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Vacuum Evolution of Atomic and Molecular Matter

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ABSTRACT

With the support of existing literature and observational evidences, it is postulated that contribution of stellar nucleosynthesis to particulate matter content of the universe might be marginal, if any. The action $m = hv/c^2$ precipitates atoms of the chemical elements from the vacuum field in our visible universe. In this action, accuracy of an element's atomic mass value is achieved by simply coupling its intrinsic waveform with Planck constant and freezing the product with the action of Avogadro constant $N_A = 1.0172(c_o/c^o)^2$. Furthermore, for an elemental quantum wavepacket, radius r, the stress field, $\tau = \Delta r/r$, due to 90^o angular oscillation of the e-m field also effects precipitation of molecular matter from the vacuum. Existing positions on matter evolution are discussed in terms of the original postulates of Burbidge and Burbidge, Fowler and Hoyle (B^2FH), including those of Noel and Kozyrev. The author's position aligns with those of Noel and Kozyrev that an increase in pressure would favor nucleosynthesis far more than an increase in temperature as a result of the well-known tendency of the latter to disrupt order. Moreover, as has been shown previously, atomic mass value is particularly specific; accuracies of one part in a billion are quite common, an action in 0^oKs deep space would stand much better chance of achieving the stringent degree of reproducibility nature imposes on atomic mass values.

KEYWORDS: Atomic mass value specificity; Avogadro constant; Chemical element's waveform; Vacuum Field nucleosynthesis; Molar mass precipitation.

1. INTRODUCTION

Emerging postulates would, if proven, challenge established concepts of origin of the chemical elements. Two theories and a dissenting voice each claims correct understanding of the way nature fabricates the chemical elements: "Stellar Nucleosynthesis" and the "Heartfire Model", while the dissenting voice is that of the Russian astronomer/astrophysicist, Nicholai Kozyrev who argues rather strongly against stellar nucleosynthesis. Here, we take a brief look at the existing positions to argue in support of vacuum nucleosynthesis.

1.1 Stellar Nucleosynthesis

Current standard view holds that hydrogen H and helium He were originally produced in the 'Big Bang' and all other elements came later through sundry mechanisms in the cores of stars. Promoters of this view would include renowned scientists like A. S, Eddington,[1] H. A. Bethe,[2] F. Hoyle[3,\4] and E. M. & G. R. Burbidge et al..[5] Hans Bethe's detailed description of stellar energy generation by burning the elements would seem to have influenced in no small measure the concept of stellar nucleosynthesis; his theory certainly provided strong backing to subsequent weaponization of nuclear energy, it definitely served as clear proof of concept. We believe that the idea of energy production from element burning certainly informed subsequent establishment of stellar nucleosynthesis. Notably, most of the papers proposing thermonuclear reactions at the core of stars were published in the 1950s and at some point in time, Burbidge et al.'s paper went on record as the most cited astrophysics paper of all time. Such is the confidence vested on the theory that some were emboldened to propose an 'evidence' for its validity, Wellenstein.[6]

1.2 Sources of Stellar Energy

The title is the 1947 doctoral thesis of Nikolai A. Kozyrev,[7] renowned Russian astronomer, astrophysicist and theoretical physicist, Briefly, Kozyrev faults stellar nucleosynthesis but does not provide an explicit alternative theory; he maintains that the sun and other stars generate their energy by a totally unknown

way. According to his biographer: "With scheme for reactions in the sun and stars proposed by the German theoretical physicist Hans Bethe in 1939, the question of stellar energy sources seemed to have been solved, and nobody except Kozyrev reconsidered the problem". Part of

the abstract to his published D.Sc. thesis reads as follows: "The temperature obtained for the centre of the sun is about 6 million degrees, this is not enough for nuclear reactions. … Stars generate their energy not in any nuclear reactions. *Stars are machines, directly generating radiations* [emphasis ours]. The observed diagram of heat generation, the relation 'mass-luminosity-radius', cannot be explained by standard physical laws. Stars exist in just those conditions where classical laws are broken, and a special mechanism for the generation of energy becomes possible, … Physical coordinates of the main points have been found using observational data. The constant (physical coordinates) should be included in theory of internal constitution of stars which pretend to adequately account for observational data. There in detail manifests the inconsistency of the explanations of stellar energy as given by nuclear reactions and also calculations as to the percentage of hydrogen and helium in stars." Thus, Kozyrev vehemently rejects any notion of stars producing energy by nuclear reaction, he insists that a totally unknown mechanism is responsible.

1.3 Inside the Earth – The Heartfire Model

The model, proposed by David Noel,[8] would seem in support of nucleosynthesis but argues, for whatever reason, in favor of it occurring in the core of planets rather than core of stars. He maintains that elements heavier than iron are created through nucleosynthesis in the mid section (mesolayer) of the Earth's core. Possibly for simplification, his presentation reads much like a college essay, completely devoid of the usual quantitative expressions often necessary for grasping the subject. We reproduce some key points considered relevant for the present purpose: (i) Earth's core comprises three layers - inner core, mesolayer and mantle; (ii) the mesolayer behaves like a critical fluid while the other two layers are solids; (iii) the mesolayer comprises predominantly neutrons; (iv) some 213 BL, equivalent to 4.284 x 10^9 kwh of heat, flows from the core to the surface of the Earth daily; (v) how and exactly where in the core this huge quantity of heat is produced remains an open question; (vi) conversion of proton to deuteron causes a seven-fold size increase, might not this be responsible for observational radial expansion of the sun and also of the Earth? (vii) would supernova-explosionmotivated formation of neutron star not imply that the unexploded star had a sphere of neutrons in its core, especially since there is no accepted position regarding the internal constitution of stars. Notably, Noel argues against the reigning astrophysics concept of supernova-explosion-motivated formation of the chemical elements.

2. METHODOLOGY

The study is based on previous publications which, themselves, rely on a prior submission by Russell and Russell R&R (1981).[9] We set out since 2012 to test the validity of some of their claims; results of that exercise have been widely reported; see, for instance, refs. 10 – 21; the present effort is a continuation of the same exercise. As stated in ref. 18, we set aside R&R's metaphysics and focus on verifying their claims with established classical physics. We first evaluated the atom's intrinsic e-m frequency v/s, absolute atomic mass of its wave m_w and particulate m_p forms following the procedures reported in refs 10,11,12. Based on the fact that the atom physically rotates, ref. 17, we use m_w and m_p values to evaluate the simple harmonic motion SIM characteristics of the wave and particulate forms as described in ref. 26, Here, values of the atom's speed of light in vacuum c_o(vacuum light speed) and in matter c^o (de Broglie radiation) are taken in combination with its physical properties to submit a model on vacuum nucleosynthesis,

2.1Vacuum Nucleosynthesis Model

One finds that *the atom is defined with four mass values,* in order to simulate this arrangement one would require an approach that replicates a system of four correspondent bodies in dynamic equilibrium. This would comprise three tangible bodies and an intangible (fluidic) body; each must continuously exchange mass-energy matrices with its neighbors to maintain local mass invariance. It turns out that an arithmetic device gives the simplest solution. A lever system perfectly illustrates the setting: the intangible fluidic body serves as fulcrum, it supports the three floating tangible bodies. The fulcrum locates what we call the 'Absolute universe' U_{w^*} and floating within it are: particulate conjugate of the Absolute universe $\underline{U_{p^*}}$, our Visible universe U_{p^o}, and the 'Invisible component $U_{p'}$ of our universe. The system works as follows: $U_{w^*} \leftrightarrow U_{p^o} \leftrightarrow U_{p'} \leftrightarrow U_{p^*} \leftrightarrow U_{w^*}$; a cyclic process where all are interconnected, see the picture, Obande.[13] Somehow, certain aspects of this simple picture confound the reigning model, its natural processes create seeming enigmas including: the black hole (portal of mass-energy exchange between the four worlds), dark matter (invisible particulate matter of $U_{p'}$ *and* U_{p^*}), dark energy (combined energies (hvs) of the three particulate matter worlds), three particle generations (chemical elements of the three particulate matter worlds), and an expanding universe (superluminal radiation of a decaying/dying universe)! The element's *v* values have been made widely available, Obande.[14,15] Values of atomic mass m retrieved with the classical mass formula CMF from the cosmic vacuum field CVF e-m radiations, Obande[15] are marginally low, they range from 7.373 x 10^{-51} kg/atom for electron to 4.322 x 10^{-40} kg/atom for americium, first and last elements of

R&R's chemical periodicity respectively. We attribute these ultra low mass values to the atom's 'absolute' atomic mass in contradistinction from 'relative' atomic mass. We have previously reevaluated established physical parameters of our world with the calculated atomic mass values to reaffirm their validity, Obande .[16-21] We present below quantitative descriptions of the various processes whereby nature forms molar units from elemental e-m waves, in other words, vacuum nucleosynthesis.

2.1 Precipitation of Particulate Matter from the Cosmic Vacuum Field

Observational evidence supports the following empirical expressions that describe precipitation of tangible matter from the CVF:

$$m_w = h\nu_{w^{*2}}/c_o{}^2 \quad (1)$$

generally, $2m_w = m_p = M_E = 1.0172h\nu_{p^o}/c^{o2}$ (2)

$$N_A = 1.0172(c_o/c^o)^2 = 1/m_{w^*\,(H)} \quad (3)$$

$$M_{E(\tau)} = \tau_{p^o}/(\omega_{p^o}/r_{p^o})^{½} \quad (4)$$

$$MeV = \tau_{p^o}/\tau_{p^o(H)} \quad (5)$$

where m_w = atomic waveform 'rest' mass; M_E = element's molar mass; c_o vacuum light speed; c^o matter (de Broglie) light speed; h = Planck constant; $m_{w^*\,(H)}$ hydrogen waveform mass: $\nu_{w^*\,(E)}$, $\nu_{w^*\,(H)}$, an element's and hydrogen atom's e-m frequencies respectively; MeV = electron-volt atomic mass unit = 1.03752842 x 10^{-5} for the waveform, and 9.311079 x 10^5 for molar atom; τ = transverse stress on the oscillating wavepacket; r_{w^*} *and* r_{p^o} = atomic waveform and molar radii respectively and the factor, 1.0172 = ν_{p^o}/ν_{w^*}, is ratio of energies (i.e. frequencies) of the material/waveform atom. For the rest of the paper: superscript * or subscript w refers to the absolute or waveform atom while superscript o, ′, or subscript p refers to the particulate atom. Eqs. (1) to (5) account for spontaneous appearance of the tangible atom and/molecule from space, we show how in a moment.

3. RESULTS AND DISCUSSION

The above narrative on vacuum evolution of matter would remain speculative and unscientific unless we provided a clear-cut verifiable explanation. With advancement in technology, literature is now rife with astrophysical reports of what was once seen as a strange phenomenon - emission of matter from the CVF onto visible space, the preceding narrative serves to demystify the effect. The CVF is nature's play ground, more takes place in there than words can tell, Wheeler.[22] Characteristic mechanical and chemical parameters of the atom self-interact *in the CVF*; the interactions, of course, include chemical reactions, usually in the extreme cold of deep space. Most, probably all, of what we perceive as physical and chemical constants of nature are actually linear correlation coefficients of the atom's parametric self interactions, these include: rest mass m, vacuum radiation c_o, matter (de Broglie's) radiation c^o, magnetic flux density B, fine structure constant α, you name it, are all linear correlation coefficients. We were able to investigate 72 of these correlations and the exercise revealed parametric definitions of a number of fundamental constants, Obande.[20,21] Wellenstein[6] is of the opinion that the chemical composition of 'peculiar stars' is proof of stellar nucleosynthesis but, Kozyrev[7] vehemently opposes this view. We think a proof of our position would require at least: (i) evidence that atomic and molecular matter are routinely produced in space ceaselessly; (ii) a clear quantitative explanation of how the elemental e-m waveform transforms to ponderable matter as solids, liquids, gases or plasma, et cetera. For (i) we simply cite a few reports to the effect: Wikipedia.org.,[23] Lutz, D. et al.,[24] Ray, J. P. et al..[25] For (ii) we refer to formation of ponderable matter from the waveform as atoms, ions, radicals, molecules, et cetera, illustrated below with calculations of atomic and molar masses using eqs, (1) to (5) above. Taking the electron e- as example we first get the mass of its waveform followed by that of the particulate form; Obande:[26], substitution into the relevant equation gives:

Eq.(1): $m^{*}_{e(w)} = 6.626\ x\ 10^{-34}\ x\ 1.0/(2.99792458\ x\ 10^{8})^{2} = 7.3725\ x10^{-51}\ kg/atom$

Eq.(2):$\mathrm{m^{o}_{e(p)}} = (6.626\ x10^{-34} x\ 1.0172)/(3.71535.\ x10^{-14})^{2}$ = $2\ x\ 4.883\ x10^{-7} = 9.7656\ \ kg/mol$ M

Eq.(3): $N_A = 1.0172(3.71535229x10{-}14)\ 1.\ \frac{1}{2.99792458x\ 10^{8}\ 2}\ \frac{1}{5099x10^{-34}} == 6.623\ x\ 10_{43} units$

Eq.(4): $MeV = 3.846\ x\ 10^{15}/(12.783/9.1312\ x10^{-15})^{0,5} = 93.158\ x10^{6}$ eV/mol = molar electric constant:, i.e., eV- kg equiv.

Eq.(5): $m_{e^o(\tau)} = 2.0\ x10^{-3}$x 3.486E15/7.139E18 $= 9.7656\ x10^{-07} kg/mol$

3.1 Avogadro Constant and Production of Tangible from Intangible Matter

Theory reveals Avogadro constant or Lochsmidt No. an interesting combination of two ratios – the ratio $(c_o/c_{p^o})^2$ i.e., vacuum light speed to matter (de Broglie) light speed squared multiplied by the ratio ν_{p^o}/ν_{w^*} , i.e., energy of a particulate element to that of its vacuum analogue, $N_A = 1.0172(c_{o^*}/c_{p^o})^2$ where energy of particulate to waveform atom, $E_{p^o}/E_{w^*} = \nu_{p^o}/\nu_{w^*} = 1.0172$. It turns out that the product,

Avogadro No. multiplied by the atom's waveform mass, gives the atom's theoretical molar mass value which, if doubled, gives empirical molar or relative 'atomic' mass, i.e.,

$$N_A m_{w^*} = M_p \text{ or } m_r \qquad (6)$$

Validity of eq.(6) requires that M_p be the *theoretical molar mass*, see ref 19, figs 1 to 4 and Table 1, pp. 68 and 69.

The challenge here is to explain, as simple as possible, the process of solidification from the waveform and compaction into solids, liquids or gases found in various structures of the cosmic expanse. Nature

freezes radiation by an ingenuous trick; it fabricates the molar unit, $N_A = 1.0172(2.99\ x\ 10^8 / 3.72\ x\ 10^{-14})^2 = 6.623\ x\ 10^{43}\ units/mol.$, then multiplies this unit by the element's waveform atomic mass to precipitate the molar form e.g. for the electron waveform: $M_{e(W)} = N_A m_{w^*} = 6.623\ x\ 10^{43}\ u,\ \ x\ 7.3724193\ x\ 10^{-51}\ kg/u = 4.883\ x\ 10^{-7} kg/mol$ and Am $= 6.623E43x\ 4.7497E - 41 = 3.146E3$ kg/mol (the value is the theoretical relative atomic mass of Am). This result confirms our previous positions: i) our theoretical evaluation of N_A was right, Obande,[11] ii) the electron is a fullfledged-element, it is the first member of the chemical periodicity.[10] However, the result raises valid questions regarding the correct value of electron molar mass: is it empirical $5.4858\ x\ 10^{-4}\ g$/mol or theoretical $4.8828\ x\ 10^{-4}\ g/mol$ or indeed $9.7656\ x\ 10^{-4}\ g/mol$ which we have been using in all previous reports, Obande.[10] It seems years of misunderstanding have not helped the electron's position; to date, its molar form is not widely appreciated (particularly in theoretical physics quarters), its absolute atomic mass value $7.373\ x\ 10^{-51}\ kg/u$ is still a curiosity awaiting the position of the mainstream. Although we shall continue to use $9.7656\ x\ 10^{-7} kg/mol$, our analytical procedure places a crucial demand for clarification. It turns out that ratio of an element E's atomic strain to H's value

gives half its (incredibly) accurate empirical molar mass: $M = \tau_{p^o(E)}/\tau_{p^o(H)}$; e.g., for e- we have: $M_{p^o(e-)} = 3.486E15/7.139E16 = 4.88E - 7\ x\ 2 = 9.7656E - 7\ g/mol$; also for Am: $M_{Am^o\ (p)} = 8.674E20/7.139E18 = 121.5\ x\ 2 = 243\ g/mol$. In view of the cosmic relevance of the expression $M_{p^o} = 2N_A m_{p^o}$, we are inclined to accept the doubling of what otherwise was supposedly already molar mass; the subject calls for further investigation. Interestingly, this issue does not arise in calculations involving electrical equivalence of gravimetric mass.

Observational evidences suggest that an atomic element formed from the waveform grows slowly in complex steps of accretion to eventually become part of a cosmic body like what we find in interstellar media, protoplanets, molecular outflows, stellar bodies, or entire galaxies. The procedure indicates that chemical elements are formed by linear correlations (self interactions) in the cosmic vacuum field CVF, it leaves no room for stellar nucleosynthesis.

3.2 Error Sources

Results of this investigation rely totally on accuracy of the atom's e-m frequency v 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 Obande (2024, p.144),[14] that a common v 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.

3.3 Further studies

Three possible follow-up research activities are immediately conceivable:

i) A program for *v* value

As stated in an earlier report, Obande,[14] the v values reported here were 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 configurations of an element regardless of mass number, i.e., electronic configurations of a many-electron atom; ii) Absolute atomic mass: Existence and value

The atom's absolute mass value, m kg/atom, has featured prominently in our reports, Obande,[9-11] this object is yet unknown to theoretical physics and, in particular, the mainstream, an independent investigation/confirmation is required;

iii) Avogadro constant AC

Confirmation of the formula for AC, $N_A = 1.0172(c_o{}^*/c_p{}^o)^2 = 6.623\ x\ 10^{43}$ units where $1.0172 = \nu_p{}'/\nu_w{}^*$, would be quite interesting. We have a haunch that N_A must be playing other roles in nature than creation of molecular from atomic mass; it is natural to suspect that that it cools/condenses the hot plasma to precipitate the atom from invisible to visible space. It would be even more interesting if we understood details of the cooling/condensation process, as in how do the reduced vacuum radiation $c_o/c_p{}^o$ and 'reduced' matter oscillation $\nu_p{}'/\nu_w{}^*$ interact with the hot atomic plasma in the freezing/precipitation process?

We are inclined, from observational lines of evidence, to the position that isolated vacuum atomic waveforms are concentric radiation rings, they would necessarily exist as infinitely elastic sub-micron thick hollow loops or toroids, see for e.g the rainbow, the radii would vary from 1.499E8 m to 2.327 m from electron to americium respectively, Obande.[11,26] Configuring this loop into the ponderable atom in its spatial mold naturally results to significant in-built observational strain and tension see, Burkert et al.[27], Obande.[17] Given the AC formulation, we may wish to know the details of its interactions with the newly-formed white-hot atom that cools it to 0^oK of deep space before it re-heats in the sundry processes of construction of cosmic structural networks. Clearly, research into subjects of this nature would require decades.

4. CONCLUSION

Atoms are produced by synthetic reactions, not in the core of stars but in ultra-cold deep space. The synthetic reaction or nucleosynthesis does not occur in stars but in the CVF. Observational evidence on quantum numbers QNs, Obande,[14] would suggest that vacuum nucleosynthesis VN is much more complex than the simplifications in eqns. (1) to (5) above. Our previous description of QNs hint at existence of spatial templates upon which the elements are formed, see for instance, Golubev.[28,29] Certainly, much more await to be investigated than what is already known.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

ETHICS APPROVAL

The University Ethics Committee ensured that the work, being a purely theoretical investigation, did not involve issues of ethical concerns.

DATA AVAILABILITY STATEMENT

The data that support the findings of this work are available on preprints.org; doi.org/10.2139/ssrn.4127879; also on Harvard Dataverse: A Compilation on the Physical Reality "Replication Data" doi.org/10791/DVN/UOVDIA

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