Exploration

Cubic Lattice Cryogenic Nucleosynthesis in the Nascent Cosmos

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Abstract

We explore an alternative to the hot Big Bang hypothesis for explaining the nucleosynthesis of hydrogen, helium and heavier nuclei during the nascency of the cosmos. The alternative hypothesis argues that the entire primordial material content of the cosmos sprang from cryogenic nucleosynthesis in a Bose-Einstein condensate that prevailed during the nascency of the cosmos. A corollary is that stellar ignitions are results of nuclear fission chain reactions due to heavy fissionable elements produced by and acquired from the nascent cosmos prior to star formation. The cubic lattice nucleon/nucleus model explains how cryogenic nucleosynthesis produced the primordial abundance of light, heavy, and fissile elements.

Keywords: Cryogenic nucleosynthesis, cold fusion, Bose-Einstein condensate, Dark Matter, nascent cosmos emergence, cubic lattice, nuclei model, element abundance.

1. Introduction

Light element abundance in the cosmos is the generally accepted basis for the Big Bang hypothesis, which posits that the elements observed in the cosmos were created in either of two ways: light elements (namely protium, deuterium, helium, and lithium) were produced in the first few minutes of the Big Bang, while elements much heavier than helium and lithium were produced in the interiors of stars that formed later in the history of the cosmos.

The fact that helium abundance relative to hydrogen is of the order of 23% is taken as evidence that the cosmos went through an initial hot phase to synthesize helium from deuterium. The hot Big Bang model is required to initiate the energetic collisions that are assumed to be needed to overcome resistance to the fusion of deuterium nuclei surrounded by electron clouds. Further support for a hot Big Bang is based on the relatively lower abundances of the other light elements. There is a consensus that we understand the physical processes that went on in the first few minutes of the emergence of the cosmos. Unexplained is the mystery of how the Big Bang originated. There is no evidence of a hot Big Bang, except for the theoretical assumption that it was needed to initiate nucleosynthesis of the light elements.

Cosmic abundances of heavy elements beyond boron, carbon and iron are attributed to stellar nucleosynthesis by high-speed collisions at high temperatures following gravitational collapse and fusion heating of massive clouds of hydrogen and helium. Accordingly, the synthesis of heavy nuclei in a star is initiated due to an initial hydrogen and helium abundance that provides the energy for the synthesis of new heavier nuclei as a byproduct of the hydrogen and helium fusion processes. The stellar fusion-produced nuclei are restricted to those only slightly heavier

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than the fusing nuclei, thus they do not contribute to the natural abundances of much heavier elements, say beyond iron, cobalt, and nickel.

The supernova nucleosynthesis theory accounts for the creation of even heavier elements that were putatively produced during the evolution and explosion of a presupernova star [1]. Development of the supernova nucleosynthesis theory advanced with the discovery of variations in the abundances of elements found throughout the cosmos. When plotted on a graph as a function of atomic number of the element, the abundances have a jagged sawtooth shape that varies by factors of tens of millions, Figure 1. This suggests a mechanism that contradicts a purely probabilistic or random process. Among several proposed processes of nucleosynthesis, stellar fissile nucleosynthesis dominates as the contributor to elemental abundances.

We propose that stellar ignition was not produced exclusively by gravitational collapse, but by a variety of fissionable heavy elements that were synthesized during the nascency of the cosmos. The fissionable elements throughout newly formed proto-galaxies were gravitationally attracted by and absorbed into hot dark stars initiated by gravitational collapse. The hot dark stars became luminous when ignited by self-sustaining nuclear fission wherein the fission chain reaction is sustained by fast neutrons. Such stars must be rich in fissile material previously produced in the nascent cosmos.

We argue that the luminous star distributions in galaxies resulted from abundant distributions of heavy elements that preexisted the luminous stars. We support the argument that explains how virtually all heavy elements, including neutron-rich fissionable elements, formed by cryogenic fusion nucleosynthesis during the nascency of the cosmos. This requires the consideration of the cubic nucleon and cubic lattice nucleus model that readily explains the jagged declinations in elemental abundances depicted in Figure 1. The cubic lattice nucleus model also predicts and explains the observed interactions and structural properties of atoms and their isotopes.

2. Primordial Abundance of Heavy Elements

Galaxies in the very early cosmos provide evidence for the primordial abundances of elements such as hydrogen and helium as well as a wide range of heavy elements. Past and present abundances of hydrogen and helium are seen as residuals within the paradigm of the Big Bang theory. The next three elements (Li, Be, B) are rare and presumed to have been poorly synthesized in the Big Bang and in stars. Actual abundances of two isotopes of lithium depart significantly from Big Bang model predictions. The discrepancy is termed the primordial light element problem because rather than providing good evidence for the Big Bang model, actual abundances of three light elements (Li, Be, B) present a significant problem. Figure 1 shows two general trends in the remaining heavier elements: (1) an alternation of abundance of elements according to whether they have even or odd atomic numbers, and (2) an exponential decrease in their abundance, as elements become heavier [2]. Within this overall trend are peaks for the abundances of iron and nickel evident in the logarithmic graph of Figure 1. The abundances of primordial heavy elements, conventionally attributed to nucleosynthesis in stars, may be attributed to cryogenic nucleosynthesis in Bose-Einstein condensates which we argue prevailed during the early stages of the evolution of the cosmos. The nucleosynthesis and extreme variations and decrements in the abundance of elements heavier than hydrogen and helium are best explained in the context of the cubic lattice nucleon/nucleus theory [3].

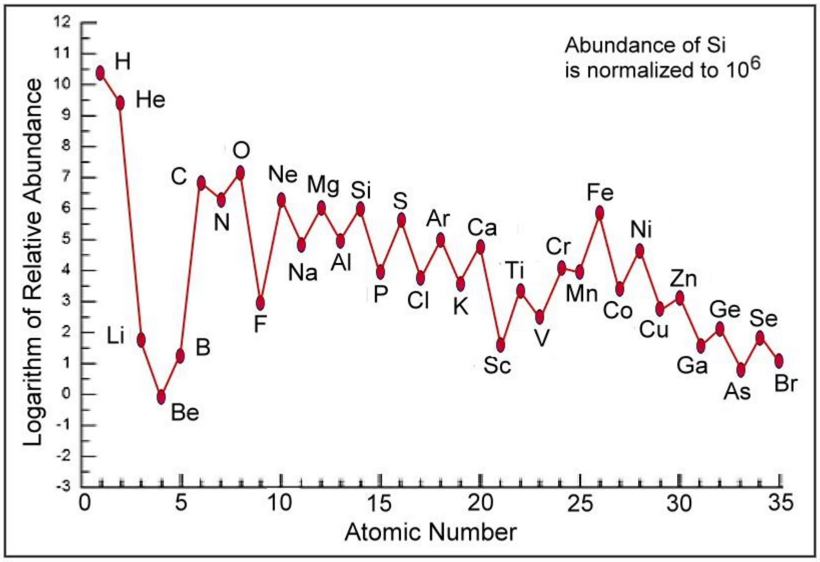

Figure 1 - Primordail abundances of the elements.

3. Preliminary Premises

The cubic nucleon model assumes that spacetime is particulate - that spacetime is a fractal substance consisting of energetic four-dimensional spacetime parcels: cubical volumes (voxels) of space that oscillate in time - that the granularity of space and time are on the scale of Planck length (10^{-33} centimeter) and Planck interval (10^{-43} second). The voxel - the cubic unit spacetime parcel - is proposed as a fundamental unit cube common to the structure posited for all elementary particles (neutrinos, electrons, positrons) and nucleons (neutrons, protons). Protons and neutrons are depicted as consisting of twenty-seven unit cubes - analogous to the Rubik cube - as explained in the following discussion of cubic nucleon protons and neutrons. This concept is useful for developing the cubic nucleon model for nucleon substructures and nuclei architectures.

The cubic nucleon model is a radical approach to visualizing the assumed substructure of nucleons. Still, the model agrees with the essential properties explained by previous models - combining their strengths while not introducing paradoxical properties, contradictory ideas, or unrealistic parameters. Established concepts, such as quark containment and nuclear binding forces are used in a unique way in the cubic nucleon model and these strengthen its underlying rationale.

The cubic nucleon model helps to predict and explain the nature of atomic nuclei and their nucleosynthesis. Certainly, the cubic nucleon model, the standard shell model, and other models are but abstractions. Atoms are not influenced by the models - nor by the specifications of any given model, mathematical abstractions or quantum mechanical schemes that account for nucleon energy levels. The cubic nucleon model is described by quasi-mathematical 'graphical metrics' that correspond to Feynman diagrams – pictorial representations of the mathematical expressions describing the behavior of subatomic particles – allowing simple visualizations of what would otherwise be represented by arcane and abstract formulas. The cubic nucleon and cubic lattice architecture provide a convenient conceptual framework for understanding and predicting observed nuclear properties and behavior [3].

4. Cubic Nucleon Quarks and the Deuteron

The most radical and innovative aspect of the cubic lattice nucleon/nucleus model is the appropriation of the quark model for protons and neutrons. When Murray Gell-Mann, George Zweig and Yuval Ne'eman imagined a scheme for combining quarks to form hadrons, they succeeded in positing quarks as elementary particles and fundamental constituents of matter. When introduced as constituents of hadrons, there was little evidence for the existence of quarks. In 1968, scattering experiments at the Stanford Linear Accelerator Center provided indications of their existence. Due to theoretical 'color confinement', quarks are never directly observed or found in isolation - they can be found only in hadrons. Within the confines of a hadron they are essentially free to move about, but only with 'asymptotic freedom'.

As indicated in Figure 2, in the cubic nucleon model for protons and neutrons, quarks do not move about freely; quarks are structural parts, called plaques (up and down plaques in protons and in neutrons). As envisioned in the cubic nucleon model, quarks have substructure, where each quark is a plaque consisting of nine energetic spacetime voxels. The cubic nucleon model assumes that up and down quarks have strong electrostatic affinity for each other, while up quarks repel each other, just as do down quarks. The fractional charges assigned to quarks (+2/3 for up and –1/3 for down) are used in the model to explain the affinity between a proton and neutron and the structural details of nucleons and nuclei. The quark triplet bonded deuteron depicted in Figure 2 is a fundamental module. The deuteron is an *essential nucleon module common to every element and isotope* from deuterium, helium and beyond. The exception is protium.

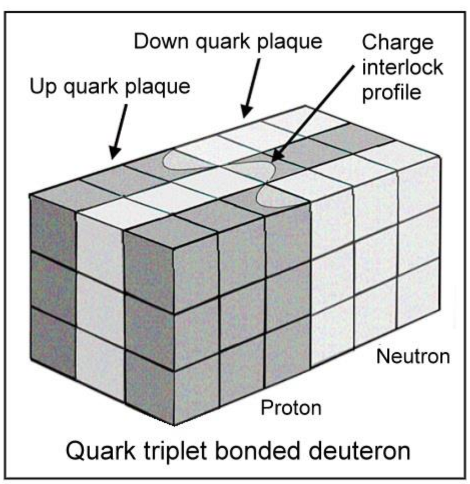

Figure 2 - Cubic deuteron module.

The cubic deuteron model represents nuclear structure in a way that is elegant, logical, and informative. Figure 3 illustrates the conceptual cubic nucleon architecture of the carbon-12 nucleus. Both deuteron and alpha modules are represented in an arrangement based on the interlocked quark edge triplets. Figure 3 depicts the affinity of deuterons that fuse to produce alpha particles, which in turn fuse to produce carbon. The fusion of deuterons in synthesizing alpha particles releases energy: 24 MeV per event. We interpret this as indicative of latent potential energy between deuteron pairs that is released when they fuse.

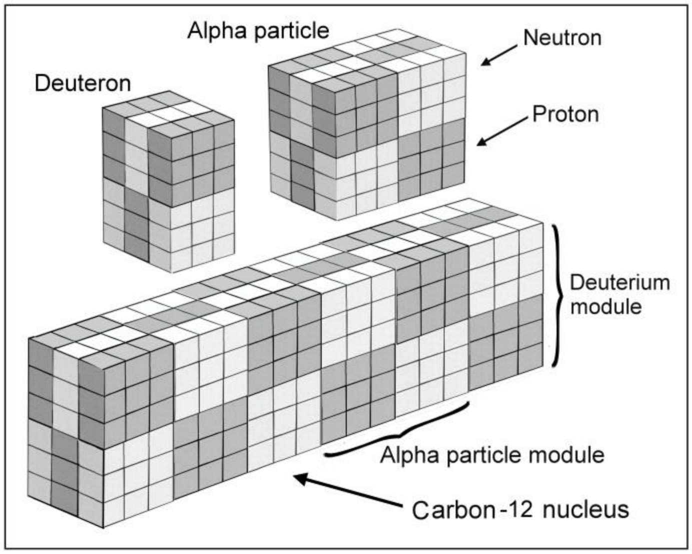

Figure 3 - Deuteron and alpha particle modules in carbon nucleus.

A schematic of carbon-12 that appears in Figure 4 also depicts conceptual ‘checkerboard’ arrangements for the stable nuclei and isotopes of elements from hydrogen-1 to fluorine-19. The color coding in Figure 4 indicates the deuteron and alpha particle (deuterium and helium-4 nuclei) modules. The checkerboard ‘brick wall’ assures facet-to-facet separation of protons from protons and neutrons from neutrons. The checkerboard pattern separating protons and neutrons is mandatory according to the logic that protons cannot bond to protons, neither in the quark triplet nor face-to-face plaque mode. Some alternate modes, however, may occur in much less stable fissile isotopes. Figure 4 shows the oxygen-16 nucleus arranged in a linear chain of four alpha particles. One possible alternative, a cluster of alpha particles, is also shown. There is evidence for an oxygen-16 nucleus structure consisting of a linear alignment of four alpha particles, which is our preferred representation [4].

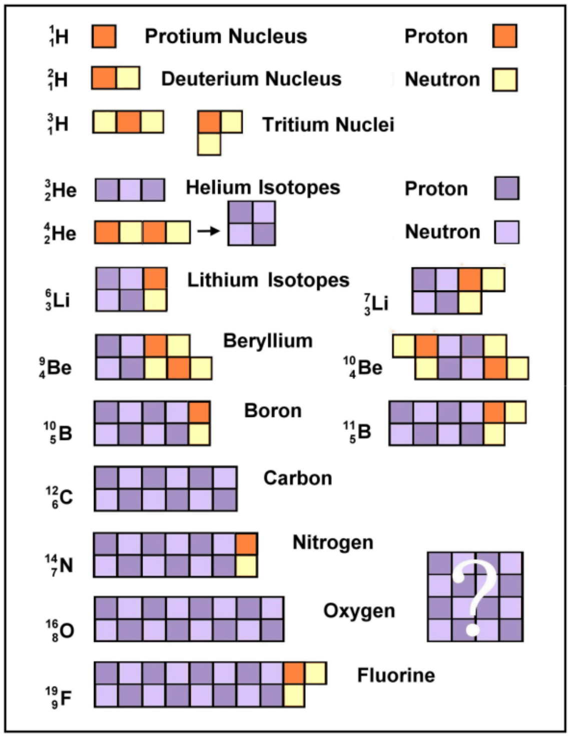

Figure 4 - Deuteron and alpha particle sythesis of nuclei.

5. The Origin of Neutrons and Deuterons

We argue that neutrons were the first baryons that emerged in the nascent cosmos. Neutrons combined with protons to form the first population of deuterons, which in turn formed more massive atomic nuclei and isotopes: deuterium, helium, lithium, etc., as indicated in Figure 4. Neutrons apparently served from the beginning of the material cosmos to prevent annihilations of particle-antiparticle pairs that are continually produced by the quantum foam ZPF (zero point field) substratum. Neutrons are needed specifically to combine and preserve electron-positron pairs in a non-volatile state. The conjectured origin of neutrons and their role in housing electron-positron pairs is just as enigmatic as the notion of the Big Bang itself.

The quantum foam of the mesostratum substratum produces the foundational fabric and content of the physiostratum [5]. Quantum foam roils within the Planck-scale particulate turbulence of the physiostratum spacetime fabric. The mesostratum energy density of fluctuations and annihilations is likely to be quite sufficient to significantly alter spacetime voxels to generate the previously described up and down quark plaques that combine to form neutrons that confine positron-electron pairs and preclude their annihilation.

Isolated neutrons, separate from protons, beta decay quickly. When a free neutron β^{-} decays, the contained positron is isolated in the resultant proton while the contained electron is emitted (Figure 5). This explains why free electrons pervade the cosmos seemingly unbalanced and not annihilated by their antiparticles. Positrons that are housed in protons that pervade cosmic space commingle with the free electrons in virtually equal populations. Neutron beta decay also suggests the process by which primordial hydrogen atoms (protium) originated and formed is that the expelled electrons simply began orbiting nascent protons.

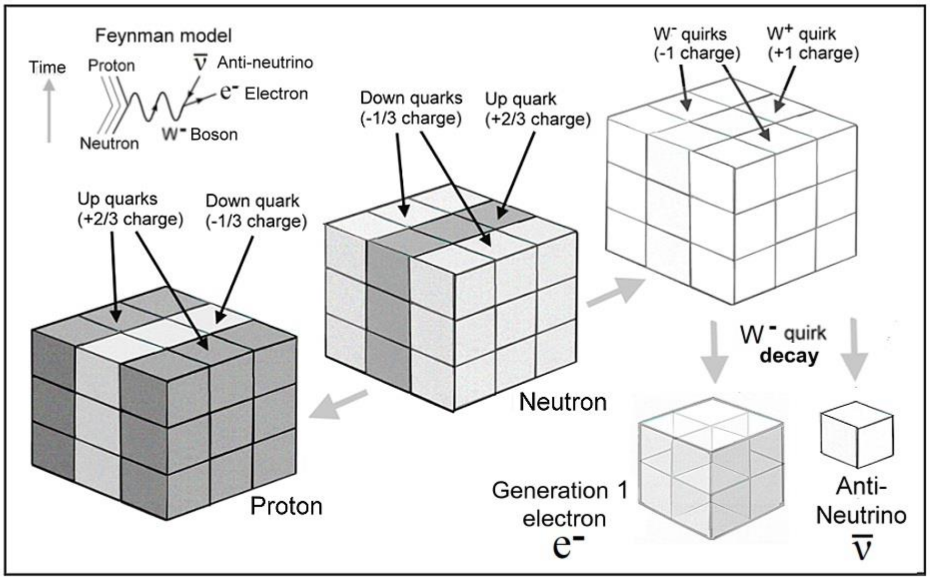

Figure 5 - Cubic nucleon model of neutron beta decay compared with Feynman model.

In Figure 5, neutron beta decay is represented as a transmutation process beginning with a cubic nucleon neutron. The process involves the emission of what we designate as W quirks. The neutron down quarks each emit a WS quirk, *subtracting* a charge of -1 from -1/3 and giving the resultant proton two up quarks each with a +2/3 charge. The neutron's up quark emits a W+ quirk, *subtracting* a charge of +1 from a +2/3 charge, giving the resultant proton a down quark with a -1/3 charge. Adjacent W+ and W- quirks annihilate. The remaining W- quirk emits an electron and an anti-neutrino.

The emitted generation 1 electron, consisting of eight unit voxels, takes a net charge of -1 as the remaining W- quirk vanishes, emitting an anti-neutrino, consisting of one unit voxel. The origin and voxel-based structure of generation I electrons and heavy electrons such as the muon and tauon are discussed in a previous article [6]. The unit neutrino voxel plus the eight unit voxels comprising the generation 1 electron account for the nine voxels of the vanished W- quirk. According to the Feynman model, the anti-neutrino reverts back in time - which we interpret as reverting back to an original voxel mode, just as adjacent W+ and W- quirks annihilate and revert back to neutral de-energized voxel modes.

It is logical to conclude that the nascent cosmos was densely populated with newly-generated neutrons a proportion of which beta decayed into protons by the process depicted in Figure 5. It is likely that a significant proportion of the new protons immediately fused with available intact neutrons forming dense populations of quark triplet bonded deuterium and tritium atoms in addition to isolated protons that captured an electron to form protium atoms, as indicated in Figure 4.

Figure 6 depicts deuteron-deuteron affinity based on the quark triplet model. The deuterons fuse with the emission of latent potential energy. Alignment and orientation of the deuteron pair depend on Bose-Einstein condensation to assure fusion of the two deuterons to produce an alpha particle helium nucleus [3].

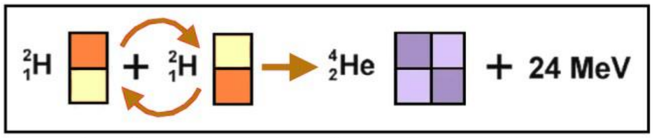

Figure 6 - Cryogenic deuteron fusion forming helium nucleus.

6. Factors Governing Relative Element Abundance

The Oddo-Harkins rule states that elements with odd atomic numbers have one unpaired proton and are more likely to capture another proton, thereby increasing their atomic number and abundance. Figure 1 shows an alternation of abundance of elements according to whether they have even or odd atomic numbers. Figures 4 and 7 show nuclei that illustrate the Oddo-Harkins rule for the alternating abundances of elements from carbon to vanadium. Figure 7 indicates that: (1) Low abundance element nuclei terminate with the rare tritium module and (2) even atomic number elements are synthesized with the highly abundant alpha module and that in elements with even atomic numbers all protons are paired, with each proton of the pair balancing the spin of the other. Balanced parity apparently enhances nuclei stabilities and abundances.

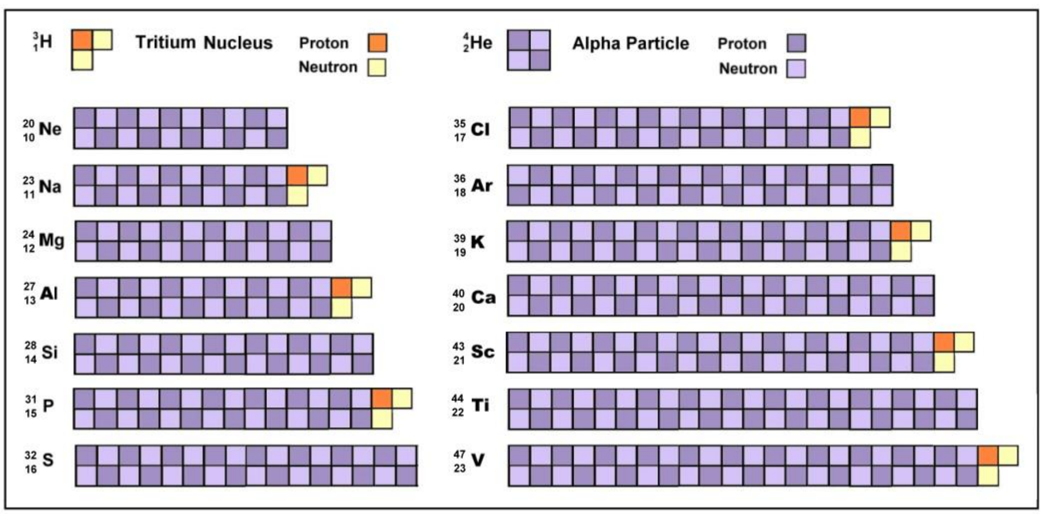

Figure 7 - Conceptual primordial nucleosynthesis based on fusion of alpha particles and tritium nuclei.
(neutron-rich stable isotopes of Ar, Sc, Ti, V, with extraneous neutrons, are omitted)

The Oddo-Harkins rule does not apply to the most abundant and simplest element: hydrogen, with an atomic number of 1. In its ionized form, hydrogen is simply a proton that may or may not ultimately pair with a neutron, as a deuteron in a deuterium or helium nucleus. In the latter case, helium appears to be the even numbered counterpart to hydrogen. Neutral hydrogen, a proton paired with an electron, constitutes the most abundant species of matter following the beta decay of precursor neutrons.

Another exception to the Oddo-Harkins rule is beryllium which, even with an even atomic number of 4, is significantly less abundant than the odd number elements lithium and boron, both of which have unpaired spin-balancing protons. Lithium and boron have two stable isotopes while beryllium has one. It is difficult to account for the extreme rarity of elements Li, Be, B unless their modules (deuterons, tritons) were 'used up' in the primordial nucleosynthesis of heavier, more energetically stable elements: specifically, C, N, O.

Peak abundances of iron and nickel evident in the graph of Figure 1 may be due to greater latent binding energy absorption associated with the configuration of their alpha modules. In Figure 8, it is evident that the nuclei of the elements Fe, Co, and Ni conform to the Oddo-Harkins rule. Figures 4, 7, and 8 represent stable isotopes presumed to have existed throughout the cosmos since its nascency. Heavy stellar and planetary isotopes may exhibit greater neutron richness due an affinity for excess neutrons prevailing in those objects. Neutron richness of virtually all isotopes in the periodic table simply testifies to an ongoing emergence of neutrons from the ZPF substratum and their affinity to fuse with available cubic proton facets of nuclei [3].

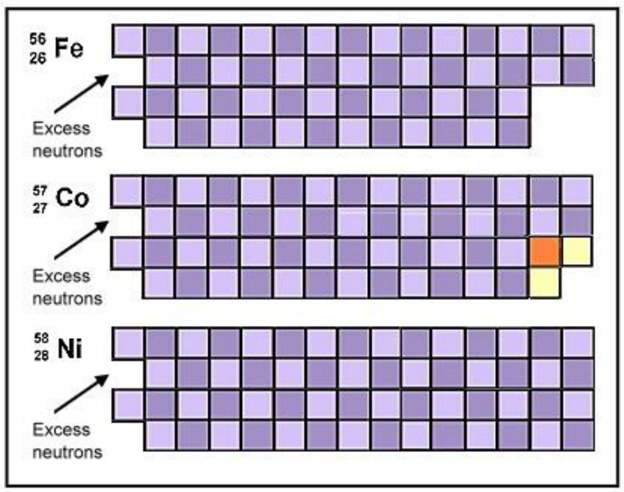

Figure 8 - Conseptual iron, cobalt, nickel nuclei excess neutrons fused to proton facets.

7. Neutron Poorness, Orphaned Protons, Instability and Fission

Either neutron poorness or neutron richness of nuclei leads to instability and transmutation, typically by beta plus β^+ or beta minus β^- decay, respectively. Neutron poorness (neutron/proton ratios less than 1) means that there exists one or more orphan protons that lack deuteron-neutron companions, or that must share a neutron with another proton. This leads to β^+ decay of the orphan protons and transmutations. The β^+ transmutation results in an element with an atomic number decreased by one without changing its mass number, if the vanished proton has been replaced by a new neutron in place of the vanished proton.

Although it occurs with orphaned protons in virtually all atomic nuclei, β^+ decay has not been observed with free or independent protons. The neutron poorness of hydrogen-1 (protium) and helium-3 are the exceptional instances of stable orphan protons not subject to β^+ decay. It is assumed that β^+ decay results from a positron emitted by orphaned protons - leaving three orphaned quarks. We contend that it results from *electron capture and quark transmutation* of the proton to a neutron by reverse β^- decay. Neutron richness (neutron to proton ratios >> 1) in high atomic weight isotopes may lead to β^- decay of some extraneous neutrons.

Figure 9 shows the cubic lattice nucleus of nickel-48 that is depicted to be composed of six alpha particles and eight helium-3 modules. Compared with the neutron richness of nickel-58, the most abundant stable nickel isotope, nickel-48 is the most neutron-poor nickel isotope known. Nickel-48 has six orphaned protons and has a half-life of about 500 nanoseconds - although it is doubly magic with 28 protons and 20 neutrons.

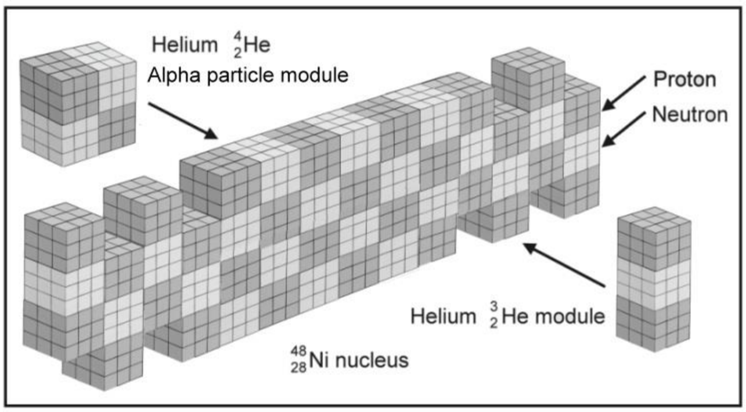

Figure 9 - Neutron poor nickel with six orphaned protons.

In the shell model, a magic number is the number of nucleons (either protons or neutrons) such that they are arranged into complete shells within the atomic nucleus. The seven widely recognized magic numbers are 2, 8, 20, 28, 50, 82, and 126. Examples of double magic isotopes include helium-4, oxygen-16, and calcium-40. According to the shell model, nuclei consisting of such a magic number of nucleons have a higher average binding energy per nucleon and are more stable against nuclear decay. In the cubic nucleon model of nickel-48 there is no obvious magic in the number of protons or neutrons, given the six orphaned protons.

The otherwise obscure decay mode of nickel-48 is easy to visualize with the cubic lattice nucleon model, Figure 10. Calcium-40 is the resultant product after the β^+ decay of four orphaned protons, transposition, and fissile ejection of two alpha particles. Retention of the alpha particles at an intermediate stage would result in chromium-48, which is also unstable with a half-life of ≈ 21.56 hours. Even without magic numbers, chromium-48 should be stable because each proton is paired with a neutron. This provides an example of fissionable isotopes produced by cryogenic nucleosynthesis during the nascency of the cosmos. Calcium-40 with doubly magic numbers of paired nucleons is stable, and the most abundant calcium isotope.

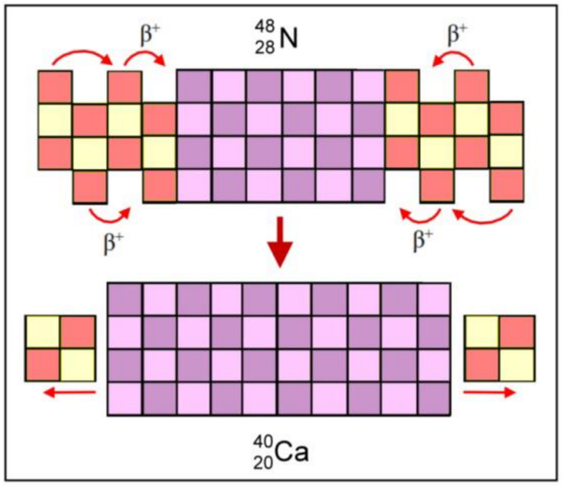

Figure 10 - Beta plus proton decay and transposition.

8. Cubic Lattice Nucleus Orbitals

As depicted in Figure 11, the carbon-12 atom illustrates cubic lattice electron orbitals. Each electron orbits a specific deuterium module. The disc-like representation of electron orbitals is meant to suggest a Parson magneton [7]. Alternate orbitals spin in opposite directions in accordance with deuteron orientations.

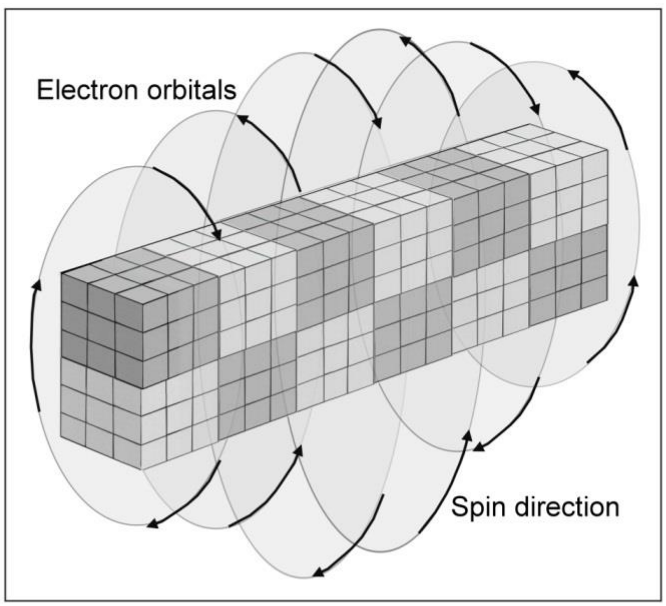

Figure 11 - Carbon atom nucleus Parson orbitals.

The schematic of the oxygen molecule in Figure 12, shows abstractions of the essential atomic components.

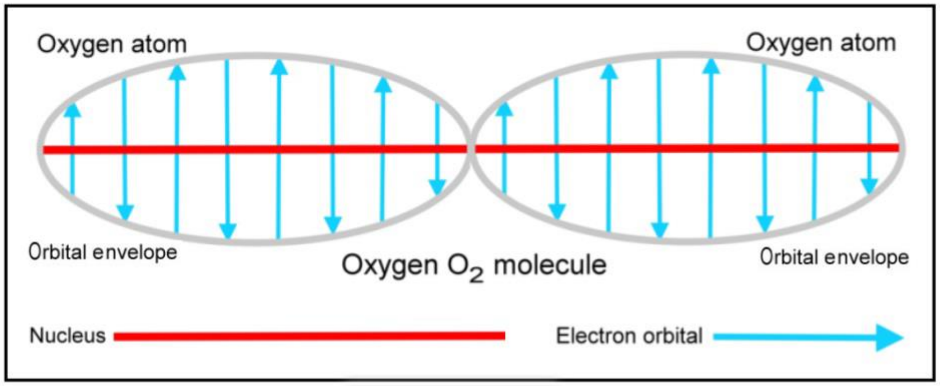

Figure 12 - Schematic of cubic lattice nucleus oxygen molecule.

The concept of atomic orbitals is itself an abstraction that attempts to describe the probabilistic locations of electrons (electron orbital clouds) orbiting the nucleus. The conventional orbital describes wave-like electrons around the nucleus. Each orbital is characterized by the unique values of three quantum numbers that correspond to the electron's energy, angular momentum, and an angular momentum vector component. Orbitals are basic building blocks of the standard atom model. The repeating periodicity of the elements in the periodic table arises naturally from the total number of electrons assigned to various sets of atomic orbitals. Modern quantum mechanics visualizes this in terms of electron shells and subshells that each hold a number of electrons determined by the Pauli exclusion principle. The cubic lattice nucleus model does not assume specific numbers of electrons in particular orbital sets, but ascribes periodic interactions of orbital electrons with nucleus modular architectures. Accompanying wave mechanics periodicity parameters should apply as with the standard orbital visualization.

9. Primordial Cosmic Cryogenic Nucleon Fusion

Referring to Figures 11 and 12, unlike the shell model electron envelope configuration, the cubic nucleus model orbital configuration is essentially open-ended; electron orbitals do not totally enclose nucleus. An orbital electrostatic repulsion barrier that prohibits fusion at low energies is absent here. The nuclei terminal ends are conceived as somewhat exposed while still accommodating molecular valence electron coupling as illustrated for O_2 in Figure 12. We will show how, when oxygen deuterons are appropriately aligned, O_2 nuclei may fuse and synthesize sulfur nuclei under Bose-Einstein condensate conditions.

The oxygen-to-sulfur transmutation process is evident in star-forming nebula. The Trifid Nebula, subject of an investigation using the Hubble Space Telescope in 1997, recorded emissions from hydrogen atoms, doubly ionized oxygen atoms and ionized sulfur atoms. Most emission nebulae are about 90% hydrogen, with the remainder helium, oxygen, sulfur, nitrogen, and other heavy elements. Esteban and his colleagues present spectroscopy studies of two regions of the Orion nebula [8]. They measured intensities of about 220 emission lines for C+, N+, N++, O°, O+, Si+, Si++ and S+, some produced by recombination and others by fluorescence. In another study, Aller, et al found that the ratio of sulfur to oxygen in Magellanic clouds is about 0.8, which agrees with the antecedence of oxygen required for sulfur to appear [9].

We take these data as evidence of the formation of stars from heavy elements, under cryogenic conditions, in nebulae that pre-exist them. Star-forming nebula typically exhibit and may need more than 104 times more mass than the stars which they produce. We posit that heavy element production (sulfur from oxygen) occurs in cryogenic Bose-Einstein condensates in which quantum mechanical tunneling occurs. A fraction of the condensate probably overcomes a barrier that could not be overcome under classical conditions assumed for fusion. A fraction of the Bose-Einstein condensate may tunnel through the coulomb barrier, which in the cubic nucleus model is so configured that it promotes nuclear fusion (as illustrated next in Figure 13). This process may involve the Josephson Effect where a fraction of condensate nuclei can tunnel through and fuse a fraction of the condensate tunnels through any barrier. Another important Bose-Einstein condensate property is coherence. Because of this property, it is possible to treat the whole condensate as a wave analogous to a coherent electromagnetic wave. Thus, it is possible for Bose-Einstein condensate molecules and their nuclei to constructively interfere and result in nucleon fusions. The cryogenic cubic nucleon fusion process does not require hot nuclear collision interactions such as those in stars.

We suggest that the planets Jupiter, Saturn, Uranus, and Neptune are relics of the cryogenic nascent cosmos, indeed a primordial Bose-Einstein condensate dark matter (BECDM) cosmos. Jupiter, Saturn, Uranus, and Neptune evidently remain cryogenic at their cores. Jupiter is an excellent example, composed primarily of hydrogen with a quarter of its mass being helium. The atmospheric proportions of hydrogen and helium are close to the theoretical composition of the primordial solar nebula. Jupiter is thought to consist of a dense hydrogen core, a surrounding layer of liquid metallic hydrogen with some helium and an outer layer predominantly of molecular hydrogen.

Jupiter radiates 1.5 - 2 times more energy than it receives from the Sun, Saturn radiates 2-3 times more energy, Uranus radiates 1.06 times more, and Neptune radiates 2.6 times more. The source of the excess thermal radiation is attributed to leftover heat from planetary formation, gravitational contraction, and from frictional heating. Our conjecture is that Jupiter, Saturn, Uranus, and Neptune formed in situ from a primordial cryogenic BECDM that existed from the earliest stages of the cosmos. The excess heat is probably primarily from ongoing deuteron fusion to alpha particles (as depicted in Figure 6) that is, cryogenic fusion of hydrogen-2 to helium-4, similar to Bose–Einstein condensate fusion being studied by Y. E. Kim [10]. Indeed, Jupiter’s sulfur satellite Io may be the spinoff of a cryogenic oxygen to sulfur fusion process.

Figure 13 schematically shows a concept of fusion nucleosynthesis of sulfur from oxygen based on the cubic lattice nucleus model. The fusion requires precise and specific orientations of nuclei and appropriate electron orbital resonances. The fusion depends on the affinity between deuteron modules that we characterize as coupled harmonic oscillators. When a deuteron is fused with an inverted deuteron, the combined oscillators are damped with the emission of energy (~ 9 MeV per event). Under Bose-Einstein condensate conditions, the affinity between deuterons should assure alignment and orientation of the oscillators and result in the fusion process. The required close proximity and alignment of nuclei already exist with O_2 molecules. The cubic nucleon model fusion process envisioned is similar to neutron capture by nuclei, in this instance facilitated by the open-ended aspect of the cubic lattice nucleus atoms. Instead of the capture of reactor-generated neutron flux, the captured species is an ambient flux of atomic nuclei.

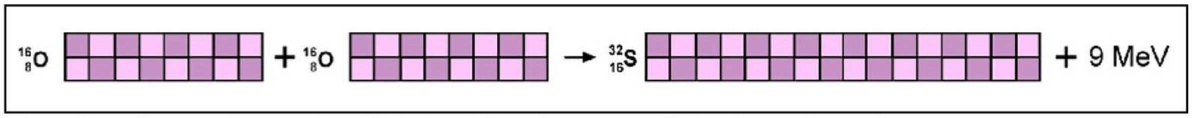

Figure 13 - Conceptual cryogenic cubic lattice fusion of oxygen nuclei forming a sulfur nucleus.

10. Discussion

We posit that the nascency of the cosmos consisted of uncountable minute energy-matter eruptions that produced the spacetime foundation for a Bose-Einstein condensate [3]. The Bose-Einstein condensate consisted of pervasive dark matter in the nascent cosmos. The dark matter agglomerated with the dynamical evolution of baryons and the growth of perturbations that provided the initial conditions for the formation of galactic nuclei, most likely of black holes. In the nascent Bose-Einstein condensate dark matter, perturbations presumptively grow more rapidly than is assumed by current cosmology models, leading to a much faster growth rate of baryonic perturbations, accelerating the galaxy and star formation process.

Studies of Bose-Einstein condensates demonstrate the implosion (fusion) and explosion (fission) of certain condensates. When the number of particles becomes sufficiently large, so that $N > N_c$, where N_c is a critical number, attractive inter-particle energy causes the condensate to implode, and at a certain critical value the imploded condensate stabilizes. The growing literature on Bose-Einstein condensate dark matter (BECDM) has been successful at describing large scale structure of the cosmos [11].

We suggest that dark matter is but an extraordinary cryogenic phase of ordinary baryonic matter that formed and agglomerated during the nascency and evolution of the cosmos. The cosmic microwave background blackbody radiation temperature of ~3 degrees Kelvin appears to be a relic indicator that the cosmos began as a vast Bose-Einstein condensate that fractionated, expanded, and agglomerated hierarchically, ultimately forming cryogenic dark matter galaxies which subsequently spawned the stars that illuminate them [12].

11. Conclusion

The cubic lattice nucleus model helps to explain conditions under which atoms fuse cryogenically and to explain the nucleosynthesis of elements and isotopes much heavier than hydrogen and helium in a presumed nascent nebular cryogenic cosmos. As a corollary, the model helps explain the presence and abundance of heavy elements and molecules in nebulae that evidently pre-exist the stars that may form within them.

Perhaps the most important feature of the cubic nucleon concept is that it supplements the standard model of particle physics. In the standard model, the Higgs boson was introduced as an ad hoc specification, along with other elementary particles that are grouped in an arbitrary way and depend on 24 numbers whose values cannot be deduced from first principles, but which have to be chosen to fit the observations. Although the standard model is imperfect, it is still considered to be adequate for all practical purposes. However, the cubic nucleon/nucleus concept predicts not only the muon and tauon of the standard model but other, yet to be discovered, massive electrons based on spacetime voxels [6].

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