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On the Nature of CMBR Universe Epoch Hologram

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Abstract: *In this work we will shown how can obtain some of* ***Cosmic Microwave Background Radiation*** *(CMBR) parameters if we adopt the models of entanglement with different Universe epochs as sources of a magnetic field (MF) from stress-energy Einstein tensor as been infused by flux lines (bit threads) of fluxoids type, that being born at by* ***Electroweak symmetry breaking (EWPT),*** *projected just to the CMBR horizon.*

Also, it is demonstrated that the scaled MF at the CMBR time, keeps the B-curl pattern of the same values as obtained in BICEP2, therefore, these images are not wrong.

We argue that the most promising way to test the hypothesis of CMBR as a projected entanglement hologram is to look for possible imprints of magnetic fields on the temperature and polarization anisotropies of the cosmic microwave background radiation (CMBR).

1. Introduction

A controversy exists about CMBR pattern after BICEP2 test, in the following I give arguments that this was not wrong, and that is in fact an entanglement hologram build by the magnetic flux lines (called bit threads) that are generate at EWPT epoch of Universe.

2. The Bit Threads as the Nature of Hologram of LIGO Site

In the following will be shown how that one obtain some of these *measured* parameters only if we adopt the models of entanglement and not of gravitational waves!.

In the last time an important progress was done on the Ryu-Takayanagi (RT) formula generalization, especially by obtaining arguments about the nature of the transfer of bulk energy (Energy flux, the rate of transfer of energy through a unit area ($J\cdot m^{-2}\cdot s^{-1}$)) to the CFT horizon.

Thus, Bit threads provide an alternative description of holographic entanglement, replacing the Ryu-Takayanagi minimal surface with bulk curves connecting pairs of boundary points [2].

$$S_A = \frac{1}{4G_N} area(m(A))$$

Despite the fact that the RT formula has been a subject of intense research for over a decade, there are still many facets of it that are only now being discovered.

Indeed, only recently was it demonstrated that the geometric extremization problem underlying the RT formula can alternatively be interpreted as a flow extremization problem [3,4]. By utilizing the Riemannian version of the max flow-min cut theorem, it was shown that the maximum flux out of a boundary region A, optimized over all divergenceless bounded vector fields in the bulk, is precisely the area of m(A).

In particular, for the minimal surface m(A),

$$N_{A\bar{A}} \le \frac{1}{4G_N} area(m(A)) \qquad (1)$$

The number of threads connecting A to $\bar{A}$ is at least as large as the flux of v on A:

$$N_{A\bar{A}} \geq \int_A v$$

The reason that don't necessarily have equality is that some of the integral curves may go from $\bar{A}$ to A, thereby contributing negatively to the flux but positively to $N_{A\bar{A}}$.

Given (1), however, for a max flow v(A) this bound must be saturated:

$$N_{A\bar{A}} = \int_A v(A) = S(A)$$

The bit threads connecting A to $\bar{A}$ are vivid manifestations of the entanglement between A and $\bar{A}$, as quantified by the entropy S(A).

In [1] and therein ref. [3-7], the authors tried to reformulate the entanglement as a flux of vector field v.

In fact, theirs goal it was to explicitly construct the thread vector of Ref. [5], where the authors suggested replacing the minimal surface by a divergenceless vector.

The Ryu-Takayanagi (RT) formula relates the entanglement entropy of a region in a holographic theory to the area of a corresponding bulk minimal surface. Using the max flow-min cut principle, a theorem from network theory, in [5] they rewrite the RT formula in a way that does not make reference to the minimal surface. Instead, is invoked the notion of a "flow", defined as a divergenceless norm-bounded vector field, or equivalently a set of Planck-thickness "bit threads". The entanglement entropy of a boundary region is given by the maximum flux out of it of any flow, or equivalently the maximum number of bit threads that can emanate from it. The threads thus represent entanglement between points on the boundary, and naturally implement the holographic principle.

Instead, in [2] they will invoke the notion of a flow, defined as a divergenceless vector field in the bulk with pointwise bounded norm; note that this is a global object, not localized anywhere in the bulk. Its flow lines can be thought of as a set of "threads" with a cross-sectional area of 4Planck areas. In the picture below, each thread leaving the region A carries one independent bit of information about the microstate of A; S(A) is thus the maximum possible number of threads emanating from A. The equivalence of this formulation to equation (1) arises from the fact that the minimal surface acts as a bottleneck limiting the number of threads emanating from A; this is formalized by the so-called max-flow min-cut (MFMC) principle, a theorem originally from network theory but which they use here in its Riemannian geometry version

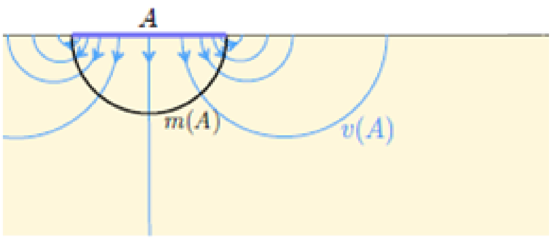

Figure 7 from [5]: According to eq. (1), the entanglement entropy of the region A is given by the maximum flux through A of any flow. A maximizing flow v(A) is illustrated by its flow lines in blue. This flux will equal the area of the RT minimal surface m(A) (divided by $4G_N$).

2.1. More About Bit Threads

As with an electric, magnetic, or fluid velocity field, it is convenient to visualize the flow v by its field lines. These are defined as a set of integral curves of v chosen so that their transverse density equals $|v|$. In [2] they call these flow lines "bit threads", for a reason that will become clear soon. Please keep in mind that the threads are oriented.

The bit threads inherit two important properties from the definition of a flow. First, the bound $|v| = 1/4G_n$ means that they cannot be packed together more tightly than one per 4 Planck areas. Thus they have a microscopic but nonetheless finite thickness. In general, their density on macroscopic (i.e. AdS) scales will be of order N^2 (in the usual gauge/gravity terminology). Therefore, unless they are interested in 1=N effects (which will mostly ignore in this paper), it should not worry too much about the discrepancy between the continuous flow and the discrete threads. Second, the condition $\nabla \cdot v = 0$ means that the threads cannot begin, end, split, or join in the bulk; each thread can begin and end only on a boundary, which could be the conformal boundary where the field theory lives, or possibly a horizon (e.g. if are considering a single-sided black hole spacetime).

One of the most remarkable discoveries in fundamental physics was the realization that black hole horizons carry entropy. This entropy is manifest in the spacetime geometry, as expressed by the Bekenstein-Hawking formula:

$$S_{BH} = \frac{k_B c^3}{\hbar} \frac{A}{4G} \tag{2}$$

where A is the area of the horizon.

Following [6a,b,c] of course, this expression (2) also reminds us that the physical constants in Nature can be combined to yield a fundamental length, the Planck scale:

$$l_P^{d-2} = 8\pi G\hbar / c^3$$

spacetime dimensions. Hence the geometric entropy (1) of the horizon is simply the horizon area measured in units of the Planck scale:

$$S_{geom} = 2\pi \frac{\mathrm{A}}{l_P^{d-2}}$$

Given a particular holographic framework, the entanglement entropy in the (d-1)-dimensional boundary theory between a spatial region A and its complement is calculated by extremizing the following expression

$$S(A) = \frac{2\pi}{l_P^{d-2}} \underset{v \sim A}{ext}\left[A(v)\right]$$

over (d-2)-dimensional surfaces v in the bulk spacetime which are homologous to the boundary region A.

In the following, we summarize here the main points of the derivation as given in Ref.[7]. Thus, the variation of the entanglement entropy obeys

$$\delta S_A = \delta\langle H_A \rangle \tag{3}$$

Where H_A is the modular Hamiltonian.

However, starting from the vacuum state of a CFT in flat space and taking A to be a ball-shaped spatial region of radius R centered at x_0, denoted $B(R, x_0)$, the modular Hamiltonian is given by a simple integral that takes the simple form

$$H_B = 2\pi \int_{B(R,x_0)} d^{d-1}x \frac{R^2 - \left|\vec{x} - \vec{x}_0\right|^2}{2R} T_{tt}$$

of the energy density over the interior of the sphere (weighted by a certain spatial profile).

Thus, given any perturbation to the CFT vacuum that have for any ball-shaped region

$$\delta S_B = 2\pi \int_{B(R,x_0)} d^{d-1}x \frac{R^2 - \left|\vec{x} - \vec{x}_0\right|^2}{2R} \delta\langle T_{tt} \rangle$$

where H_B and S_B denote the modular Hamiltonian and the entanglement entropy for a ball, respectively.

One example is when is to consider a conformal field theory in its vacuum state, $\rho_{total} = |0\rangle\langle 0|$ in d-dimensional Minkowski space, and choose the region A to be a ball $B(R, x_0)$ of radius R on a time slice $t = t_0$ and centered at $x^i = x_0^i$.

Hamiltonian takes the simple form

$$H_B = 2\pi \int_{B(R,x_0)} d^{d-1}x \frac{R^2 - |\vec{x} - \vec{x}_0|^2}{2R} T_{tt}(t_0, \vec{x}) \tag{4}$$

where $T_{\mu\nu}$ is the stress tensor.

In summary, starting from the vacuum state of any conformal field theory and considering a ball-shaped region B, the first law (3) simplifies to

$$\delta S_B = \delta E_B \tag{5}$$

where is defined

$$E_B = 2\pi \int_{B(R,x_0)} d^{d-1}x \frac{R^2 - |\vec{x} - \vec{x}_0|^2}{2R} T_{tt}(t_0, \vec{x}) \tag{6}$$

The gravitational version of EB is simply obtained by replacing the stress tensor expectation value in (4) or (6) with the holographic stress tensor

$$E_B^{grav} = \int_S d\,\Sigma^\mu\, T_{\mu\nu}^{grav} \zeta_B^\nu = 2\pi \int_{B(R,\vec{x}_0)} d^{d-1}x \frac{R^2 - |\vec{x} - \vec{x}_0|^2}{2R} T_{tt}(t_0, \vec{x})$$

giving E_B^{grav} an integral of a local functional of the asymptotic metric over the region

$B(R, x_0)$ at the AdS boundary.

To convert the nonlocal integral equations into a local equation, the strategy is to make use of the machinery used by Iyer and Wald to derive the first law from the equations of motion.

The Iyer-Wald formalism is reviewed in detail in the next section, but for now is just need one fact: the crucial step in the derivation is the construction of a (d−1)-form χ that satisfies

$$\int_B \chi = \delta E_B^{grav}, \int_B \chi = \delta S_B^{grav} \tag{7}$$

and for which $d\chi = 0$ on shell (i.e. when the gravitational equations of motion are satisfied).

The first law follows immediately by writing

$\int_\Sigma d\chi = 0$ and applying Stokes theorem (i.e. integrating by parts).

To derive local equations from the gravitational first law, they show that there exists a form χ which satisfies the relations (7) off shell, and whose derivative is

$$d\chi = -2\xi_B^a \delta E_{ab}^g \varepsilon^b \tag{8}$$

where the d-form ε^b is the natural volume form on co-dimension one surfaces in the bulk (defined in eq. (5.3) from [7]), ξ_B is the Killing vector that vanishes on $\tilde{B}(R, x_0)$, and δE_{ab}^g are the linearized gravitational equations of motion. In addition, they require that $d\chi|_{\partial M} = 0$ (9)

where ∂M is the AdS boundary, assuming the tracelessness and conservation of the holographic stress tensor.

In detail in [7], by using the Noether identity (discussed in appendix B of [7]) linearized about the AdS background is obtained.

$$\nabla_a (\delta E^g)^{ab} = 0, \tag{10}$$

a divergenceless condition as the necessity mentioned before.

Using the vanishing of $E^g_{\mu\nu}$, the general solution to (10) can be written as:

$$\delta E^g_{z\mu} = z^{d-1} C_\mu, \; \delta E^g_{zz} = z^{d-2} C_z - \frac{1}{2} z^d \partial_\mu C^\mu \tag{11}$$

for unfixed C_μ, C_z which are functions of the boundary coordinates. It simply need to show that C_μ, C_z must vanish. This is achieved by the requirement (9) which (using eq. (8) and (11) gives:

$$0 = d\chi|_{\partial M} = -\left(\zeta^\mu_B C_\mu + \tilde{\zeta}^x_B C_z\right) dt \wedge dx^1 ... \wedge dx^{d-1} \tag{12}$$

Here, is defined $\tilde{\zeta}^z_B = \lim_{z \to 0}(z^{-1}\zeta^z_B) = -2\pi R^{-1}(t - t_0)$ which is related to the boundary conformal Killing vector via: $\partial_\mu (\zeta_B)_\nu + \partial_\nu (\zeta_B)_\mu = 2\eta_{\mu\nu}\tilde{\zeta}^z_B$. Since it is possible to construct _ for all possible boundary regions B and in all Lorentz frames, it follows that $C_\mu = C_z = 0$.

In summary, it can obtain the full set of linearized gravitational equations, if it can show that a form χ exists, which satisfies eqs. (7), (8) and (9), they in [7] found this. Thus, applying this discussion in an arbitrary frame, after a long way they have now established that, at the boundary, χ is equal to the conserved current that appears in the modular energy:

$$d\chi|_{\partial M} = d\sum^\mu T^{grav}_{\mu\nu}\zeta^\nu \tag{13}$$

Conservation and traceless of the CFT stress tensor therefore imply $d\chi|_{\partial M} = 0$, completing the derivation requested.

Now, only the differential form for Gauss's law for magnetism is of this type:

$$\nabla \cdot B = 0$$

The magnetic field **B**, like any vector field, can be depicted via field lines (also called *flux lines*) – that is, a set of curves whose direction corresponds to the direction of **B**, and whose areal density is proportional to the magnitude of **B**. Gauss's law for magnetism is equivalent to the statement that the field lines have neither a beginning nor an end: Each one either forms a closed loop, winds around forever without ever quite joining back up to itself exactly, or extends to infinity.

3. MAGNETIC FIELD GENERATION IN FIRST ORDER PHASE TRANSITION BUBBLE COLLISIONS

To note, that in case of electroweak and QGP epochs the magnetogenesis is analyzed for different mechanisms [8], [9], [10], [11], [3], [12].

When the Universe supercooled below the critical temperature ($T_c \approx 100GeV$) the Higgs field locally tunneled from the unbroken $SU(2) \times U(1)_Y$ phase to the broken $U(1)_{em}$ phase [14].

The tunneling gave rise to the formation of broken phase bubbles which then expanded by converting the false vacuum energy into kinetic energy.

The typical size of a bubble after the phase transition is completed is in the range

$$R_{bubble} \sim f_b H^{-1}_{EW} \tag{14}$$

Where

$$H^{-1}_{EW} \sim \frac{m_{Pl}}{g_*^{1/2} T_c^2} \approx 10cm \tag{15}$$

is the size of the event horizon at the electroweak scale, m_{Pl} is the Planck mass, $g_* \sim 10^2$ is the number of massless degrees of freedom in the matter, and the fractional size f_b is $\sim 10^{-2} \div 10^{-3}$.

Finally, Törnkvist [14] discuss the suggestion made in cited Ref. [9], that magnetic fields may be generated in the decay of Z -strings. It is well-known that the unstable Z -string decays initially through charged W -boson fields. The idea is that these

W fields form a "condensate" which then in turn would act as a source of magnetic fields. One extremely important caveat is that the presence of W fields is highly transient, as the Z -string is known to decay to a vacuum configuration [32]. It is conceivable, however, that the large conductivity of the plasma in the early universe, cited refs. [2,11,33] may cause the magnetic field lines to freeze into the fluid so that it remains preserved at later times.

The conventional gauge-invariant definition of the electromagnetic field tensor in the SU(2) × U(1) Yang-Mills-Higgs system is given by following eq. where a possible generalization of the definition for the Weinberg-Salam model was given by Vachaspati [9]. It is

$$F_{\mu\nu}^{em} \equiv -\sin\theta_{EW}\hat{\phi}_a F_{\mu\nu}^{a} + \cos\theta_{EW} F_{\mu\nu}^{Y} -$$
$$i\frac{\sin\theta_{EW}}{g}\frac{2}{\Phi^{+}\Phi}\left[(D_\mu\Phi)^{+}D_\nu\Phi-(D_\nu\Phi)^{+}D_\mu\Phi\right]$$

Where $\hat{\phi}_a \equiv \dfrac{\Phi^{+}\tau^{a}\Phi}{\Phi^{+}\Phi}$, $D_\mu = \partial_\mu - i\dfrac{g}{2}\tau^{a}W_\mu^{a} - i\dfrac{g'}{2}Y_\mu = \partial_\mu - iA_\mu$

As the value of the mixing angle (Weinberg angle) is currently determined empirically, it has been mathematically defined as

$$\cos\theta_W = \frac{m_W}{m_Z}$$

$$B \approx \frac{\sin\theta_W}{g}\gamma M_H^2(T_B) \tag{16}$$

The magnetic field will "freeze out", i.e. become insensitive to thermal fluctuations, at some temperature $T_B < T_c$, where T_B is to be determined in what follows.

Hence, T_B is determined by the condition $\xi^3 B^2/2 \cong T_B$, where the correlation length

$\xi = [2M_W(T_B)]^{-1}$, the fraction of energy density redistributed $\gamma = 0.1$.

$$\frac{T_B^2}{T_c^2} \approx \left[1+\frac{T_c^2}{M_W^2}\left(\frac{4g}{\gamma\sin\theta_W}\frac{M_W^2}{M_H^2}\right)^4\right]^{-1} \tag{17}$$

From the condition $\xi^3 B^2/2 \cong T_B$ is obtained for a first-order phase transition

$$T_B \approx \left(\frac{\gamma\sin\theta_W}{4g}\frac{M_H^2}{M_W^2}\right)^2 M_W$$

Note that the magnetic freeze-out temperature T_B is generally lower than the Ginzburg temperature, which may be very close to the critical temperature.

In summary, for spontaneously generated magnetic fields in either a first- or second order electroweak phase transition, the above estimates of the magnetic field strength B and correlation length ξ give

$$B_{sp} \cong \left[\frac{M_H}{100GeV}\right]^2 \cdot 10^{22} Gauss,\ \xi_{sp} \cong 10^{-2} GeV^{-1} \tag{18}$$

From eq. cited ref. (38) one then obtains the bound

$B \le \sin 2\theta_W Z_{12}$

The integral here is evaluated over a surface perpendicular to the $Z - string$. Assuming that the flux is confined to an approximate cross-sectional area πM_Z^{-2}, is found

$Z_{12} \cong 4\cos\theta_W \; M_Z^2 / g$, and therefore

$$B \le \frac{8\cos^2\theta_W \, \sin\theta_W}{g} M_Z^2 \tag{19}$$

The correlation length of the magnetic field is thus $\xi \approx \min(M_Z^{-1}, M_H^{-1})$.

In summary, for magnetic fields generated by decaying non-topological defects, we obtain the following numerical estimates:

$$B_{ntop} \le 10^{24} Gauss, \; \xi_{ntop} \approx \left[\frac{100GeV}{M_H}\right] \cdot 10^{-2} GeV^{-1} \tag{20}$$

Finally, we have the above RT formula as expressed in the bit threads:

$$\frac{2\pi}{\hbar}\int d^2x\sqrt{g}T_\mu^\mu = \frac{2\pi}{\hbar}\rho_{bulk} = \frac{3H^2}{2\cdot 2\cdot G} n \frac{1}{\hbar} \tag{21}$$

$$\frac{2\pi\cdot c^3\cdot\rho}{\hbar} = \frac{3H^2\cdot c^3}{4G}\frac{1}{\hbar} \text{ or } \frac{c^3\cdot\rho}{3\hbar} = \frac{H^2\cdot c^3}{8\pi G}\frac{1}{\hbar} \text{ or, } \frac{c^3\cdot\rho\cdot l_P^2}{3\hbar} = H^2[s^{-2}],$$

$$\text{or, } \frac{c^3\cdot\rho\cdot l_P^2}{3\hbar}\frac{1}{c^2} = H^2[m^{-2}] \tag{22}$$

$$\rho\big|_{bulk} = n_{bit\_threads}\rho_{bubble} = n\rho = n\frac{T_j}{c^2\lambda_C^3}$$

For example, $\rho = \dfrac{M_U}{n_{bit\_threads}\cdot\lambda_C^3}$; (22')

$n = n_{bit\_threads} = \dfrac{M_U c^2}{m_A}$;

from section 3. above, we appreciate

$m_A = 100GeV$; $l_P = 7.8\times 10^{-35}$

4. BUILDING UP SPACETIME WITH QUANTUM ENTANGLEMENT

The build of spacetime is obtained by using well-known Inflation models [15a-c], which in our opinion is nothing else than a spreading of entanglement-energy source-horizon end, where the scale leaving the horizon at a given epoch is directly related to the number $N(\varphi)$ of e-folds of slow-roll inflation that occur after the epoch of horizon exit. Indeed, since H-the Hubble length is slowly varying, we have $d\ln k = d(\ln(aH)) \cong d\ln a = \dfrac{\dot{a}dt}{a} = Hdt$. From the definition this gives $d\ln k = -dN(\varphi)$, and therefore $\ln(k_{end}/k) = N(\varphi)$, or, $k_{end} = ke^N[m]$, where k_{end} is the scale leaving the horizon at the end of slow-roll inflation, or usually $k^{-1} << k_{end}^{-1}[m]$, the correct equation being $k = k_{end}e^N[m^{-1}]$.

During Universe evolution, the horizon leave is when $a_{leave} = k_{leave}/H_{leave} = 1$,

and $k_{leave}^{-1} = H_{leave}^{-1} = 10^{-18}[m]$, .

In the case of a homogeneous potential directed along the z-axis [8] eq. (2.2), the Einstein stress-energy tensor is:

$T^{00} = T^{11} = T^{22} = -T^{33} = \rho = \frac{\varepsilon_0 c^2 B^2}{8\pi}$; $T^{0i} = 0$, where $\rho_B[J/m^3]$-the magnetic energy density.

$$\varepsilon = \frac{V_{vol}\varepsilon_0 c^2 B^2}{8\pi} = \rho V_{vol} = m_A = V[J], \tag{22''}$$

$V_{vol} = 2\pi\lambda_C \lambda_c (4\lambda_C) \cong 8\pi\lambda_C^3$, at Compton length equally with the penetration length $\lambda_C = \lambda$, that results

$$E^2 = \frac{(V)}{\varepsilon_0 (\lambda_C^{e*})^3}$$

With $V = \varepsilon_{gluons}$ as above is obtained $B = E_{q\bar{q}}/c$.

$$\varepsilon = \frac{V_{vol}\varepsilon_0 c^2 B^2}{8\pi} = \rho_B V_{vol} = V = m_A = [J],$$

$V_{vol} = 2\pi\lambda_C \lambda_c (4\lambda_C) \cong 8\pi\lambda_C^3$, at Compton length $\lambda_C = \hbar/mc$

$E^2 = \frac{(V)}{\varepsilon_0 (\lambda_C^{e*})^3}$, also $E = Bc = \frac{\hbar c}{e\lambda_C^2}$

Here, the Hubble constant is defined as, see eq. (3.20,3.21,3.22) from [8].

$H^2 = \frac{8\pi G V^4}{3(\hbar c)^3 c^4}$ $[m^{-2}]$, and by use of the Compton length as:

$$H^2 = \frac{1}{R^2} = \frac{8\pi G V^4}{3(\hbar c)^3 c^4} \to \frac{8\pi G V^4}{3\lambda_C^3 (mc^2)^3 c^4} \to \frac{8\pi G}{3} \frac{V}{\lambda_C^3 c^4}[m^{-2}] \tag{23}$$

4.1. Strain Model

From [16] we have:

$\lambda = \kappa^{-1} e^{kv}$; $\kappa^{-1} = 4M$; $v = t + r^*$; $C = 1 - 2M/r$; and $r^* = \int C^{-1} dr$; $C_{,r} = 2M/r^2$

We will assume that $T_{vv}(v)$ represents ingoing radiation which changes the black hole's mass by only a small fractional amount, $|\Delta M| << M$. We can then take κ to be constant to lowest order. If we change the independent variable from λ to v = t + r∗, then

$$\frac{d}{d\lambda} = e^{-\kappa v} \frac{d}{dv}; \; v = 1/\omega; \kappa = \frac{c^3}{4GM}$$

And

$$T_{\mu\nu} k^\mu k^\nu = e^{-2\kappa v} T_{vv}$$

For spherically symmetric pulses, the shear and vorticity vanish, and the Raychaudhuri equation, Eq. (36) from [16], becomes

$$\frac{d\theta}{dv} = -\frac{1}{2}e^{\kappa v}\theta^2 - 8\pi e^{-\kappa v}T_{vv}(v)$$

The equation for the horizon area can be expressed as

$$\frac{dA}{dv} = e^{\kappa v}A\theta$$

If we take $A_0 = 16M_0^2$ to be the initial area of the black hole in the distant past, where M_0 is its initial mass, then we have

$$\frac{\Delta A}{A_0} \cong \frac{a}{\kappa}e^{\kappa v_+} = 2\frac{\Delta M}{M_0}$$

In this approximation, the change in the mass of the black hole is

$$\Delta M = \frac{a}{2\kappa}M_0 e^{\kappa v_+} = \frac{aA_0}{8\pi}e^{\kappa v}$$

where we have used $\kappa = 1/(4M) \cong 1/(4M_0)$.

This agrees with the result obtained by calculating the change in mass directly from Eq. (25) as $\dot{M} = \frac{dM}{dt} = F = \int T_t^r r^2 d\Omega$

On the horizon, $T_t^r = T_{vv}$, $r = 2M + \varepsilon$

Since the quarks generated inside nucleons or in EW bubbles are generated by a pulsating process with frequency $v = \omega^{-1}$, a such pulse of stress-energy it could be $8\pi T_{\mu\nu}k^\mu k^\nu = a\delta(\lambda)$, a is a positive constant, and the surface gravity $\kappa = \frac{c^3}{GM}[s^{-1}]$.

We can observe that $\frac{\Delta A}{A} = \frac{8\pi GM}{c^2}\cdot\frac{1}{R} = \frac{r_{Schw}}{R}$, or, we have obtained the classical formula for deformation.

5. ELECTROWEAK SYMMETRY BREAKING-QUARKS EPOCH (EWPT)

From [14] we have

$\varepsilon_{EWPT} = 100GeV \to 1.7\times10^{-8}J$ from section 3.; $a_{end-EW} = 0.9$; $k_{end}^{-1} = 0.1[m]$, with eq. (22) $R = 0.4m$, and $H_{end}^{-1} = 0.1 \cong H_{EW}^{-1}[m]$, $t_{end} = H_{end}^{-1}/c = 3.3\times10^{-10}s$,

$n_{bit\_threads} = \frac{M_U c^2}{1.7\times10^{-8}} = 5.1\times10^{77}$; $k_{end}^{-1} = 0.1$; $B_{EWPT} = 6.3\times10^{19}[T]$; $\lambda_C = 1.7\times10^{-18}$;

$H_{leave}^{-1} = k_{leave}^{-1} = 10^{-18}[m]$ we found $N = 39.22$

5.1. The Strain at Universe-Today Site

We use the above model of section 4.1.

With $a = \frac{c}{R}[s^{-1}]$; where $R = 0.1[m]$; $a = 2.9\times10^9$; with $M = 1\times10^{53}[kg]$; $\kappa = 10^{-18}[s^{-1}]$; if we have the generation eq. (24), $v = \omega^{-1} = (R/V\cdot V_{vol})^{-1}$; where

$R/V\times V_{vol} \cong 4.4\times10^{71}\cdot\lambda_C^3 = 2.4\times10^{18}[s^{-1}]$,

$v = 4\times10^{-19}[s]$; $e^{\kappa v} \cong 1.0$.

In other words the pulse is entangled at the *today* Universe site, that it means the greater contribution to expansion.

So, the deformation is $\frac{\Delta A}{A} = 7.4\times10^{26}$, or the expansion due of EW epoch since continue till today since $\Delta A = 7.4\times10^{26} \bullet A = 7.4\times10^{25}[m]$, where $A = H^{-1} = R = 0.1[m]$.

5.2. First Step-Near CMBR

An important contribution to further Universe expansion is given by the flux lines.

Thus, with $\varepsilon_{EWPT} = 100GeV/a_{end\_CMBR} = 1.7\times10^{-9}GeV = 1.7\times10^{-19}J$, and horizon-entry is when $k_{end}^{-1} = 1.0\times10^{10}[m]$, $a_{end\_CMBR} = 1.0\times10^{11}$, from eq. (22) results $H_{end}^{-1} = 1.1\times10^{20}[m]$, with

$\rho = \frac{M_U}{n_{bit\_threads}\cdot\lambda_C^3} = 1.2\times10^7$; from eq. (22'), and when the number of bit threads passing the hologram are reduced as

$n = n_{bit\_threads} = \frac{M_U c^2}{m_A \cdot a_{end\_CMBR}} = 10^{67}$ as from the total of $\cong 5.1\times10^{77}$ at the hologram, see figure 7. above . Also, results $t_{end} = 1.2\times10^{13}s$, with $H_{leave}^{-1} = k_{laeve}^{-1} = H_{EW} = 0.1[m]$ from [12], we found $N = 27.3$, $\lambda_{C\_BH} = 1.5\times10^{-7}[m]$.

The primordial magnetic flux from eq. (22") $B_{CMBR} = 1.4\times10^{-3}[T]$, the same with

$$B_{CMBR} = \frac{6\times10^{19}}{a_{end\_CMBR}^2} = 5.9\times10^{-3}[T] .$$

The results are illustrated in figure 1.

5.3. The Born of Quarks Inside the Bubbles as a Permanent Process

Now, the rate per unit volume of quarks pair creation is given by using the Schwinger effect R inside the EW bubbles, *when this electric field* E *is induced by* $e^+ - e^-$ *quarks pairs Which decay in* $W^{\pm}$ *that explaining* β^- *decay,* of leading order behavior

$$R = (E/E_{cr})^2(c/\lambda^4)(8\pi^3)^{-1} * \exp(-\pi E_{cr}/E)$$

(24) or $E/E_{cr} << 1$, positron charge e, mass m, Compton wave-length $\lambda_C = \hbar/mc$ and so-called "critical" electric field

$$E_{cr} = m^2c^3/e\hbar$$

the volume is given by:

$V_{matter} = (\lambda_C)^4\frac{1}{c}[m^3 s]$; the mass of quarks.

6. The calculation of spacetime windows for electro-magnetic-waves (EMW) generation at CFT (CMBR)

As the applied field increases, the fluxoids begin to interact and as the consequence ensembles themselves into an Abrikosov flux lattice. A simple geometrical argument for the spacing, d of a triangular lattice then gives the flux quantization condition [18],

$$Bd^2 = \frac{2}{\sqrt{3}}\Phi_0$$

where B, is the induction. With the above value of $B = E/c[T]$ and λ_C as from Hadronic Epoch; $\Phi_0 = 2*10^{-15}[Tm^2]$, results $d[m]$, and the number of cells being deduced from the $sphere\_area/Abrikosov\_triangle\_area$ or $N_{lattice} = \left(\frac{4\pi\lambda_C^2}{\frac{\sqrt{3}}{2}d^2 / 2}\right)$ cells; or $\theta = 360^\circ / N_{lattice}$, or from $(\theta/1^\circ) \approx 200/l$, results l [18].

Thus, with the above value of $B = E/c = 6\times10^{19}[T]$; $E = 1.8\times10^{28}[N/C]$ and $\lambda_C = 7\times10^{-18}$ as from *EW Epoch*; $\Phi_0 = 2*10^{-15}[Tm^2]$, results $d = 6.1\times10^{-18}[m]$, and the number of cells being deduced from the $sphere\_area/Abrikosov\_triangle\_area$ or

$N_{lattice} = \left(\frac{4\pi\lambda_C^2}{\frac{\sqrt{3}}{2}d^2 / 2}\right) = 2.4$ cells; or $\theta = 360^\circ / 2.4 = 148^\circ$, or from $(\theta/1^\circ) \approx 200/l$, results $l = 1.34$.

Here, it was defined an "effective magnetic field", B_{eff}, in terms of the total energy density in the magnetic field of MF Vortex,

$$\varepsilon_0 = \frac{\varepsilon_0 c^2 B_{eff}^2}{8\pi} \qquad (25)$$

Roughly speaking, the multipole moments C_L^{TT} measure the mean-square temperature difference between two points separated by an angle
$(\theta/1^\circ) \approx 200/l$.

At this surface an angle θ degrees subtends a commoving distance [15c]

$x \cong 200\theta Mpc = 200\times2\times10^6\times30\times10^{15} = 6\times10^{24}[m]$.

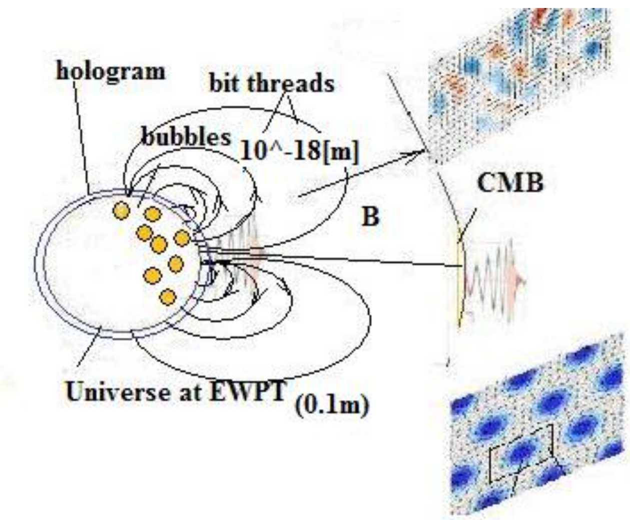

Figure1. *Hologram at CMBR, a possible primordial Abrikosov Vortexes lattice, BICEP2 pattern*

7. Conclusions

By adopting a model of entanglement of the stress-energy pulse as a magnetic field of fluxoid type and infused in vacuum via bit threads, that are generated by at EWPT bubbles collisions, it is created a hologram projected at CMBR spacetime. There, the photons which are decoupled from electrons as due of low temperature~3000K, they pass through this magnetic screen with a Faraday rotation, that keeping the image till today.

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