DEVELOPING THE COSMOLOGY OF A CONTINUOUS STATE UNIVERSE

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"It is sensible and prudent... to think about alternatives to the standard model, because the evidence is not all that abundant... and we do know that the standard cosmological model is pointing to another surprise... because (it) *traces back to a singularity.* " P.J.E Peebles (1993)

Abstract. Although popular, Bigbang cosmology still contains untested assumptions and unresolved problems. Recent observational and theoretical work suggest it has become feasible to consider introducing a new standard model of cosmology. Parameters for developing a Continuous State Universe (CSU) are introduced in a primitive initial form.

1. Introduction

We have recently entered one of the periodic transitional phases in the evolution of fundamental theories of physics, giving sufficient pause to reinterpret the general body of empirical data. Recent refinements in observation of cosmic blackbody radiation [1] and various programs of theoretical modeling [2,3] suggest it might be reasonable to explore replacing the naturalistic Bigbang cosmology (BBC). A Continuous State Universe (CSU) based on alternative interpretations of the observational data is introduced in preliminary form. We begin reexamining pillars of BBC, briefly review alternate interpretations, then introduce general parameters for a continuous state universe (CSU).

Reviewing the historical development of physical theory [4] illustrates the fact that two general models, one unitary and the other dualistic, have evolved simultaneously in the scientific literature:

- Unitary Model. Naturalistic, Darwinian, Newtonian; a classically oriented model aligned with current interpretations of the standard models - i.e. Bigbang Cosmology, Bohr's phenomenological interpretation of Quantum Theory, standard Maxwellian electromagnetism and Einstein's General theory of Relativity. Many unanswered questions like the breakdown of Maxwell's equations at singularities remain.

- Dualistic Model. Includes all conventional wisdom plus extended theory; Bohm, de Broglie, Vigier, & Proca implying a polarizable Dirac vacuum with additional parameters and interactions. Best evidence is the Casimir effect. Offers plausible explanation for many unanswered questions, for example the Proca equations satisfy problems in electromagnetic theory. Also allows room for teleological causalities.

Only in the context of dualistic parallels of *extended theory* can a CSU cosmology be viably presented. The concept of a polarizable Dirac vacuum introduces an additional

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causal order not deemed acceptable in physical theory because it was considered unreasonable that spacetime could contain an ordered periodicity or significant additional symmetry. As discussed below a dual causality and additional vacuum symmetry invites extension of the Wheeler/Feynman [5] radiation law to dynamics of spacetime topology itself where the *present state* is comprised of a continuous *future-past* standing wave [6].

The CSU is intended as the next evolutionary step in the progression of modern cosmological modeling stemming from Einstein's 1917 proposal of a Static Universe (ESU) and the banner 1948 development of both the Steady-State Universe (SSU) of Bondi, Gold & Hoyle and the BBC by Gamow, Alpher and Bethe. Although the CSU could be considered a form of ESU or SSU modeling, it is sufficiently different to require a proliferation of nomenclature. For example the CSU has neither inflation or expansion; and the CSU is not confined to the limits of the $3(4)D+N_c$ Einstein/Minkowski/ Riemann/Hubble sphere of the current standard BBC and SSU models.

The CSU introduces a revolutionary structural change in the universe. The Hubble sphere represents only an observational limit. Fundamental CSU space is an absolute holographic-like space projecting a megaverse of a potentially infinite number of nested *relational* Hubble-type domains, each with different laws of physics and complete causal separation from our M_4 realm [7]. The additional subspace dimensions N_c hypothesized as compactified in the initial BBC event are not a subspace in the CSU; instead 'our' whole *relational* Hubble sphere is a subspace of an absolute hyperspace without dimensionality as now defined. Additional dimensions are not compact, but 'open', undergoing a process of continuous compactification and dimensional reduction as the 'standing wave' of the present is continuously created and recreated [8].

2. Parallel Interpretations Of Cosmological Data

	BIGBANG	CSU
RED SHIFT	Doppler recession of an inflationary expanding universe. ($m_\gamma = 0$)	'Tired light' phenomena, non-zero mass photon ($m_\gamma \neq 0$) couples to vacuum dissipating energy.
CMBR	$2.75^\circ k$ blackbody remnant of initial hot cataclysmic explosion ~ 20 billion years ago.	Result of continuous state blackbody emission by spacetime cavity QED electrodynamics inherent in a continuous compactification D reduction process.
OLBER'S PARADOX	Expansion of the universe accounts for dissipation of luminosity.	Lifetime of stars insufficient to illuminate heavens; absorption by vacuum coupling and dispersion by interstellar media.
MATTER	Matter creation at initial Bigbang. Missing dark matter required to explain galactic rotation etc.	Dark energy - balances the gravitational potential by matter in the megaverse. Results in flat spacetime. Spontaneous creation of matter; black hole evaporation removes evolved material.

3. Philosophy Of Space In CSU Cosmology - Origin Of Structure

Although the concept of Absolute Space (AS) as defined by Newton is discarded in contemporary physics, a deeper more fundamental form of AS nevertheless seems to

exist and is a required foundation for CSU Cosmology. The CSU reintroduces a complementary AS that is non Newtonian because Newtonian AS, once considered the basis of 'our space', first of all is only a form of Euclidian space without sufficient degrees of freedom to incorporate Quantum or Relativity theory. CSU AS is different, but similar enough that Newton deserves credit for realizing the importance of AS. Secondly the relational space of the Einstein universe contains insufficient symmetry parameters to describe the additional causal properties of a supralocal megaverse. The AS proposed by the CSU) (defined in postulate 1) represents the ground of all existence and 'resides' beyond the observed Hubble universe or even the infinite number of other possible supralocal nested Hubble-type spheres (with varied laws of physics) [7]. The ultimate nature of CSU AS remains ineffable at the moment, but empirical tests are being prepared [14, 19]. In the meantime we can deduce some AS properties to steer empirical investigations to higher order properties these deductions suggest.

Postulate 1: *Space is the most fundamental 'form or substance' of existence; and the origin of all structure. The demarcation and translation of which constitutes the basis of all energy or phenomenology. Space takes two forms in CSU cosmology, Absolute Space and the temporal relational subspaces that arise from it. A basis for energy* (*space geometry*) *is a fundamental form of information which signifies the cosmological foundation of causality. This postulate also connotes the most rudimentary basis of structural-phenomenology.*

The complementarity between the new concept of AS in CSU Cosmology and the contemporary relational space suggested by Einstein's theories of relativity can be simplistically represented as a 'virtual reality' by interpreting CSU AS as a fundamental background space of the related space fields referred to by Einstein's quote below.

Time is a complex process only just beginning to be addressed by physicists [9]. One can say that all forms of time [6, 9] represent various types of motion and in that sense time can be discounted as a concept (i.e. - not absolutely fundamental). Then geometric translation or field propagation becomes more fundamental. Thus space (whatever it is) is the most fundamental concept of the universe. Space with boundary conditions or energy is fundamental to all forms of matter.

Difficulty in defining the fundamental nature of a spacetime stems from the incomplete unification of quantum and gravitational theories with electromagnetism [3]. The conceptual disparity arises in terms of correspondence between the Newtonian worldview of a continuous AS in opposition to current Einsteinian view of discreteness. This debate about the nature of space has continued at least since Aristotle. Einstein in his last published statement regarding the nature of space and time said:

> "The victory over the concept of absolute space or over that of the inertial system became possible only because the concept of the material object was gradually replaced as the fundamental concept of physics by that of the field...The whole of physical reality could perhaps be represented as a field whose components depend on four space-time parameters. If the laws of this field are in general covariant, then the introduction of an independent (absolute) space is no longer necessary. That which constitutes the spatial character of reality is then simply the four-dimensionality of the field. There is then no 'empty space', that is, there is no space without a field." [10].

Einstein's view is a form of the *relational theory* of space developed by Leibniz and Huygens [12,13]. The relational model is limited to the Hubble sphere of human observation. The HD supralocal megaverse retains an absolute character of which Einstein's relational domain is a corresponding subspace. Relationalism is in opposition to 'substantivalism' which gives space the ontological status of an independent reality as

a kind of *substance*[12]; the Newtonian concept of absolute space being the prime example. As stated above the CSU redefines the nature of absolute space.

3.1 THE WHEELER GEON CONCEPT

Wheeler [17] postulates a photonic mass of sufficient size to self cohere spherically. In Wheeler's notation the Geon is described by three equations. The first (1) is the wave equation, followed by two field equations the first (2) of which gives a mass distance relationship and the second (3) variation of the factor Q:

$$d^2 f / d\rho^{*2} + [1 - (l^* Q / \rho)^2 (1 - 2L / \rho)] f = 0 \tag{1}$$

with circular frequency $c\Omega$ related to the dimensionless radial coordinate $\rho = \Omega r$ such that $d\rho^*$ is the abbreviation for $d\rho^* = Q^{-1}(1 - 2L/\rho)^{-1} d\rho$

$$dL / d\rho^* = (1/2Q)[f^2 + (df / d\rho^*)^2 + (l^* Qf / \rho)^2 (1 - 2L / \rho)] \tag{2}$$

$$dQ / d\rho^2 = (\rho - 2L)^{-1}[f^2 + (df / d\rho^*)^2] \tag{3}$$

Wheeler states that this system of equations permits change of distance scale without change of form [17].

3.2 THE HYPER-GEON DOMAIN OF CSU FIELD THEORY

Wheeler originally defined the Geon as a classical spacetime construct. A more complex Hyper-Geon postulated to reside beyond 3(4)D relational spacetime is utilized in the CSU[9]; and acts as an HD *cover* engulfing the Einstein/Hubble Universe. It forms the lower bound energy of a projected 12D space and action principle of the unified field.

***Postulate 2*:** *The Supralocal Hyper-Geon is the most fundamental energy or phenomenology of existence. This Energy arises from the ordering and translation of AS 'space' (i.e. information or change of entropy). This fundamental Geon energy, is the unified field, the primary quantum of action of all temporal existence; filling the immensity of space (nonlocally) controls the evolution of the large scale structure of the universe, the origin of life ('elan vital') of classical philosophy and finally is the root and 'light of consciousness'.*

4. Introduction To The CSU Spacetime Formalism

Extending work by Rauscher [8], and Cole [20] on 8D complex Minkowski space $M_4 + C_4$; the CSU is instead formalized utilizing a 12D complex Minkowski metric $M_4 + C_8$ (or $\pm C_4$) developed from the standard four real dimensions plus 8 imaginary D representing a *retarded* and *advanced* complex hyperspace topology S_N. Cramer [15] expanded the Wheeler/Feynamn absorber radiation law [5] to include quantum theory. The S_N complex hyperspace representation further extends Wheeler/Feynman law to the continuous topological transformation of spacetime itself. For symmetry reasons the

standard Minkowski line element metric $ds^2 = g_{ij}dx^i dx^j$ is expanded into periodic *retarded* and *advanced* topological elements fundamental to relational space 'extension':

$$F^{S_N}_{symM_4} = \frac{1}{2}\left[R^{S_N}_{retC_4} + R^{S_N}_{advC_4}\right], \tag{4}$$

which adapts the complex $(M_4 + C_8)$ Minkowski metric from a standard form

$$S_N = S_0 + S_1 + S_2 \tag{5}$$

to a periodic form for application to 11(12)D CSU spacetime where $S_0 = M_4$, the new 3(4)D 'standing wave' Minkowski 'present' spacetime; and $S_1 = -C_{4(ret)}$ and $S_2 = +C_{4(adv)}$ for complex correspondence to the standard 4 real dimensions utilizing 8 imaginary dimensions. The 8 imaginary dimensions, while not manifest generally on the Euclidean real line, are nevertheless 'physical' in the CSU [6]; and can be represented by coordinates $X = \pm(x + i\xi), Y = \pm(y + i\eta), Z = \pm(z + i\zeta)$ and $t = \pm(t + i\tau)$ designating correspondence to real and retarded/advanced continuous spacetime transformation.

The complex 12 dimensional CSU space, $(M_4 + C_8)$, can be constructed so that $Z^i = \chi^i_{\mathrm{Re}} + i\chi^j_{\mathrm{Im}}$ and likewise for Z^j where the indices i and j run 1 to 4 yielding (1, 1, 1, -1) [8]. Hence, we now have a new complex twelve space metric $ds^2 = \pm(\eta_{ij}dZ^i dZ^j)$. We can further develop this space in terms of the Penrose twistor algebra, asymptotic twister space and spinor calculus since twister algebra as already developed by Penrose falls naturally out of complex spaces and the twistor is derived from the imaginary part of the spinor field [8]. In CSU singularities take a 3-torus form.

The Penrose twistor SU(2,2) or U_4 is constructed from four spacetime, U_2 $\tilde{U}_2$ where U_2 is the real part of the space and $\tilde{U}_2$ is the imaginary part of the space. The twister Z is usually a pair of spinors U^A and π_A which Penrose uses to represent a twistor as in the case of the null infinity condition a zero spin field is $Z^e\overline{Z}_e = 0$ [8].

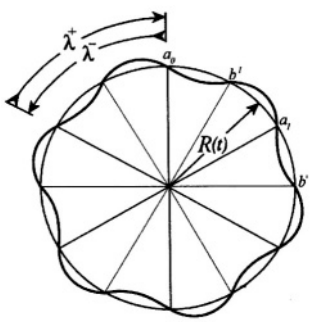

Figure 1. Counterpropagating, complex, future-past, 'hyper-Geon' elements act in concert to 'create' instantaneous harmonic elements of localized Euclidian 3-sphere extension. They are 'standing wave' relational spacetime extensions *R(t)* of the absolute 12D hyperspace that form the fundamental basis of observational reality representing a metric framework for events and interactions. Extension is mediated by the noumenal action principle of the unified field by $F_n = E_n / R_{(t)}$, where E_n is energy of the unified field [18].

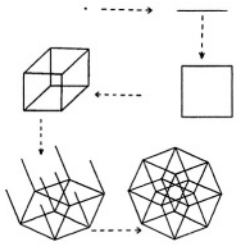

Figure 2. Compactification is a continuous process of D reduction. A 12D CSU provides enough degrees of freedom so that two complex imaginary 3(4)D spacetime packages can topologically transform into a "standing wave" present, i.e. the present has a future-past basis by extending Wheeler- Feynman radiation law to include the continuous state transformation of the topology of spacetime dynamics itself.

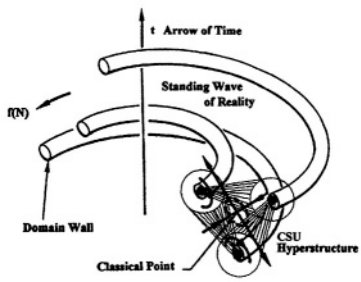

Figure 3. The three 3(4)D ($S_0 = M_4$, $S_1 = -C_{4(ret)}$ and $S_2 = +C_{4(adv)}$) spacetime packages surround a virtual Planck scale singularity, (in the form of a 3-torus $\left[\sqrt{(x^2+y^2)}-R\right]^2+z^2=r^2$) the continuous propagation of which 'create and recreate' periodically the 'standing wave' Euclidean real line illustrating the virtual basis of relational Einsteinian reality as a subspace of absolute HD CSU space.

5. Conclusions

Scientific theory, whether popular or unpopular at any point in history, must ultimately be based on description of natural law, not creative fantasies of a scientist's imagination. Only by adequate determination of natural law can a theory successfully model reality. *"There is good reason for the taboo against the postulate of new physics to solve new problems, for in the silly limit one invents new physics for every new phenomena* [15]*"*. Cosmology is becoming a mature science; mature enough that there is no room for surprises?

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