant electron probability density of benzene ring; they illustrate one of the polygonal structures common to couplings within symmetry group IV. In passing, we consider Figs. 2D and 2F among the most innovative of Le Bon's experiments, much stands to be gained in repeating these experiments; obtaining Figs. 2D and 2F with use of only chemical reaction and electrical circuitry would have far reaching laboratory implications particularly for developing countries.

v) Figure 2F

The figure perfectly reproduces mitotic cell rounding stage, see the video post by Chee (2017). In our context, Fig. 2F represents a composite of *all symmetry groups*, observe the close similarity with zones or poles of Kikuchi line, Wikipedia.org. Notably, Fig. 2 draws correspondences between the processes that motivate observational effects in physics, chemistry, geology and biology, showing that force fields having identical symmetry classes determine all natural geometric forms. It reminds of the geometric formulation of QFT – the amplituhedron regarding which Wolchover (2013) says: 'They [Arkani-Hamed and J. Trnka] have also found a "master amplituhedron" with infinite number of facets, analogous to a circle in 2-D, which has an infinite number of sides. Its volume, in theory, represents the total amplitude of *all physical processes*' (emphasis ours).

C. Basis of cosmic conformal invariance

From the 70's to date Oldershaw has been making some very valuable contributions to develop his "Self-Similar Cosmological Model SSCM", Oldershaw (1989), (2007), (2008), see also Wikiversity, Mazilu et al. (2014), Berry et al. (2016), Chen et al. (2017), Fedosin (2017). In one of his contributions, Oldershaw (2008), compares some atomic with planetary nebula morphologies and reminds in Oldershaw (2014) that Bohr's celebrated model of the H atom "was based on direct analogy between atoms and the Solar System. … the idea of stellar/atomic analogies has been rehabilitated …". Notably, none of the atomic orbitals cited in the comparisons exceeds the principal quantum number n = 4; given the present results, it would be most unlikely to find nature posting a shape off the natural symmetry groups SG IV. We note that the cited nebula morphologies belong to stars in their death throes, this is in line with the concept that informs Fig. 1; the figure illustrates sets of two electrical atomic halves each of which combines to produce the 'neutral" couple. Each half depicts atomic (*charged*) configuration, it couples to give the shape of the visible (*neutral*) body; therefore, similarity of the SG with a stellar body is an indication that the body has been reduced to its electrical (charged) half on account of age; the subject is a little more involved. Oldershaw (2014) observes as follows: 'According to this hypothesis and empirically-derived scale transformation equations, *excited atoms* in neutral or partially *ionized states* are analogous to main sequence stars … If the self-similarity between atoms and main sequence stars is valid, then the stars would have shapes that are similar to those of atoms. … Unfortunately, nearly all stars are "point" sources and cannot be resolved by existing telescopes. Stellar systems, like planetary nebulae, that *eject their outer layers* offer an indication of what those shapes might be, …'. The emphases are ours, they are intended to highlight the point that condensed matter's intrinsic SG is observable only for the "denuded", i.e., decoupled electrical (charged) halves. In other words, celestial bodies disappear into space by reduction to the starting "atomic" halves; 'excited atoms', 'ionized states' and 'planetary nebulae that eject their outer layers' are denuded forms. All forms in a state of good health, such as our sun and several other stars, would not manifest their intrinsic SGs, it is unlikely a question of telescope's resolution power, until, of course, physics develops a technique able to differentiate between the two [±] electrical halves of the couple.

4. Electron or wave configuration?

The more one probes the atom with the classical mass formula $h\vartheta = mc^2$ the more evident the fact that, without the element specific ϑ value, it would be herculean, or indeed, absolutely infeasible, even with a global network of the most powerful computers, to construct an analytical framework that explicitly describes the atom. Quantum mechanics is a phenomenal achievement of the human intellect and, despite its shroud of mystery, would remain an indispensable analytical tool, but the underlying physics is unavoidably faulty in several respects. Due to its inherent deficiencies, physics continues to accommodate substantial inconsistencies, contradictions and misconceptions; for instance, it is wrongly held that: i) the atom has a solid nucleus surrounded by quantized electron (probability?) wave functions; experimental results such as the rings of Fig. 2E (when measured!) help to promote this notion; ii) H is first element of the chemical periodicity, hence it assigns with unit charge, valence and electron configuration $1s^1$; iii) e^- is a point charge "subatomic" particle yet imbued with substantial relative atomic mass, some 1/1836 mass of H^+; iv) a massless photon engages the massive electron in an energetically balanced pair-production process $\gamma + \gamma \leftrightarrow e^+ + e^-$; iv) there exists a Planck space with a radius some 10^{20} value of the classical *point* charge e^-; vi) electric charge is some ponderable substance smearable over an energy packet or localized within the packet and devoid of geometric expression, and vii) the chemical periodicity expresses monotonous (linear) mass incremental and division into two ("A" and "B") blocks reflects chemical reality devoid of a physical significance. With these and many more handicaps the luminaries developed quantum physics and the tradition lives on. This report is already lengthier and more diversified than anticipated; we are, therefore, unable to address each handicap individually, more so that some have already been addressed in presentation of the subjects of this two-part report and in our previous reports; we, therefore, submit as follows:

i) There is ample evidence in support of the "wave (e-m field) only" atom, Macken (2011), Obande (2015a), (2016a), (2016b), (2017), Consiglio (2015).
ii) Two periods of (as yet) inaccessible elements precede hydrogen thus rendering the $1s^1$ and most other orbital assignments fortuitous, Obande (2016a) despite their apparently awesome analytical power in describing electron configuration.
iii) Nature's four symmetry groups emerge from existing electron configuration if the s, p, d, f subshells identified with the K, L, M, N main shells respectively; however, in order to reflect reality, the existing configuration would need some slight modification. Accommodation of more than one coupled mirror image [↑↓] in $\ell = 1$; $\ell = 2$, and $\ell = 3$ subshells contradicts nature. Nature has no subshells, each symmetry group accommodates only one set of the coupled force fields [↑↓]; i.e., nature accommodates only a couple in one chamber.
iv) The shell structure informs the result of Lord Rutherford's 1911 α-particle scattering experiment unavoidably misinterpreted (to date) to contradict J. J. Thomson's model of the atom. The complete octet constituting a main shell is a "brick wall" normally impenetrable except in the unusual energy regime, it continues to create the illusion of a "solid" nucleus; but x-ray diffraction reveals, even for H, only the rings of complete shells with no material object at the atom's core, see, for instance, Fig 2E and the Newatlas.com's image.
v) Wave frequency increases logarithmically to constitute a shell, e.g., we have 1.0, 2.048×10^3 and 6.44245×10^9 Hz for the filled and unfilled shells in e, H, and Am respectively, meaning there are no less than 2×10^3 electrons in bosonic H atom; 6×10^9 electrons and 3×10^6 H atoms respectively in bosonic and fermionic Am atom. The existing scheme perfectly accounts for atomic number but definitely not the billions of electrons, assigning each electron an orbital using the existing scheme would require a bit of trick; however, nature simply multiplies electron's unit frequency logarithmically and couples the classical (deterministic) wave functions electrically in only four symmetry groups.

It follows from the results that: i) electron configuration as presently constituted grossly overestimates the number of natural symmetry groups that define atoms of the chemical elements; ii) the fundamental constants arise from couplings of physical properties of the atom; iii) the constants define in spatial symmetry groups, i.e., they are geometric (3-D slices of spacetime) and, therefore, constitute the atom's internal structure.

Although it is quite obvious, it might still be relevant to mention that only during literature search for compilation of the draft did we become aware of the significant development in the subject of "Quantum Geometrodynamics" QGD, Wheeler (1957), Misner and Wheeler (1957), Anderson (2004), Pitkanen (2016), Cabral & Lobo (2017). Our approach has been developed quite independent of the QGD; indeed our tag "electro-geometrics" intends shorthand for "electricity is geometrical", any bearing of the EGM concept to QGD is incidental.

5. Conclusion

After evaluating ϑ in $m = h\vartheta/c^2$, we successfully tested the results by simulating relative atomic mass of each element with the absolute atomic mass value, Obande (2013). It became obvious that the atom must be a wave-only electromagnetic resonator with characteristic SHM parameters, values of which corroborated observational data, Obande (2015a); results of atomic mass investigation sealed the case for the wave-only atom, Obande (2016a). We proceeded to investigate possibility of inter-relationships between the physical parameters and found that they correlate linearly $y = ax^k$ where the coefficient reproduces established value of the fundamental constant, Obande (2015b), (2017), it led to an investigation of the exponent k, the result of which is presented herein. This series of investigations is informed by sheer curiosity having been concerned, since college, for non-availability nor, indeed, mention of absolute atomic mass in the literature. We had no idea where the series would lead, the rule was consistency of the analytical procedure and inferences based on established scientific knowledge. Inferences drawn in Part I follow from use of clearly defined classical analytical tools and seem less debatable; however, the outcome of the present investigation, although derives from classical analysis, is so radical as to compel more exhaustive examination of the subject. Inferences that refer to spherical co-ordinates have been drawn freely based on use of Cartesian co-ordinates, this would appear unsatisfactory, more importantly, the entire analytical procedure would benefit from professional application of topology; however, given Wolchover's (2013) report, we would be surprised if consistent application of higher analytical tools contradicted our inferences. We submit the foregoing for critical examination.

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