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A Simplified Solution of the CMB Dipole by the "Expansion Center Model"

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Abstract

ECM paper XXV: The new Hubble law by the "expansion center universe" (ECU), within a range of very low redshifts *z*, with *cz* values corrected only for the motion of the Sun in the Local Group (*LG*), leads to a combined *cz*-dipole pointing at about 65° from the center *VC* of the Bahcall & Soneira huge void, towards the same apex *A* of that CMB dipole2 which results from the observed CMB dipole after subtracting the velocity of the Sun in *LG*. By normalization, that combined *cz*-dipole produces a cosmic dipole pointing towards *VC* and confirming the "expansion center model" (ECM) at 28 mean *z*-depths, from the very nearby to the deep Universe (cf. paper XXII). The new dipole anisotropy with apex *A* at a mean redshift 0.0050, when applied to the ECM decelerating universe at very low redshifts *z*, is able to generate the same velocity as the CMB dipole2, that is a fictitious velocity of about 627 *km/s* of *LG* towards the apex *A*. Indeed *LG* and all the Local Hubble Flow is running away from and around the huge void, within a cosmic frame centred on the void center *VC*, with a velocity of about 61200 *km/s* towards an apex *FA*, at a galactic longitude of about 103° and a galactic latitude of about -25°. The cosmic mechanics should produce a space or "cosmic medium" (*CM*) deceleration which gives both an increasing wavelength to the elettromagnetic waves running against the Hubble flow and a decreasing wavelength to those running in the same direction as the Hubble flow. The simplified solution here presented, after the successful tests of the combined *cz*-dipole at the mean redshifts 0.012 from 1989 G7 data and 0.0046 from 1982 data by Aaronson et al., confirms the revolutionary results presented at EWASS 2016 (cf. papers XXI, XXII, XXIV), that is a likely origin of the CMB radiation at a mean depth of about 21 *Mpc*, in addition to a cosmic deceleration with a relativistic parameter +2.

Keywords

Cosmology, Huge Void Center, Hubble Flow, Cosmic Medium, Dipole Anisotropy, Deceleration Parameter, CMB Origin

1. Introduction

Working from the 1973 groundbreaking but misunderstood RFR effect [44, 46-48], a first series of Hubble ratio dipoles pointing towards the center *VC* of the Bahcall & Soneira huge void [6] was obtained within a preliminary model of "expansion center universe" (ECU) [21-24] based on data by de Vaucouleurs, Sandage & Tammann, Hoessel-Gunn-Thuan, Aaronson et al., Bahcall & Soneira, Bahcall, Lucey & Carter and Abell-Corwin-Olowin [50, 47, 14, 1, 2, 7, 5, 43, 3].

A second series of Hubble ratio dipoles was presented in the 1999 ECM papers I-II [25-26] dealing with "the expanding universe from the huge void center" and a "local solution of a spherical homogeneous universe radially decelerated towards the expansion center" within a more rigorous "expansion center model" (ECM) which was successfully confirmed at 28 cosmic depths, from a mean redshift $\langle z \rangle = 0.0025$ to 1.10, as summarized in papers XX-XXII-XXIII [38, 40, 41]. All these empirical dipoles showed the experimental consistency of a statistical dipole anisotropy of the observed redshift *z* (a cosmic dipole!).

Note that the series of ECM papers I $\longrightarrow$ XVI were referenced in section 8 of "A briefing on the expansion center universe", that is paper XVII [34], while RFR is for Rubin-Ford-Rubin [46], S&T for Sandage & Tammann [47], B&S for Bahcall & Soneira [6], G7 for Faber et al. [13].

2. The Expansion Center Universe

2.1. The Hubble Flow and a New Expansion Law

Starting from the Big Bang as a big crush [21, 25, 35], one finds

$$\frac{dR_{(km)}}{dt} = HR \tag{1}$$

as the equation of the Hubble flow, where $H = H(t)$ is the Hubble parameter and $R = R(t)$ is the distance from the expansion center, that is the center $VC(l \approx 195°, b \approx +40°\ or\ \alpha \approx 9^h, \delta \approx +30°)$ of the Bahcall & Soneira huge void (B&S: $z \approx 0.03 - 0.08$), within a Euclidean space [6]. In this case the radial velocity $\dot{r}$ from our Local Group *(LG)* at the emission epoch *t* may be written as the difference in expansion velocity, projected on the distance *r* referring to that epoch *t*, between any galaxy/group/cluster *(ga/gr/cl)* and *LG*, which is assumed and shown to be almost motionless within the Hubble flow (cf. papers I→XXV). So it is easy to write

$$\dot{r} = (H + \Delta H)(R + \Delta R)\cos\alpha - HR \cdot (-\cos\gamma) \tag{2}$$

$$\cos\gamma = \sin b_{VC} \sin b + \cos b_{VC} \cos b \cos(l - l_{VC}) \tag{3}$$

where $\Delta H = H_{ga} - H_{LG}$, $\Delta R = R_{ga} - R_{LG}$, α is the angle (centred on the source) between the distances *r* and $R + \Delta R$ and γ is the angle (centred on the observer) between the direction *(l, b)* of the source and that of the center *VC* (see Figure 1, which is described both in section 2 and 4). In eq. (2) $(R + \Delta R)\cos\alpha$ can be transformed as follows:

$$(R + \Delta R)\cos\alpha = r - R\cos\gamma \tag{4}$$

Indeed, here $\Delta H \neq 0$ is assumed to be due to a space effect $(SE \neq 0)$ as a finite difference between the Hubble function $H_{ga} = H_{ga}(t)$ of the observed galaxy and the Hubble function $H_{LG} = H_{LG}(t)$ of the Local Group (*LG*), both referring to the same emission epoch *t*. Consequently eq. (2) gives a new expansion law, which has its complete and rigorous formulation through the addition of a new term, as shown in section 5.1 paper I [25], that is

$$\dot{r} = (H + \Delta H) \cdot r - R\Delta H \cos\gamma + R\dot{w}\sin\gamma \tag{5}$$

In eq. (5), which refers to the past epoch *t*, $\dot{w}$ represents a differential rotation in space $(SE \neq 0)$ of a single point as the resulting angular velocity of the radial run of the observed galaxy/group/cluster *(ga/gr/cl)* with respect to that of *LG*. That $\dot{w}$, when applied to the very nearby universe to *LG*, may be easily interpreted as due to a variation of the cosmic revolution $\dot{\vartheta}$ around *VC*, i.e. $\dot{w} \propto \Delta\dot{\vartheta}$.

Note that $\Delta H = 0$ and $\dot{w} \propto \Delta\dot{\vartheta} = 0$ reduce eq. (5) to the canonic Hubble law $\dot{r} = Hr$.

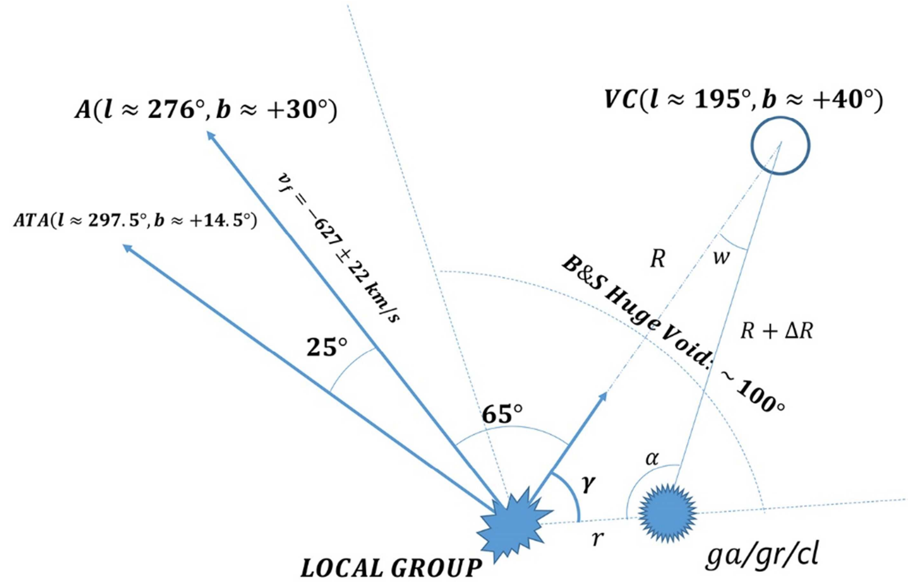

Figure 1. *Local cosmographic section, as described in the text.*

2.2. A Restricted Cosmological Principle

Unlike the canonical point of view, here the agreement of the “expansion center universe” (ECU) with the well known “cosmological principle” (*CP*) gives local homogeneity and isotropy, which means limiting the *CP* conditions to the very nearby Universe, with $r \ll R$. One must underline that the adoption of such a “restricted cosmological principle” *(RCP)* within the “expansion center universe” gives $H = H_{ga} = H_{LG}$ and $\dot{\vartheta} = \dot{\vartheta}_{ga} = \dot{\vartheta}_{LG}$. In this case one has both $\Delta H = H_{ga} - H_{LG} = 0$ and $\Delta\dot{\vartheta} = \dot{\vartheta}_{ga} - \dot{\vartheta}_{LG} = 0$, hence no space effect $(SE = 0)$.

2.3. The Crucial Light-Space *r*

Experimentally, any luminous signal travelling towards the Earth at the speed of light *c* inside an expanding "cosmic medium" (*CM* hereafter), which may be regarded as the Hubble flow from *VC* of a hypothetical Lorentz ether, will have covered the light-space $r = -c(t - t_0) > 0$ in *CM* during the light-time $\Delta t = t - t_0$, being t_0 our epoch; that means

$$r = \frac{\delta r}{\delta t}\Delta t = -c(t - t_0) \quad (6)$$

$$\dot{r} = \frac{dr}{dt} = c\left(\frac{dt_0}{dt} - 1\right) = c\left(\frac{\lambda_0 - \lambda}{\lambda}\right) = cz \quad (7)$$

after assuming $dt_0/dt \equiv \lambda_0/\lambda$ in $c = \lambda/dt$ (cf. [28, 30]).

Note: In (6) $\delta r = -c\delta t$ indicates the infinitesimal *CM* space run by light travelling towards the observer during an infinitesimal $dt = \delta t$ of past time. This δr is important only to avoid confusion with the conventional dr, which represents the *r* variation of any galaxy observed at the light-distance *r*. Consequently, in place of the usual total derivative with respect to time, an alternative total derivative with respect to light-space, as $\delta/\delta r$, was introduced [25].

Therefore, as a consequence of a light-space *r* run in Δt and registered at t_0, one obtains $\dot{r} = cz$ as a measure at our epoch t_0 of the cosmic expansion at the epoch *t*. In this context also ΔH, like r and $\dot{r}$, must represent a quantity observed at our epoch t_0, that is $\Delta H = H - H_0$ as a finite difference between the Hubble function $H = H(t)$ of the observed epoch *t* and the Hubble function $H_0 = H(t_0)$ of the observer at our epoch t_0. In the same way $\Delta\dot{\vartheta} = \dot{\vartheta} - \dot{\vartheta}_0 \neq 0$ follows. One must underline that, according to *RCP*, in the very nearby Universe both $\Delta H \neq 0$ and $\Delta\dot{\vartheta} \neq 0$ should be due only to a time effect $(TE \neq 0, SE = 0)$. In the light of the previous remarks, eq. (5) comes to represent a different expansion law, with a light-space as $r = -c(t - t_0)$, an observed expansion speed as $\dot{r} = cz$ where the observed redshift *z* is corrected only for the motion of the Sun in the Local Group, an observed Hubble parameter as $H = H_{ga} = H_{LG} = H_0 + \Delta H$ and $\dot{w} \neq 0$ signifying a likely angular velocity $\dot{\vartheta} = \dot{\vartheta}_{ga} = \dot{\vartheta}_{LG} = \dot{\vartheta}_0 + \Delta\dot{\vartheta}$ of the cosmic revolution, with $\dot{\vartheta}_0 = y_0 H_0$ applied.

2.4. The New Hubble Law

If a differential rotation of the very nearby Universe is taken into account, the velocity contribution $R\dot{w}\sin\gamma$ to $\dot{r} = cz$ in eq. (5) may be considered as being the contribution of a vector $-R\Delta\dot{\vartheta}$, perpendicular to the radius vector R and representing an observable variation of the transversal velocity around VC. In this case the new expansion law as **a new Hubble law** becomes

$$\dot{r} = (H + \Delta H)\cdot r - R\Delta H\cos\gamma - R\Delta\dot{\vartheta}\cos\beta \quad (8)$$

after putting

$$R\dot{w}\sin\gamma \equiv -R\Delta\dot{\vartheta}\cos\beta \quad (9)$$

$$\cos\beta = \sin b_{ATA}\sin b + \cos b_{ATA}\cos b\cos(l - l_{ATA}) \quad (10)$$

where β is the angle between the observed point (l, b) and the direction of a transversal apex $ATA(l_{ATA}, b_{ATA})$ of the component $R\Delta\dot{\vartheta}$, while $R\Delta H$ has VC as the radial apex. Two orthogonal components in eq. (8), $R\Delta H$ and $R\Delta\dot{\vartheta}$, allow to define the angle γ_0^* between their resultant and the VC direction, through a dimensionless ξ_0 as follows:

$$\lim_{r\to 0}(R\Delta\dot{\vartheta}/R\Delta H) = \tan\gamma_0^* \equiv -\xi_0 \quad (11)$$

Consequenly, after putting

$$R\Delta\dot{\vartheta} = -\xi R\Delta H \quad (12)$$

the new Hubble law (8) for the very nearby rotating Universe may be rewritten as a combined *cz*-dipole, pointing towards an apparent apex AA, in the form

$$cz = cz_0 + cu(z_0)\cdot(\cos\gamma - \xi\cos\beta) \quad (13)$$

where $z_0 = (H_0 + 2\Delta H)\cdot rc^{-1}$ is the central redshift and $cu(z_0) = -R\Delta H$ the related angular coefficient [39, 40].

3. Expansion Center Model: A briefing

The previous contents are independent from the "expansion center model" (ECM) which, as presented and calibrated on 83 S&T nearby individual galaxies in the 1999 papers I-II [25, 26], is here applied only to the very nearby Universe, with $H_0 R_0 \cong 18150\ km\ s^{-1}$conserved.

3.1. ECM Fundamentals

ECM is based on a simulation on the Hubble law (1) and its derivative, now in the forms

$$\frac{\delta R}{\delta r} = -\frac{HR}{c} \Longrightarrow R = R_0 + q_0 r + \cdots \quad (14)$$

$$with\ (q_0)_{ECM} = -\frac{H_0 R_0}{c} \equiv -0.0605 \quad (15)$$

$$\frac{\delta^2 R}{\delta r^2} = -\frac{R}{c}\frac{\delta H}{\delta r} - \frac{H}{c}\frac{\delta R}{\delta r} \Longrightarrow H = H_0 + K_0 r + \cdots \quad (16)$$

$$with\ K_0 = \left(\frac{\delta H}{\delta r}\right)_{r=0} = \frac{H_0^2}{c} - \frac{c}{R_0}\left(\frac{\delta^2 R}{\delta r^2}\right)_{r=0} \quad (17)$$

being $\delta R \equiv dR$ and $\delta r = -cdt$ by $r = -c(t - t_0)$. After assuming the linear equations $H = H_0 + K_0 r$ $(\Delta H = K_0 r)$ and $R = R_0 + q_0 r$ as rigorously true at $r \to 0$, the solution of eq. (14) leads to the formula (18) (cf. [25]), that is

$$K_0 = \left(\frac{\delta H}{\delta r}\right)_{r=0} = \left(\frac{3H^2}{c}\right)_{r=0} \quad (18)$$

$$with\ H_0 = 70 \pm 3\ km\ s^{-1}Mpc^{-1} \quad (19)$$

$$R_0 = 260 \pm 22\ Mpc \quad (20)$$

$$R_0 K_0 = -3q_0 H_0 = 12.7 \pm 0.6\ km\ s^{-1}\ Mpc^{-1} \quad (21)$$

as ECM numerical outputs from 1975a data by Sandage & Tammann (cf. [26]). Consequently, the angular coefficient $cu = -R\Delta H$ of the combined dipole (13), which is applied to the very nearby Universe $(r \ll R_0\ or\ z_0 \lesssim 0.01)$, can be expressed by an approximate formulation, the following

$$R\Delta H \cong R_0 K_0 r \quad (22)$$

3.2. ECM Deceleration

As a consequence of the ECM fundamental result (18), eq. (16) is able to show the cosmic deceleration through its radial deceleration component [25], that in *c.g.s.* units becomes

$$\ddot{R}_0 = -2H_0^2 R_0 \Rightarrow -\frac{\ddot{R}_0 R_0}{\dot{R}_0^2} = (q_0)_{rel} = +2 \qquad (23)$$

Such $\ddot{R}_0$, in the special context of ECM with $\dot{R}_0 = H_0 R_0$, even expresses a relativistic deceleration parameter, that is $(q_0)_{rel} = +2$.

3.3. Dirac's Cosmic Age from ECM

Further, simply by integrating the ECM eq. (18) as follows

$$\int_{H_0}^{\infty} \frac{\delta H}{H^2} = \frac{3}{c}\int_0^r \delta r \Rightarrow r = \frac{c}{3H_0} = ct_0 \qquad (24)$$

one finds $t_0 = 4.65 \pm 0.20$ billion years, which coincides with the cosmic age by LNH [11, 12, 27].

4. New Dipole Anisotropy

4.1. LG Almost Motionless Relative to LHF

Edwin Powell Hubble in his *Realm of Nebulae* concluded: "The Local Group is a typical, small group of nebulae which is isolated in the general field" [16]. An analysis of "*The solar motion relative to the Local Group*" suggests that the Local Group is more compact and isolated from its surroundings than previously believed [9]. The *cz*-dipole of the very nearby Universe, according to the data analysis carried out in papers I-II-V-XIX [25, 26, 28, 37], is obtained by correcting the observed redshift *z* only for the motion of the Sun in the Local Group (*LG*). An added correction for the motion of *LG* (through a reference frame in which the CMB should appear isotropic according to the canonic theory) practically deletes the *cz*-dipole. These remarks and results speak clearly in favour of an almost motionless *LG* relative to the Local Hubble Flow (*LHF*).

4.2. The CMB Dipole

Canonically, the CMB dipole is considered as due entirely to the motion of the Sun in the rest frame of the "cosmic microwave background" (CMB). However, within the ECU new scenario, the canonical components of the CMB dipole should be reinterpreted, as follows: the first as due exclusively to the velocity of the Sun in the Local Group assumed motionless relative to *LHF*, the second as the effect of a combined *cz*-dipole according to eq. (13). Let us recall that the CMB dipole2, corresponding to an apparent velocity $v = -627 \pm 22\ km\ s^{-1}$ (cf. eq. 25 below), is the result of the observed CMB or 3K dipole ([10]: $370.6 \pm 0.4\ km\ s^{-1}$ towards $l = 264°.31 \pm 0°.17, b = +48°.05 \pm 0°.10$) after subtracting the kinematic component ([9]: $308 \pm 23\ km\ s^{-1}$ to $l = 105° \pm 5°, b = -7° \pm 4°$), which is due exclusively to the velocity of the Sun in *LG*. This CMB dipole2, which is known to be a dipole anisotropy in temperature T around a central value T_0 [8], according to the formulae

$$T = T_0 \cdot \left(1 + \frac{\Delta T_0}{T_0}\right) = T_0 \cdot \left(1 - \frac{v}{c}\cos\alpha\right) \qquad (25)$$

$$\frac{\Delta T_D}{T_0} = -\frac{v}{c} \qquad (26)$$

, points towards an apex A $(\alpha = 0)$ at $l = 276° \pm 3°, b = +30° \pm 3°$ [10], at about 65° from the huge void center $VC(l \approx 195°, b \approx +40°)$ [6], as $\cos\gamma$ of eq. (3) gives the same $\gamma \approx 65°$ as the first ECM theoretical solution (cf. paper VII section 5: $\gamma_0^* \approx 65° \pm 3$ and $\xi_0 = -2.15 \pm 0.23$), which strictly refers to the very nearby Universe (see Fig. 1). Then the apex *A* of the CMB dipole2 might coincide with that *AA* of the combined *cz*-dipole (13). If this is the case, spherical trigonometry is able to furnish the direction $\beta = 0$ of an apparent transversal apex *ATA* towards which one should find a *cz* value including the variation $-R\Delta\dot{\vartheta} = -\xi cu$ due to light delay, similar to the observed variation $-R\Delta H = cu$ towards the void center *VC*, which coincides with the apparent radial apex *ARA* at $\gamma = 0$. The resulting solution gives two provisional orthogonal apices:

$$ARA(\gamma = 0) \equiv VC\colon l \approx 195°, b \approx +40° \qquad (27)$$

$$ATA(\beta = 0)\colon l \approx 297°.5, b \approx +14°.5 \qquad (28)$$

The prospected preliminary solutions (27)(28), after reaching a full confirmation from the sample tests carried out in papers XXI-XXII-XXIV, mean that the combined *cz*-dipole (13) (referring to the very nearby Universe with $\xi_0 = -2.15 \pm 0.23$) points towards the same apex $A \equiv AA(\gamma^*, \beta^*)$ of the CMB or 3K dipole2, at $l \approx 276°, b \approx +30°$, with $\gamma^* \approx 65°$ and $\beta^* \approx 25°$.

Therefore two cosmological observables, redshift *z* and temperature *T,* show a new dipole anisotropy which can be produced by one cause, that is the *LG* or *LHF* cosmic deceleration producing both $-R\Delta\dot{\vartheta} \neq 0$ and $-R\Delta H \neq 0$ as astronomical effects due to light delay.

4.3. The Apex of the Local Hubble Flow

One must underline that the previous apices (27)(28) refer to the observed deceleration of the Local Hubble Flow. In other words there is no motion of the Local Group relative to *LHF*, which however is apparently decelerating towards the apex $A \equiv AA$, likely owing to the mechanical action of the inner Universe. So our Hubble flow, when referred to a cosmic frame centred on *VC,* runs in a direction opposite to *A* with a velocity having two orthogonal components, $H_0 R_0$ and $\dot{\vartheta}_0 R_0$ (being $\dot{\vartheta}_0 = y_0 H_0$), whose provisional apices are *RA* and *TA*, respectively:

$$RA\colon l \approx 15°, b \approx -40° \qquad (29)$$

$$TA\colon l \approx 117°.5, b \approx -14°.5 \qquad (30)$$

In order to find the coordinates of the apex *FA* towards which *LHF* runs with a velocity

$$V_{FA} = R_0 H_0 \sqrt{1 + y_0^2} \qquad (31)$$

the value $y_0 = 3.22^{+0.4}_{-0.3}$ is applied [29], as follows:

$$y_0 = \frac{R_0 \dot{\vartheta}_0}{R_0 H_0} \equiv 3.22 = \tan a \Rightarrow a = 72°.747 \qquad (32)$$

Combining the (32) result with (29)(30), by spherical trigonometwry one obtains the provisional coordinates (33) of the apex *FA* of the Local Hubble Flow running away from and around *VC* with a velocity $V_{FA} \approx 61200\ km\ s^{-1}$:

$$FA: l \approx 103°, b \approx -25° \quad (33)$$

The coordinates (33) are close to those of a hypothetic 'dipole repeller' [15, 19] which, associated with the Shapley concentration, should be responsible for the canonic fast motion of *LG*. Indeed repulsion and attraction might work together; however, it is good to underline again, ECM excludes such motion of *LG*. ECM implies an observable variation of expansion velocity (transversal+radial), that is an observable deceleration of *LG* [39-40].

4.4. The Dipole Anisotropy by Deceleration

The combined *cz*-dipole (13) pointing towards the same apex *A* of the CMB dipole2 clearly shows a smaller redshift *z* of the hemisphere $(\cos\gamma - \xi\cos\beta) > 0$ and a greater redshift *z* of the hemisphere $(\cos\gamma - \xi\cos\beta) < 0$, that is a new dipole anisotropy including all the electromagnetic waves. This dipole may be generated by a deceleration of the Hubble flow or, which is the same, by a decelerating space or cosmic medium *CM* or Lorentz ether, in which light runs. In this case the "space" as a cosmic medium *CM* should have a material consistency (dark matter?) which should be sensitive to a mechanical action of the inner Universe including the huge void of Bahcall and Soneira. The presence of a possible massive *CM* seems to be supported by the high cosmic density $(\rho_0 = 2.3^{+0.4}_{-0.5} \times 10^{-28} g\ cm^{-3})$ that was computed within ECM [29]. Hence the mechanics of the inner Universe should produce a space or *CM* deceleration which gives both an increasing λ to the electromagnetic waves running against the Hubble flow and a decreasing λ to the electromagnetic waves running in the same direction as the Hubble flow. In other terms, the electromagnetic waves running against the decelerating Hubble flow have an increased redshift, while the electromagnetic waves running in the same direction as the decelerating Hubble flow have a decreased redshift. The previous simple qualitative remarks should support how the space or *CM* deceleration towards the apex $A \equiv AA$ is responsible for the origin of the new dipole anisotropy [39-41]. Note that a hypothetical material cosmic medium *CM* of the previous picture should work for the light transmission like the hypothetical Lorentz ether.

4.5. Deceleration in Relativistic Cosmology

An important further confirmation of the cosmic deceleration can come from relativistic cosmology, through a new computation of its deceleration parameter $(q_0)_{rel}$ based on SCP data [18, 4] and the discovery of the related "Magnitude anomaly" of SNe Ia in paper XVI [33]. Paper XII - Evidence for a high deceleration of the relativistic universe – presented at EWASS 2012 in Rome and merged with the 2011 paper X – A crucial dipole test of the expansion center universe – into paper XV, leads to the numerical result $(q_0)_{rel} \geq +2$, confirming the ECM prediction $(q_0)_{rel} = +2$ of eq. (23).

5. The ECM Cosmic Dipole

The combined *cz*-dipole (13) comes out from the eqs. (5) (8) with $\dot{r} = cz$. As an observable variation of the cosmic revolution around the expansion center *VC* should give (on average) opposite algebraic values of $\dot{w}$ corresponding to equal γ in the same hemisphere, the normal points corresponding to a same value of γ ought to present a statistical result $\langle R\dot{w}\rangle \equiv 0$ (cf. paper I subsection 7.4), within a restricted statistical *z*-bin which may be applied even to the deep Universe. Consequently, the new expansion law (5) after normalization can provide a linear fitting in the form of a normal *cz*-dipole, $cz = cz_0 + cu \cdot \cos\gamma$, pointing towards the center $VC(\gamma = 0)$ of the B&S huge void, as a cosmic dipole that was confirmed to be in agreement with the ECM predictions at 28 mean *z*-depths, from $\langle z\rangle \equiv z_0 = 0.0025$ to 1.10, as summarized in paper XXII [40].

6. Tests for the Combined cz-Dipole

A successful test for the combined *cz*-dipole (13), based on two different samples, at $\langle z\rangle \equiv z_0 = 0.012$ from G7 data [13] and $\langle z\rangle \equiv z_0 = 0.0046$ from data by Aaronson et. al. [1, 2] respectively, confirmed ECM, as shown in papers XXI-XXII-XXIV [39, 40, 42], that is both the predicted values of the angular coefficient $u(z_0)$ and that theoretical parameter $\xi_0 = -2.15 \pm 0.23$ obtained in paper VII [29].

7. Solving the CMB within ECM

As repeatedly shown by the analysis carried out in papers VII-IX-XX-XXI-XXII [29, 31, 38-40], the dipole anisotropy in temperature *T* of eq. (25) is connected to the combined *cz*-dipole (13) which is able to show a fictitious velocity v_f of *LG* towards the apparent apex *AA* according to the formula

$$\frac{c\Delta z_0}{1+z} = -\frac{c\Delta T_0}{T_0} \equiv v_f \cdot \cos\alpha \quad (34)$$

where $c\Delta z_0 = cu \cdot (\cos\gamma - \xi\cos\beta)$ from eq. (13) with $cu = -R\Delta H$ and α is here the angle (centred on the observer) between the direction *(l, b)* of the source and that of the apex $AA(\alpha = 0)$. Eq. (34) at $z \to 0$ (referring to the very nearby Universe) may be rewritten as follows:

$$R\Delta H \cdot (\cos\gamma - \xi\cos\beta) \equiv -v_f \cos\alpha \quad (35)$$

So the radial and transversal components of eq. (35) can be assembled to give v_f in the forms

$$R^2\Delta H^2(1 + \xi^2) \equiv v_f^2 \quad (36)$$

$$v_f \cong -R_0K_0r\sqrt{1 + \xi_0^2} \quad (37)$$

after applying the ECM eq. (22) as a simplified solution at $r \ll R \cong R_0$ or $z_0 \lesssim 0.01$ with $\Delta H \cong K_0r$.

Once introduced both $R_0K_0 = 12.7 \pm 0.7\ km\ s^{-1}Mpc^{-1}$ and $\xi_0 = -2.15 \pm 0.23$ as ECM standard values, eq. (37) gives the very nearby Universe the approximate value of v_f corresponding to a fixed light-space *r.* Table 1 lists a few couples of these values as examples (in 2^{nd} and 1^{st} column respectively) and only one central redshift (in 3^{rd} column) of the combined *cz*-dipole (13), that is

$$z_0 = 0.0050 \pm 0.0003 \quad (38)$$

corresponding to a mean light-space $r = 20.8\, Mpc$ from which we receive the light waves showing the same dipole of about $627\ km\ s^{-1}$ as that of the CMB radiation.

Note that also $\xi_0 = -2.0 \pm 0.2$, as the best value experimentally found in papers XXI-XXII-XXIV [39, 40, 42], does not change meaningfully the results listed in Table 1.

Table 1. *Origin of CMB according to ECM.*

$r_{(Mpc)}$	$\sim v_{(km\ s^{-1})}$	$z_0 \equiv \langle z \rangle_{CMB}$
10	-301	
20	-602	
20.8	-627 ± 88	~ 0.0050
40	-1205	
80	-2409	

8. Conclusions

The conclusion of this final ECM paper XXV is simple and revolutionary. After showing that the CMB dipole2 velocity vector of about $627\, km\, s^{-1}$ has the same apex as the combined *cz*-dipole (13), even the simplified analysis here presented confirms the crucial results of papers XXI-XXII-XXIV [39, 40, 42], that is a likely origin of CMB at a mean cosmic depth of about 21 *Mpc*. In other words, the emission location of the $3K$ radiation within ECM should be shifted to the very nearby Universe, at a mean redshift $\langle z \rangle \cong 0.0050$. More precisely, the experimental research on the "expansion center universe" leads to a combined *cz*-dipole (13), which results from the sum of two orthogonal vectors referring to LG, $-R\Delta H$ and $-R\Delta\dot{\vartheta}$, both due to a light time effect within the decelerated Hubble flow of the very nearby Universe at $z \lesssim 0.01$. A solution of that combined *cz*-dipole gives the same apex $AA(l = 276° \pm 3°, b = +30° \pm 3°)$ as that of the CMB dipole2 velocity vector of $627 \pm 22\ km\ s^{-1}$ [10], that is a more complex and new dipole anisotropy with *cz* values corrected only for the motion of the Sun in the Local Group and the coefficient $\xi \approx -\tan(65°)$ from eq. (11). In this regard, two successful sample tests of eq. (13), at $\langle z \rangle = 0.012$ in papers XXI-XXII [39, 40] and $\langle z \rangle = 0.0046$ in paper XXIV [42] respectively, confirmed the ECM predictions and the theoretical value $\xi_0 = -2.15 \pm 0.23$ obtained in paper VII [29]. Finally, a few results of all the ECM research, in particular on the cosmic structure and mechanics of our very nearby $(z \lesssim 0.01)$ and nearby $(z \lesssim 0.1)$ Universe, are here recalled as a completion of the new cosmographic picture:

1. ECM, still from eq. (24), gives $t_0 = 4.65 \pm 0.20$ billion years as cosmic age in paper III [27];

2. The Local Group must be almost motionless relative to the Local Hubble Flow, in accordance with various analyses of the past century (cf. [16, 9]), including those confirming ECM in the very nearby Universe (cf. section 9.2 in paper I [25]);

3. The Local Hubble Flow follows an orbital path from around the center VC of the huge void; our Hubble flow seems to run towards an apex $FA(l \approx 103°, b \approx -25°)$ with a velocity $V_{FA} \approx 61200\ km\ s^{-1}$ within a frame centred on *VC*;

4. While the very nearby Universe $(z \lesssim 0.01)$ is running away almost rigidly with the Local Group, at a depth $z \approx 0.1$ the Universe behaves and appears to the observer as an expanding vortex from the huge void center *VC*; there the effects of cosmic rotation perturbation should be at their maximum, as shown by the "Magnitude anomaly" in paper XVI [33] of the SCP supernovae [45, 17, 18, 4, 49];

5. The CMB dipole is a combined dipole as resulting from the sum of the CMB dipole1, due to the velocity of the Sun in the Local Group, with that CMB dipole2 of $627 \pm 22\ km\ s^{-1}$ [10], which results to be a fictitious *LG* velocity generated by a combined *z*-dipole of CMB, due to the cosmic deceleration of the Local Hubble Flow;

6. The CMB dipole2, corresponding to an observed Δz_0 with a fictitious velocity $v_f \equiv -627\ km\ s^{-1}$ pointing towards the apparent apex *AA*, has only one regular solution within ECM (solution I), corresponding to the very nearby Universe, while an extrapolated solution (solution II), corresponding to the ultra-deep Universe, should present a value $\xi \to 0$, that is against ECM, as shown in papers XXI-XXII [39, 40].

On the whole, the results above summarized give a new look to modern cosmology, by falsifying a few pillars of the standard model, whose critical issues are deeply analysed in an impressive new research work [20].

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