THE ORIGIN OF CMBR AS INTRINSIC BLACKBODY CAVITY-QED RESONANCE INHERENT IN THE DYNAMICS OF THE CONTINUOUS STATE TOPOLOGY OF THE DIRAC VACUUM

Aplications of Quantum Gravity Part II [1]

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Abstract. The isotropic Cosmic Microwave Background Radiation (CMBR) is reinterpreted as emission from the geometric structure of spacetime. This is postulated to occur in the context of the Wheeler/Feynman transactional radiation law, extended to include the dynamics of spacetime topology in a framework of continuous state Spacetime Cavity-QED (STCQED) where the Planck Blackbody spectrum is described as an equilibrium condition of cosmic redshift as absorption and CMBR as emission. The continuous state spin-exchange compactification dynamics of the Dirac vacuum hyperstructure is shown to gives rise naturally to a $2.735° K$ Hawking type radiation from the topology of Planck scale micro-black hole hypersurfaces. This process arises from the richer *open* Kaluza-Klein dimensional structure of a post Bigbang continuous state cosmology.

1. Introduction

A putative model of CMBR/Redshift as blackbody emission/absorption equilibrium is predicted to occur in the Cavity-QED (STCQED) Spacetime topology of the polarized Dirac vacuum is presented in terms of a continuous state, periodic dimensional reduction, topological spin-exchange

1. For *part I* see Amoroos, R.L, Kafatos, M. & Ecimovic, P. , The origin of cosmological redshift in spin exchange vacuum compactification and nonzero rest mass photon anisotropy, in G. Hunter, S. Jeffers & J-P Vigier (eds.) Causality and Locality in Modern Physics, 1998, Dorderecht: Kluwer Academic.

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compactification process. The dynamics of this new CMBR model take place in the context of a post Bigbang continuous state universe (CSU) model where the *present* is a standing wave of the *future-past,* (Amoroso, 2002a). The well known Wheeler-Feynman absorber radiation law (1945)was extended by Cramer (1986) and independently by Chu (1993)to include quantum theory; (WFCC) for short. In this preliminary paper, WFCC theory is further extended to include continuous state transformations, *future-past topological dynamics,* of a 12D complex $(M_4 \pm C_4)$ Minkowski spacetime (S_N) (Amoroso, 2000, 2002). The 3-torus singularity structure of *f-p standing wave dynamics* are a foundational principle of the Continuous State Universe (CSU). Thus in WFCC-CSU theory any present state or event is a result of a complex tier of future-past influences as illustrated in unexpanded form by

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

It is common knowledge that photon emission results from electromagnetic dipole oscillations in boundary transitions of atomic Bohr orbitals. Bohr's quantization of atomic energy levels is applied to the topology of Spacetime CQED boundary conditions (STCQED) in accordance with equation (1) where spacetime QED cavities of energy E_i undergo continuous harmonic transition to a higher state $E_j (> E_{iH})$ (redshift-absorption mode) or to a lower state $E_k (< E_{iL})$ (CMBR-emission) according to $h\nu = E_j - E_{iL} = E_{iH} - E_k$. Thus we postulate that boundary conditions inherent in continuous standing wave spacetime spin exchange cavity compactification dynamics of vacuum topology also satisfy the requirements for photon emission. In metaphorical terms, periodic phases or modes in the continuous spacetime transformation occur where *future-past exiplex*[2] *states* act as *torque moments* of CMBR/Redshift BB emission/absorption equilibrium.

Compactification appears as localized scalar potentials to standard quantum measurement, but nonlocally, in the WFCC-CSU model, are a continuous transformation of QED or SED hyperdimensional cavities in black body equilibrium. Delocalized compactification dynamics produce a periodic mass equivalency by oscillations of the gravitational potential (GP) providing the action principle for absorption and emission (see section7). Theoretical feasibility of Planck scale Black Holes (BH) has long been demonstrated (Markov, 1966). Thus the CMBR can be considered a form of Hawking radiation (Hawking, 1976) from the hypertiling of the Dirac sea. The CSU is modeled as a type of hyperdimensional Klein bottle, topologically representative of Kant's antinomy of an open/closed spacetime. The hypergeometry of which translates in a metric of comoving Birkhoff spheres (Birkhoff, 1923) where $\dot{R} \equiv C$ is preserved through all levels of scale (Amoroso, Kafatos & Ecimovic, 1998, Kafatos, Roy & Amoroso, 2000). Taking the Hubble sphere as the arbitrary radius of the observable universe, the GP is opposed within the sphere, not by inflation but by a nonlocal equivalence to the GP, i.e *dark energy* of the megaverse (Amoroso, 2002).

2 An *exiplex* (a form of eximer), usually chemistry nomenclature, used to describe an excited, transient, combined state, of two different atomic species (like XeCl) that dissociate back into the constituent atoms rather than reversion to some ground state after photon emission.

Both CMBR-emission and Redshift-absorption arise from an 'electromotive torque' (17) in the GP equivalent acceleration of the translation of the co-moving topology of higher and lower spacetime dimensions fundamentally equivalent to a Planck scale black body hypersurface.

2. General Properties Of Black Body Radiation

A BB cavity radiates at every possible frequency dependent on the temperature of the walls of the cavity. In thermodynamic equilibrium the amount of energy $U(\nu)$ depends only on temperature and is independent of the material of the walls or shape of the container. The radiation field behaves like a collection of simple harmonic oscillators that can arbitrarily be chosen to have a set of boundary conditions of dimension *L* which is repeated periodically through spacetime in all directions. These boundary conditions will yield the same equilibrium radiation as any other boundary conditions, and with this result no walls are actually required because the walls thermodynamically only serve in the conservation of energy (Bohm, 1951); allowing the putative feasability of a STCQED origin for CMBR to be compatible with natural law.

2.1 BLACKBODY CAVITY - COSMOLOGICAL CONSTRAINTS

Defining the observable universe as an Einstein 3-sphere, any spherical distribution of matter of arbitrary size (according to the general theorem proven by Birkhoff) (1923) maintains a uniform contribution of the GP with any particle in the volume. Metaphorically the WFCC-CSU model defines the radius of the universe *R* in terms of a comoving Hubble sphere with the topology of a hyper-Klein bottle. This relation maintains itself through all levels of scale. Therefore Birkhoff's theorem can apply hyperdimensionally to all matter in the megaverse. This can explain the origin of the cosmological constant, why space appears universally flat and why 3-sphere dark matter is not required to explain galactic rotation since in CSU cosmology (Amoroso,2002a), it is instead a magaversal *dark energy*.

This arbitrary cavity putatively modeling the structure of the universe, as drawn from current astrophysical data, is generally accepted to be a perfect BB radiator of 2.75 $^\circ K$. Einstein introduced the cosmological constant to balance the GP in a *static universe*. Which he then retracted when Hubble discovered what was erroneously thought to be a Doppler recessional redshift, apparently obviating the need for a cosmological constant. Further Einstein postulated the existence of singularities derived from the field equations of general relativity; from which Friedman suggested that the universe itself originated in a temporal singularity giving rise to the Bigbang model of recent history. It has been shown in *Part I* (Amoroso, Kafatos & Ecimovic, 1997) that redshift is intrinsic to photon mass anisotropy; suggesting that recession is an observational rather than a Doppler Bigbang effect.

When the CMBR was discovered it was interpreted as definitive proof that the Bigbang was the correct model of creation. However, the same observational data may be also interpreted in the manner here. CSU Gravity, which models compactification as a rich dynamic hyperstructure provides an inherent mechanism to balance the GP in a *static universe* where the CMBR is not a remnant of adiabatic inflation but intrinsic to the equilibrium conditions of Planck scale spacetime CQED or CSED.

2.2 BLACKBODY MICROCAVITY CONSTRAINTS

Dirac vacuum CQED boundary conditions are taken to represent the walls of Birkhoff BB-BH microcavities comprised of a tiled stochastic hyperstructure of Planck scale S_N phase cells with the lower limit of dimensional size determined by the Heisenberg uncertainty principle with the cavity volume defined by $\delta x \delta y \delta z \delta p_x \delta p_y \delta p_z = |h|^3$ and the energy for each coordinate defined by $\sum_{S_N} \delta E_N \delta t \sim h$ (Amoroso, 2002). During the continuous cycles of dimensional reduction the energy E is parallel transported by an *energyless Topological Switching*[3] of higher to lower dimensionality $D-(\delta E_x \delta t)$ without distorting the smoothness of perceived macroscopic realism because of the standing wave spin exchange process. Although in CSU reality the Planck backcloth is a 11(12)D hypertiling of topologically comoving hyperstructures, not a rigid tiling of 3D cubes with primal fixed compactification as in Bigbang theory.

2.2.1 *CMBR Energy Damping by Vacuum Conductivity*

Planck's radiation law for a harmonic oscillator is energy per unit time per unit volume. An order of magnitude calculation for the energy of a single transverse CMBR cavity wave mode for the energy density is $\omega = \frac{1}{2}\varepsilon_0 E^2 + \frac{1}{2\mu_0} B^2 \approx \varepsilon_0 E^2$. According to Lehnert & Roy (1998) energy $E = E_0(r - c_0 t) \cdot \exp(-\frac{1}{2} R\sigma r$ where R is radius of the universe and r is direction of propagation. This implies that the energy density has an e-folding decay length $L_{decay} = \frac{1}{R\sigma}$ where $\sigma \equiv$ conductivity of the vacuum because the conductivity is extremely small. The corresponding energy decay time (damping time for E to decay from original value) would be $t_{decay} = L_{decay} / c = 1 / R\sigma c \equiv$ absorption time of the "tired light" redshift absorption effect. This applies to all waves where R is radius of universe.

3. Black Holes

Any number of bosons may cohere in a phase cell while Fermions must have energy $\Delta E \Delta t < h$ to occupy the same domain because of the Pauli exclusion principle and therefore must be degenerate in black holes. These Planck volumes considered as the boundary conditions of the cavity ground state, cohere stochastically to embody any required energy configuration. The general expression for BB radiation derived by Planck takes the form:

$$M_\lambda^b = 2\pi hc^2 \lambda^{-5} (e^{hc/\lambda kT})^{-1} \tag{2}$$

where $M_\lambda^b(T)$ is spectral emittance, and k is the Boltzmann constant. Hawking found a similar relationship for the hypersurface of a black hole (Hawking, 1974a, 1976). The topology of the Planck backcloth has been considered to be a latticework of micro black holes. The thermodynamic relationship between black hole area and entropy

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3 *Topological Switching* refers to the optical illusion occurring when fixating on a panel of Necker cubes where a background vertex switches to a foreground vertex; here utilized as a metaphor of how parameters of a higher dimensional topology may interplay harmonically by parallel transport into lower dimensional structures.

$E_{\deg raded} = \left(\sum Area / 16\pi\right)^{1/2} = \left(\sum M^2_{iired.}\right)^{1/2}$ (Beckenstein, 1973) and emittivity (Hawking, 1974a,b; Berezin, 1997) found to occur at the hyperstructure surface of a black hole is putatively developed here for similar emittivity for CMBR black body emission intrinsic to the CQED features of spacetime topology.

3.1 SIZE TEMPERATURE RELATIONSHIP OF KERR BLACK HOLES

Bekenstein, (1973) suggested a relationship between the thermodynamics of heat flow and the surface temperature of a BH, which led Hawking, 1974a to the finding that all BH's can radiate energy in BB equilibrium because the entropy of a black hole S_{bh} is related to the surface area A of its event horizon. Where k is Boltzmann's constant, $S_{bh} = M^2 2\pi [kcG / (h / 2\pi)]$ (Sung, 1993). This leads to the expression for the surface temperature of a black hole:

$$T(^\circ K) = (h / 2\pi) D / [32\pi h M (M - 1/2Q^2) / M + D] \tag{3}$$

where $D = (M^2 - Q^2 - L^2 / M^2)^{1/2}$, Q = charge, and L = momentum (Sung, 1993). This shows that the BB temperature of a BH is the inverse of its mass, which for a typical Kerr BH represents a temperature of one $^\circ K$ for a BH a little larger than the moon or for each 10^{26} gm..

Accordingly the Beckenstein - Hawking relationship, while a stellar mass BH has the expected fractional degree temperature, the predicted temperature for microcavity Planck scale BH would be about $1.9x10^{31}{}^\circ K$. Therefore the additional physics of WFCC-CSU spin exchange dynamics must be added to account for the difference in the geometry of a black hole having a fixed internal singularity structure with a lifetime of billions of years and a Planck scale black hole with an open singularity (Amoroso, 2002) rotating at the speed of light c with a Planck time lifetime of 10^{-44} sec.

While a micro-BH might be considered to have a temperature of billions of degrees Kelvin if the nature of its internal singularity and total entropy is derived through the predictions of GR and bigbang cosmology; because according to GR a singularity occupies no volume and has infinite energy density. But GR breaks down and is known to be incomplete at the quantum level; requiring new physics to describe spacetime quantization. Further, although Einstein said 'spacetime is the ether' (Einstein, 1922) radiation was still considered to be independent of the vacuum, which is now known not to be the case (Amoroso, Kafatos, & Ecimovic, 1997).

3.2 TEMPERATURE RELATIONSHIP OF DIRAC CAVITY 'BLACK HOLES'

In the transition from the Newtonian continuum to quantum theory, what still remains to be properly addressed is the ultimate nature of a discrete point. The infinite density Einstein singularity is still too classically rooted. In terms of WFCC-CSU the energy density is delocalized in terms of the equivalent GP of compactification dynamics. Planck scale black body cavities are topologically open nonlocally and spin exchange entropy through a continuous flux of energy; and are not scalar compactified singularities originating in a Bigbang, but constantly accelerate toward an open propagating ground that is never reached nonlocally. The inertia inherent in this dynamic results in the intrinsic $2.75^{\circ} K$ CMBR

4. Spin Exchange

Starting with the Hawking radiation modification of the Planck BB relationship as applied to BH surface dynamics, the requirement for application to a quantum BB QED cavity generally defined as the phase space of $|h_c|^4$ in (5) is the addition of spin exchange parameters. Where

$$\sum_{i}^{Z^a Z_a} N_i \left| P_l / P_t \right|^4 = |h_c|^4 \Leftrightarrow C_\gamma . \tag{4}$$

N is the complex sum of Planck hyperunits comprising one BB QED microcavity.

Spin dynamics can be readily described using the density matrix formalism. Spin states are represented as linear combinations of α and β states corresponding to the spin eigenvalues; and can be used in terms of the wave function to determine the value of spin characteristics Q.

$$Q = |S_{c1}|^2 Q_{\alpha\alpha} + S_{c1} S_{c2}^* Q_{\alpha\beta} + S_{c1}^* S_{c2} Q_{\beta\alpha} + |S_{c2}| Q_{\beta\beta}$$
$$\rho = \begin{bmatrix} |S_{c1}|^2 & S_{c1}^* S_{c2} \\ S_{c1} S_{c2}^* & |S_{c2}|^2 \end{bmatrix} \tag{5}$$

The density matrix ρ is made up of the spin coupling coefficients S_{c1} and S_{c2}. The diagonal elements correspond to real local spin orientations, and the nondiagonal elements correspond to complex quantities representing spin projection on planes perpendicular to axes of quantization. For the purposes of discussion any arbitrary axis may be chosen as an axis of quantization; but in the spin exchange process the geometry of the complex topology of the Argand plane transforms from real to complex in the retiling of compactification dynamics. The variance in the diagonal elements effects the longitudinal spin polarization along the axis of quantization; and the nondiagonal variances effect transverse spin polarizations. It is the phase of the elements that determine the angle of spin coupling with each dimensional axis. This relates CMBR emission/absorption to the cycle of torque moments.

The mass equivalent inertial properties comprising the linear and angular momentum components of spin exchanged in the nonlocal compactification structure allow the Dirac vacuum to maintain perfect BB equilibrium inside the scale invariant Hubble Birkhoff sphere.

5. Spontaneous Emission Of CMBR By Spacetime Cavity QED

This preliminary model for continuous spontaneous emission of STCMBR directly from CQED dynamics of the stochastic properties of the Dirac sea, obviates CMBR origin as the relic of an initial state Bigbang cosmology as the standard model has predicted. In this model we make one speculative new assumption that is not based on the published body of empirical data for CQED. Spontaneous emission by atomic coupling to vacuum zero-point fluctuations of the Dirac sea is already an integral part of CQED both in the laboratory and theory; here we postulate that a similar process can occur in free space. In classical electrodynamics the vacuum has no fluctuation; by contrast quantum radiation can be viewed as partly due to emission stimulated by vacuum zero-point fluctuations.

The literature on CQED is rich in descriptions of the nature of spontaneous emission of radiation by atoms in a cavity (Berman, 1994) We begin development by choosing, for historical reasons, the upper limit of the number of atoms in the vacuum of space to the figure of one atom per cubic centimeter as derived by Eddington, (1930). This figure could be considered arbitrary, but for our purposes it is sufficient to note that *there are sufficient free atomic particles moving in space for spontaneous* CSU-STCQED *emission* of WFCC-CMBR.

> « Charged particles are coupled to the electromagnetic radiation field at a fundamental level. Even in a vacuum, an atom is purturbed by the zero-point field, and this coupling is responsible for some basic phenomena such as the Lamb shift and spontaneous radiative decay. » (E.A. Hinds, 1993)

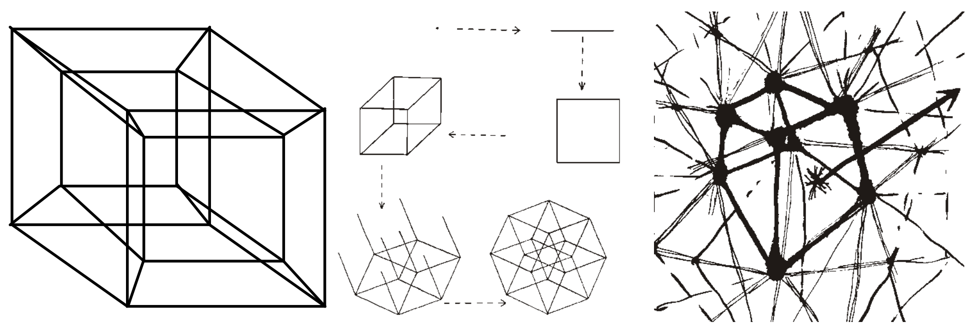
Recent developments in CQED have included descriptions of emission by Rydberg atoms in microwave cavities that include optical frequencies. (Carmichael et al, 1993 ; Jhe et al, 1987; Heinzen et al, 1987 ; Raizezn et al, 1989; Zhu et al, 1990; Thompson et al, 1992 and Rempe et al, 1991. The Rydberg formula for atomic spectra is related to the binding energy of an electron by:

$$R = \mu_0^{\,2} me^{\,4} c^{\,3} \,/\, 8 h^{\,3} \qquad (6)$$

where μ_0 is the magnetic permeability which is the ratio of the magnetic flux density *B* of an atom to an external field strength *H*. $\mu = B / H$ which is also related to the permeability of free space μ_0, the Coulomb constant *k* and the magnetic constant k_m by

$$c = \sqrt{\frac{k}{k_m}} = \frac{1}{\sqrt{\mu_0 / \varepsilon_O}} = 3x10^8 m/s$$

where ε_0 is the vacuum permittivity of free space; *m* and *e* are mass and charge of an electron respectively, *c* is the speed of light and *h* is Planck's constant. In the nonperturbative regime strength



of the dipole coupling is larger than the dissipation rate and quantum mechanical effects have been shown to include multi-photon resonance, frequency shifts and atomic two state behavior at vacuum Rabi resonance, the latter of which will be of most interest in our discussion (Carmichael, et al,1993).

Figure 1. a) In CSU cosmology Euclidian space is a subspace of complex HD space (The reverse of Bigbang theory); such that each 3(4)D scale invariant 'cell' is covered by the hyper-geon of the unified field and it's associated action. b) Illustration of continuous D reduction; Not observable from a Euclidian orientation because

it is imbedded in complex space $(\pm C_4)$. c) A CMBR photon emission from the Planck CQED backcloth *exiplex torque modes* of the *future-past* WFCC-CSU compactification cycle.

Spontaneous emission requires only a single quantum so the internal state of the atom-vacuum coupled cavity system may be described by the simple quantum basis

$$|0\rangle|-\rangle,\ |0\rangle|+\rangle,\ |1\rangle|-\rangle \tag{7}$$

where $|0\rangle$ and $|1\rangle$ are the Fock photon states and $|-\rangle$ and $|+\rangle$ are two states of the Rabi/Rydberg atom. Momentum operators $x(p)$ an d $y(p)$ relate center of mass and atom ground state $|-\rangle$ dynamics where a master equation can describe the two state atom interacting with the mode of the vacuum cavity momentum distribution after spontaneous emission and the emission spectra (Ren et al, 1992; Carmichael et al, 1993).

$$\dot{\rho}=(1/i\hbar)[\hat{H},\rho]+\kappa(2\hat{a}\rho\hat{a}-\hat{a}\hat{a}\rho-\rho\hat{a})+$$
$$(\gamma_I/2)(2\hat{\sigma}-\rho\hat{\sigma}_+-\hat{\sigma}_+\hat{\sigma}_-\rho-\rho\hat{\sigma}_+\hat{\sigma}_-) \tag{8}$$

where the a's are the boson creation and annihilation operators and the sigma's the raising and lowering operators for the atom (Carmichael, 1993).

We assume that the atom acts classically as a free wave-packet where $\rho_{\text{int}}(t)$ describes the internal state of the system which can be described by

$$\rho_{\text{int}}(t)=w(t)(|0\rangle|-\rangle)(\langle-|\langle0|)+|E_{\text{int}}(t)\rangle\langle E_{\text{int}}(t)|,$$

(9)

With

$$|E_{\text{int}}(t)\rangle=x(t)|1\rangle|0\rangle+y(t)|0\rangle|+\rangle,$$

(10)

where

$$\frac{dx}{dt}=-(\kappa+i\omega_0)x+g\quad\cos(\Omega t+\Phi)y,$$

(11)

And

$$\frac{dy}{dt}=-\gamma_1/2+i\omega_0)y-g\quad\cos(\Omega t+\phi)x,$$

(12)

In addition to the atoms classical motions as a free wave-packet, the vacuum coupled system when excited, has two harmonic potentials related to the atoms motion and spontaneous emission process as in the following from Carmichael, 1993.

$$|\mu\rangle=(1/\sqrt{2})(|0\rangle|+\rangle+i|1\rangle|-\rangle)$$

(13)

$$|l\rangle = (1/\sqrt{2})(|0\rangle|+\rangle - i|1\rangle|-\rangle)$$

(14)

Vacuum Rabi atomic orbital splitting is the normal mode splitting of the coupled harmonic oscillators ; one mode describing the atomic dipole and the other the cavity field mode. This system of coupled harmonic oscillation is extremely versatile and can be applied to describe Dirac vacuum cavity QED emission of the CMBR when driven by the vacuum quantum mechanical stochastic field. Our application to the CMBR is based on the work of Agarwal, 1991 and Carmichael, 1993 on the nature of stochastic driving fields in CQED.

Starting with the hamiltonian for a coupled harmonic oscillator

$$H(t) = \tfrac{1}{2}(p_A^2 + p_C^2) + \tfrac{1}{2}\omega_0^2(q_A^2 + q_C^2) + 2\omega_0 g \quad \cos(\Omega t + \phi) q_A q_{C,} \qquad (15)$$

where q_A, q_C, p_A, p_C are the coordinates and momenta of the one dimensional oscillator ; with the subscripts A and C referring to atomic dipole and cavity modes respectively of the Rabi/Rydberg atom in free space. The oscillator coupling is modulated by the Doppler frequency Ω , with phase ϕ modulating the dipole coupling constant for atomic motion ; the equations of which take the form of equations (12) (Carmichael, 1993).

This has been a non-perturbative formalism much simpler to interpret than a QED perturbative expansion that we deem sufficient for this stage of development of the Vigier-Amoroso CQED CMBR Dirac spacetime emission theory.

6. Possibility Of Blackbody Emission From Continuous Spacetime Compactification

It is also suggested that further development of the CQED model of CMBR emission could be extended to include spontaneous emission from the continuous dimensional reduction process of compactification. This would follow from modeling spacetime cavity dynamics in a manner similar to that in atomic theory for Bohr orbitals. In reviewing atomic theory Bohm, (1967 states :

> « Inside an atom, in a state of definite energy, the wave function is large only in a toroidal region surrounding the radius predicted by the Bohr orbit for that energy level. Of course the toroid is not sharply bounded, but ψ reaches maximum in this region and rapidly becomes negligable outside it. The next Bohr orbit would appear the same but would have a larger radius confining ψ and propagated with wave vector $k = \rho / h$ with the probability of finding a particle at a given region proportional to $|\psi|^2 = |f(x, y, z|^2$. Since *f* is uniform in value over the toroid it is highly probable to find the particle where the Bohr orbit says it should be « (Bohm, 1967)

.

A torus is generated by rotating a circle about an extended line in its plane where the circles become a continuous ring. According to the equation for a torus. $[\sqrt{(x^2 + y^2)} - R]^2 + z^2 = r^2$ where *r* is the radius of the rotating circle and *R* is the distance between the center of the circle and the axis of rotation. The volume of the torus is $2\pi^2 Rr^2$ and the surface area is $4\pi^2 Rr$, in the above Cartesian formula the *z* axis is the axis of rotation.

Electron charged particle spherical domains fill the toroidal volume of the atomic orbit by their wave motion. If a photon of specific quanta is emitted while an electron is resident in an upper more excited Bohr orbit, the radius of the orbit drops back down to the next lower energy level decreasing the volume of the torus in the emission process.

We suggest that these toroidal orbital domains have properties similar to QED cavities and apply this structure to *topological switching* during dimensional reduction in the continuous state universe (CSU) model (Amoroso, 2000, 2002). To summarize pertinent aspects of CSU cosmology :

1. Compactification did not occur immediately after a big bang singularity, but is a continuous process of dimensional reduction by *topological switching* in view of the Wheeler-Feynman absorber model where the present is continuously recreated out of the *future-past*. Singularities in the CSU are not point like, but dynamic wormhole like objects able to translate extension, time and energy.

2. The higher or compactified dimensions are not a subspace of our Minkowski 3(4)D reality, but our reality is a subspace of a higher 12D megaverse of three 3(4)D Minkowski spacetime packages.

During the spin-exchange process of dimensional reduction by topological switching two things pertinent to the discussion at hand :

1. There is a transmutation of dimensional form from *extension to time to energy* ; in a sense like squeezing out a sponge as the current Minkowski spacetime package recedes into the past down to the Planck scale ; or like an accordian in terms of the *future-past* recreating the present.

2. There is a tension in this process that could be like string tension in superstring theory that allows only specific loci or pathways to the dimensional reduction process during creation of the transient Planck scale domain . Even though there are diccrete aspects to this process it appears continuous FAPP from the macroscopic level (like the film of a movie); the dynamics of which are like a harmonic oscillator.

With the brief outline of CSU parameters in mind, the theory proposes that at specific modes in the periodicity of the Planck scale pinch effect, cavities of specific volume reminiscent of Bohr toroidal atomic orbits occur. It is proposed rather speculatively at present that these cavities, when energized by stochastically driven modes in the Dirac ether or during the *torque moment* of excess energy during the continuous compactification process, or a combination of the two as in standard CQED theory of Rabi/Rydberg spontaneous emission, microwave photons of the CMBR type could be emitted spontaneously from the vacuum during *exiplex* torque moments. This obviously suggests that Bohr atomic orbital state reduction is not the only process of photon emission; (or spacetime modes are more fundamental) but that the process is also possible within toroidal boundary conditions in spacetime itself when in a phase mode acting like an atomic volume. A conceptualization of a Planck scale cavity during photon emission is represented in figure 1c with nine dimensions suppressed.

7. Deriving The Topological Action Principle For Dirac Cavity CMBR Emission

Well known forms of the Schrodinger equation central to quantum theory have correspondence to Newton's second law of motion $\sum f = ma$; which is also chosen as the formal basis for CSU CMBR emission theory. A more rigorous defense of the logic for this choice will be given elsewhere. Here only the postulate that CMBR emission is governed by a unified electo-gravitation action principle is stated. Neither Newtonian $F = Gm_1 m_2 / r^2$ (although it was derived from $f = ma$)

nor Einsteinian $G = 8\pi T$ gravitation is utilized for deriving the *advanced/retarded* description of CMBR emission because the related structural-phenomenological boundary conditions of the cavities topology has no relation to classical dynamics which both of these theories do. Newton's gravitation law also contains a constant of undesired dimensionality; whereas $f = ma$ is without dimensionality. For similar reasons Einstein's gravity is also not chosen.

Since relativistic energy momentum and not mass is required, first we substitute Einstein's mass energy relation $E = mc^2$ into Newton's second law and obtain: $F_{(n)} = E / c^2 a$. Where $F_{(N)}$ will become the unitary emission/absorption force and E arises from the complex self-organized electro-gravitational Geon energy related to S_N of the CSU complex Minkowski metric $(M_4 \pm C_4)$ as defined in the basic premise of CSU theory (Amoroso, 2002) where $S_0 = M_4$, $S_1 = -C_{4(ret)}$ and $S_2 = +C_{4(sdv)}$:

$$S_N = S_0 + S_1 + S_2$$

(16)

E is scale invariant through all levels of the CSU beginning at the highest level in the supralocal Megaverse as a hyperdimensional Wheeler Geon (Wheeler, 1955) . A Geon is a ball of photons of sufficient size that it will self cohere through gravitational action. At the micro level the Geon becomes synonymous with the E term and quantized as a unit of *Einstein's* , the fundamental physical quantity defined as a 'mole or Avogadro number of photons'. Next the equation is generalized for the CSU as derived from the work of Kafatos, Roy & Amoroso, 2000.

Taking an axiomatic approach to cosmological scaling, such that all lengths in the universe are scale invariant, we begin with the heuristic relation that $c \equiv \dot{R}$ or $\dot{R} = l / t = c$ where $\dot{R}$ represents the rate of change of scale in the universe. This corresponds to the Hubble relation for perceived expansion of the universe where $H_o = \dot{R} / R$ and $a = \dot{R} \times H_0$ or substituting $\dot{R}^2 / R$. So continuing for final substitution we have $F_{(n)} = E / c^2 a = E / c^2 x\dot{R}^2 / R.$ Since $c \equiv \dot{R}$ The c^2 & $\dot{R}^2$ terms cancel and we are left with:

$$F_{(n)} = \pm E_{S_{(N)}} / R_t \qquad (17)$$

Which is the formalism for the fundamental unitary action equilibrium conditions of the GP . It should be noted that R is a complex rotational length and could also be derived in terms of angular momentum spacetime spinors or Penrose twistors at higher levels closer to domains described by conventional theory. But the derivation above is more fundamental to CSU CMBR. The Hubble Einstein 3-sphere, a subspace in CSU cosmology, is *covered* by the scale invariant hyper-geon (unified) field. The spin exchange mechanism of continuous dimensional reduction-compactification dissipates the putative heat predicted by gauge theory for the Planck scale BH backcloth (Markov, 1966; Sung, 1993).

The free energy for CMBR emission during the periodic *exiplex* moment arises by parallel transport during continuous dimensional reduction. Spacial dimensions, by the boundary of a boundary = 0 condition, first transport to temporal dimensionality (Ramon & Rauscher, 1980) and then to energy (Cardone et al, 1999) $s \rightarrow t \rightarrow E.$ This key concept will be clarified in an ensuing paper.

8. Summary

A preliminary formalism for CMBR emission and *tired light* redshift absorption as BB equilibrium from the continuous state topological dynamics of the Dirac vacuum in a CSU has been presented. This has taken two possible forms: 1. A stochastically driven CQED effect on Eddington free space Rabi/Rydberg atoms coupled to vacuum zero-point field fluctuations. 2. A composite *exiplex* of advanced - retarded spacetime topological cavity modes which may act as an atom-cavity « molecule » formed on the basis of gravito-quantum coherence effects by unitary action of $F_{(N)}$. Both postulated by only two new theoretical concepts, from already observed CQED effects in the laboratory: 1. A Dirac type vacuum coupling between the atom and vacuum cavities of the structure of spacetime itself, and 2. CMBR photon emission can also occur from the Bohr-type boundary conditions of spacetime topology without the presence of an atom with *E* transport by topological switching in D-reduction of $s \rightarrow t \rightarrow E$.

BH's have been demonstrated to emit BB radiation in the quasiclassical limit, and the lower limit has been shown to be the Plank mass providing a firm theoretical foundation for intrinsic vacuum emmitivity. A non inflationary origin of CMBR obviates the Bigbang requiring reinterpretation of the standard cosmological model with profound implications for the future of cosmological theory.

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